A triangulated, mixed-method investigation of an online curriculum mapping system in medical education

Author:
Watson, Eilean Genevieve Sinclair

Publication Date:
2013

DOI:
https://doi.org/10.26190/unsworks/16374

A triangulated, mixed-method investigation of an online curriculum mapping system in medical education

Volume I: Thesis

Eilean Genevieve Sinclair Watson

A thesis in fulfilment of the requirements for the degree of

Doctor of Philosophy

Australian Institute of Health Innovation

Faculty of Medicine

January 2013

PLEASE TYPE

THE UNIVERSITY OF NEW SOUTH WALES
Thesis/Dissertation Sheet

Surname or Family name: Watson

First name: Eilean   Other name/s: Genevieve Sinclair

Abbreviation for degree as given in the University calendar: PhD

School: Australian Institute of Health Innovation   Faculty: Medicine

Title: A triangulated, mixed-method investigation of an online curriculum mapping system in medical education

Abstract 350 words maximum: (PLEASE TYPE)

This research investigates the use of an online curriculum mapping system developed to support the design, delivery and review of undergraduate medical education. This is an advanced, web-enabled and database-driven system known as eMed Map that has been in use by educational staff since late 2003 and by students since early 2004. eMed Map forms part of an integrated curriculum management system which sits at the interface of education, technology and practice. This mixed-method research project uses a case-study approach and a triangulation of methods. It consists of a qualitative component based on observations and textual documentation, a quantitative component appraised via web log reports linked to staff data, and an attitude assessment through a predominantly quantitative self-reported survey questionnaire. The thesis addresses a deficit in the current knowledge base about curriculum map use and impacts. Using systems theory and systems thinking paradigms to synthesise and discuss the findings, the research uncovered a number of interrelated factors affecting map use pertaining to the individual user, the technology and the organisation. Map awareness and use varied considerably, chiefly by staff type and by school location, and distinct groups of users were identified. Knowledge about the Map varied substantially, while utilisation of its help sites was minimal. The system was generally being used for content management while its more advanced educational and organisational uses were not being realised. The need for further information and training for staff was evident, as was the need to review certain educational and organisational procedures and information technology features and functions. Hence, while the system was widely available, its diffusion amongst staff was not what was hoped by planners and advocates of the curriculum map. The thesis considers practical implications for improving the diffusion of eMed Map by reviewing the whole curriculum mapping system and its leverage points from a systems thinking and system dynamics perspective. The lessons learnt from this case-study and the suggestions and key recommendations derived from it can be applied not only to medical education but also to other higher education programs that use or plan to use advanced online curriculum mapping systems.

Without changing our pattern of thought, we will not be able to solve the problems we created with our current patterns of thought.

Albert Einstein

Dedications

To my parents Graciela and Hamish Watson and to my colleague and friend Alan Hodgkinson (all recently deceased and warmly remembered).

Originality Statement

‘I hereby declare that this submission is my own work and to the best of my knowledge it contains no materials previously published or written by another person, or substantial proportions of material which have been accepted for the award of any other degree or diploma at UNSW or any other educational institution, except where due acknowledgement is made in the thesis. Any contribution made to the research by others, with whom I have worked at UNSW or elsewhere, is explicitly acknowledged in the thesis. I also declare that the intellectual content of this thesis is the product of my own work, except to the extent that assistance from others in the project’s design and conception or in style, presentation and linguistic expression is acknowledged.’

Signed ……………………………………………………………………………………………………

Date ………………………………………………………………………………………………………..

Copyright Statement

Authenticity Statement

Acknowledgements

This thesis would not have been possible without the guidance and support of many individuals. I would like to start by thanking those who gave me the opportunity to get involved in curriculum mapping the undergraduate medicine program some ten years ago, including Bruce Dowton, Susan Toohey and Patrick McNeil from the Faculty of Medicine, and Adrian Lee for the University fellowship in innovative teaching and educational technology. I would also like to thank all those who helped design, develop and improve the curriculum map over the years, in particular the Faculty's IT team comprised of Jim Leeper, Peter Moloney, Luc Betbeder-Matibet and Clayton Gilbert, and members of the eMed reference group in particular Philip Jones, Suzanne Mobbs and Chris Hughes.

Grateful thanks go to my supervisor Jeffrey Braithwaite for his invaluable advice, timely and thorough feedback and words of encouragement and wisdom throughout this research, and to my co-supervisors Lesley Land and Patrick McNeil for their skilful guidance and support in their areas of expertise. Special thanks also go to Mary Westbrook and Bayzidur Rahman for their advice on statistical methods and data presentation and to Andrew Georgiou for reviewing the final thesis. I am also thankful to my academic advisor Alan Hodgkinson for allowing me to take time off work when needed to conduct this research.

I am grateful to all staff members who participated in the various components that formed part of this research, including the observational and textual documentation study, the web log with data linkage study and the survey. I am indebted to Vicky Truskett, Phil Crawford and Jake Surman for their help in gathering the web log and staff data, and to Suzanne Mobbs and Chris Hughes for their help in piloting the survey instrument. Special thanks also go to Nicole Kalish and to the Sawmill software support team for their help in programming the application.

I am thankful to my friends Susan Bowers for her meticulous proofreading and skilful editing of my thesis, Debbie McIvor for reading the thesis for sense and to the rest of the group for pushing me to hurry up and finish. Special thanks also go to all friends and family for their patience in listening to me talk about the study for years on end including my claims that it would be finished soon. Finally, I would like to acknowledge my mother Graciela Domínguez de Watson who engendered in me a love of learning and teaching, and my father Hamish Watson who encouraged me to take up the challenge of doing this doctoral thesis.

Keywords

Curriculum mapping, curriculum management tool, curriculum information tool, curriculum database, electronic curriculum management system, education, medical education, higher education, instructional design, learning and teaching, educational technology, information technology, information systems, educational administration, organisation and management, research, evaluation, qualitative research, quantitative research, mixed-methods research, case-study, systems thinking, systems theory, system dynamics.

Abstract

This research investigates the use of an online curriculum mapping system developed to support the design, delivery and review of undergraduate medical education. This is an advanced, web-enabled and database-driven system known as eMed Map that has been in use by educational staff since late 2003 and by students since early 2004. eMed Map forms part of an integrated curriculum management system which sits at the interface of education, technology and practice. This mixed-method research project uses a case-study approach and a triangulation of methods. It consists of a qualitative component based on observations and textual documentation, a quantitative component appraised via web log reports linked to staff data, and an attitude assessment through a predominantly quantitative self-reported survey questionnaire. The thesis addresses a deficit in the current knowledge base about curriculum map use and impacts. Using systems theory and systems thinking paradigms to synthesise and discuss the findings, the research uncovered a number of interrelated factors affecting map use pertaining to the individual user, the technology and the organisation. Map awareness and use varied considerably, chiefly by staff type and by school location, and distinct groups of users were identified. Knowledge about the Map varied substantially, while utilisation of its help sites was minimal. The system was generally being used for content management while its more advanced educational and organisational uses were not being realised. The need for further information and training for staff was evident, as was the need to review certain educational and organisational procedures and information technology features and functions. Hence, while the system was widely available, its diffusion amongst staff was not what was hoped by planners and advocates of the curriculum map. The thesis considers practical implications for improving the diffusion of eMed Map by reviewing the whole curriculum mapping system and its leverage points from a systems thinking and system dynamics perspective. The lessons learnt from this case-study and the suggestions and key recommendations derived from it can be applied not only to medical education but also to other higher education programs that use or plan to use advanced online curriculum mapping systems.

Table of Contents

List of Figures

List of Tables

List of Abbreviations

Abbreviation	Definition
AAF	Assessment Activity Form in eMed Map
AAMC	Association of American Medical Colleges
AR	Adjusted (standardised) Residual value of a cell in cross-tabulation statistical analysis in SPSS v. 20
COF	Course Outline Form in eMed Map
CoP	Community of Practice
DIFM	Do It For Me (as an approach to support with Map use)
DIG	Design and Implementation Group for courses in the UMP
DIY	Do It Yourself (as an approach to support with Map use)
FET	Fisher's Exact Test (a statistical test of association)
GP	General Practitioner
GO	General Observations (a qualitative research method)
GST	General Systems Theory
HREAP	UNSW Human Research Ethics Advisory Panel
HREC	UNSW Human Research Ethics Committee
ILP	The Independent Learning Project component done by medical students in Phase 2 of the UMP
ICT	Information and Communication Technology
IS	Information Systems
IT	Information Technology
ITET Fellowship	UNSW Innovative Teaching and Educational Technology Fellowship between 2001 and 2004
KMS	Knowledge Management System
L&T	Learning and Teaching
LAF	Learning Activity Form in eMed Map
LCF	Learning Context Form in eMed Map
LCMS	Learning Curriculum Management System
LMS	Learning Management System
MCSU	Medicine Computing Support Unit at UNSW Faculty of Medicine
MESO	Medical Education and Student Office at UNSW Faculty of Medicine
OME	Office of Medical Education at UNSW Faculty of Medicine that was later restructured and subsumed by MESO
P1, P2, P3	Phases 1, 2 and 3 of the UMP
PDTM	Professional Development and Talent Management system of UNSW Faculty of Medicine
PO	Participant Observations (a qualitative research method)
Rx	Reflections by researcher (a qualitative research method)
Sawmill or Sawmill 8	Sawmill Professional version 8.1.5 software application for web log analysis
SPSS v. 20	Statistical Package for the Social Sciences version 20 software application for statistical analysis
ST&M methodology	Systems Thinking and Modelling methodology
SUV evaluation model	'Systematisk Utvärdering på Vetenskaplig grund' (Swedish), which translated to English means 'Systematic evaluation on a scientific basis'
Txt	Textual documentation analysis (a qualitative research method)
UMP	Undergraduate Medicine Program at UNSW
UNSW	The University of New South Wales, Sydney, Australia

Glossary of Terms

Term	Description
Blackboard (v9)	A third party learning management system for use by students and staff which has been supported and managed centrally by UNSW since 2009. It has been used in the UMP in combination with the content management system in Map v4.0 to provide extra course information, as well as quizzes and general communication.
eMed	A password-protected, online curriculum management system developed by the Faculty of Medicine at UNSW to manage the educational and administrative aspects of the undergraduate medicine program (UMP). Developed on the Lotus Domino platform and in use by staff and students since 2004. The system comprises a number of interrelated tools, which are described below.
eMed Assessment Item Bank	A central repository used only by staff to import, develop, review, classify, select and export various types of assessment items for use in summative exams and formative quizzes.
eMed Feedback (formerly Teamwork)	A self and peer feedback tool for students to use in relation to project group work. Also used by teachers to provide feedback on a student's contributions to learning activities. Comments are available to the portfolio exam assessor.
eMed Help	A tool available to staff only that contains technical and educational information on how to use various eMed tools.
eMed ILP	A tool used by staff and students to manage the Independent Learning Project component of the UMP.
eMed Issue Log	A tool used by staff to document IT development requirements and fixes.
eMed Map	A curriculum mapping tool available to staff and students. This is the central repository of curriculum data. It holds up-to-date information about the structure, content, graduate capabilities and assessments in the UMP.
eMed Placements	A preference registration tool for staff and students to register preferences for clinical service placements.
eMed Portfolio	A tool for students to submit their assignments, group projects, evidence of achievement and reflective essays for their portfolio examination.
eMed Registrations	A preference registration tool for students to register their assignment and project preferences.
eMed Results	A provisional grades tool for students to view their submission and exam results. Final grades are available through the University's central system.
eMed Timetable	A personalised timetable tool used by staff and students to view their own timetable of learning activities. Each listed activity links back to the Map.
eMed Tracking	An assessment management tool used by staff to enter grades and comments for assignment and project submissions, and exams.
eMed webpage and tutorial	An external password-protected webpage and online tutorial available to students (and staff) which contains general information on how to access and use various eMed tools.
Professional Development and Talent Management (PDTM) system	An on-line system developed by the Faculty of Medicine at UNSW, available to staff since 2009 to track and manage their personal career development and create their academic portfolio.
WebCT (Campus Edition and Vista)	A third party course management system for use by students and staff which was supported and managed centrally by UNSW up until 2009-2010. Between 2004 and 2008, it was used in the UMP to supplement information in earlier versions of eMed Map by providing the course content, as well as quizzes and general communications.

Part 1: Introduction, Literature Review and Theoretical Framework

Chapter 1 : Introduction

Introduction

This research project investigates the use of an online curriculum mapping system developed to support the design, delivery and review of an undergraduate medical education program. This is an advanced, web-enabled and database-driven system known as eMed Map and has been in use by educational and administrative staff since late 2003 and by students since early 2004. eMed Map forms part of an integrated curriculum management system known as eMed which sits at the interface of education, technology and practice (Watson et al., 2007).

The thesis examines and weighs up the use of eMed Map by staff members involved in the medicine program using a case-study-based research approach consisting of qualitative and quantitative methods. This is a multi-component, mixed-method, triangulated approach. It explores the use of eMed Map from an educational, organisational and information systems perspective. It looks at curriculum mapping as a process (the action of capturing curriculum data), a product (a map containing various curriculum elements) and a tool (an information system used to support the process and generate the product) (Oliver, Ferns, Whelan, & Lilly, 2010). The process of curriculum mapping was first described by English (1979, 1984), its online use in North American K-12 schools was popularised by Jacobs (1997), and the concept was further expanded and adapted to medical education by Harden (2001a). A review of the literature showed that the use of advanced online curriculum mapping systems in higher education both in Australia and overseas is limited, although their use in medical education and other health professions is more extensive (e.g. Bell, Ellaway, & Rhind, 2009; Britton, Letassy, Medina, & Er, 2008; Metz, Lee, Albright, & Alkasab, 2001; Salas et al., 2003; Thompson, 2009; Uchiyama & Radin, 2009; Watson et al., 2007). Research examining them, and substantial evaluations of them, are sparse.

There are many different types of curriculum mapping perspectives, approaches and systems, and these are discussed in the Literature Review chapter. Harden notes that “The key to an effective integrated curriculum is to get teachers to exchange information about what is being taught and to coordinate this so that it reflects the overall goals of the school. This can be achieved through curriculum mapping..." (Harden, 2001a, p. 123). As proposed by Harden, eMed Map provides a multi-dimensional view of the curriculum which allows staff and students to look at the curriculum through different lenses.

Much of the literature on curriculum mapping consists predominantly of opinions and ideas on the expected benefits, challenges and requirements of curriculum mapping. However, the literature rarely reports on the actual benefits, challenges and requirements based on empirical evidence from formal evaluations of long-term curriculum map use in either higher education or K-12 schools. A number of authors have noted the limited scholarship on curriculum mapping and the need for comprehensive evaluative studies on curriculum map use and impacts (Bartoo, 2005; Harden, 2001a; Naik et al., 2011; Oliver et al., 2010; Sumsion & Goodfellow, 2004; Willett, 2008). Since curriculum mapping is a labour intensive and time-consuming endeavour, it is important to establish its educational and organisational benefits and shortcomings based on empirical evidence and not only on expert opinion. This triangulated investigation of eMed Map, therefore, addresses the deficit in empirical evidence in the curriculum mapping literature.

The Aims

This research project aims to explore if and how staff members involved in the Undergraduate Medicine Program (UMP) at The University of New South Wales (UNSW) use eMed Map, and the various factors affecting its use such as staff demographics, knowledge and attitudes, organisational incentives and barriers, and technical functions. This thesis also aims to explore if the potential uses of eMed Map as envisaged during the system's conceptualisation phase and embedded in its actual design have come to fruition. Finally, it aims to derive from its findings and the relevant literature some practical implications on how to improve the use of curriculum mapping in medical education and other higher education programs.

Research Approach

This research employs a triangulation technique, exploiting qualitative and quantitative methods to measure the observed behaviours and practices of Map users, as well as their inferred values, beliefs and attitudes towards the information system and the mapping process. It consists of three separate but interrelated studies. The observations and textual documentation study uses qualitative methods; the web log report and data linkage study employs quantitative methods; and the self-reporting survey study predominantly uses quantitative methods (see Figure 1.1).

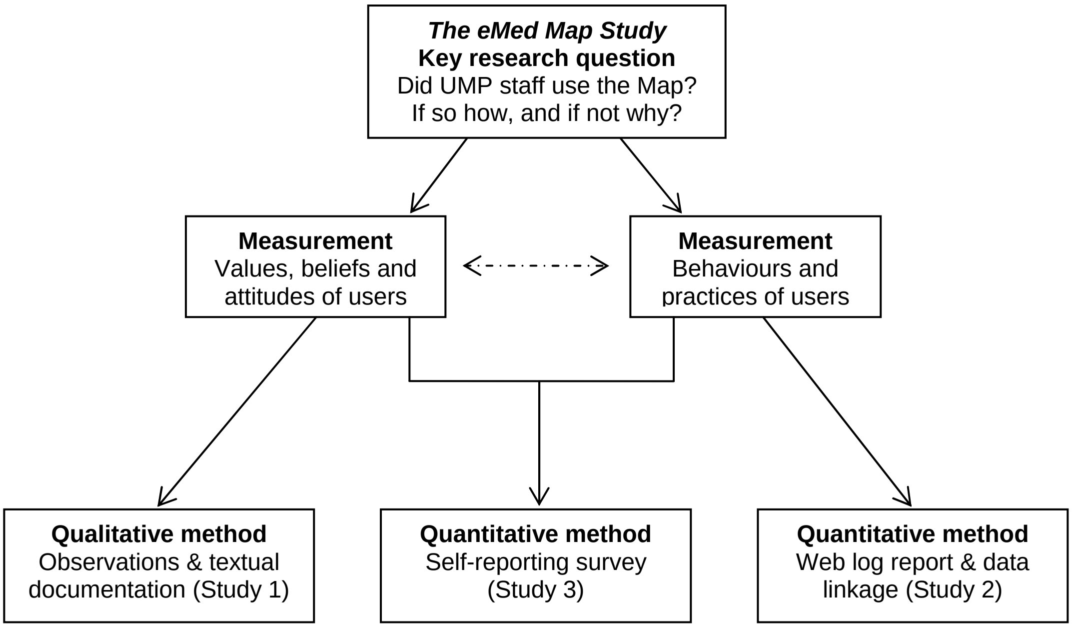

Figure 1.1: A triangulation of research measurements, methods and studies.

Research Questions and Hypotheses

This research commenced with the qualitative study. The one **broad research question** was: Did UMP staff members use eMed Map? If so how, and if not why not? The thesis started with no specific hypothesis to test or theory to follow, other than to examine map use via a sophisticated research design, since these were intentionally allowed to emerge inductively from the qualitative study results. The qualitative findings went on to trigger more specific research questions about the characteristics of Map users, as well as their knowledge, behaviours and experiences with using the Map. These specific questions are outlined at the beginning of each quantitative study (Chapters 6 and 7). The inductive process used also led to the development of three working hypotheses which are outlined in the discussion section of the qualitative study (Chapter 5), and which are tested through the two quantitative studies (Chapters 6 and 7). Also through this process, general systems theory (GST) along with the systems thinking paradigm and the qualitative system dynamics methodology were selected as the theoretical framework which informed the rest of the research; these are discussed in Chapter 3.

The Researcher

The researcher was a full-time tenured academic staff member in the Faculty of Medicine. She was the educational designer of eMed Map and, as such, was part of a small team of academic and general Faculty staff involved in designing, developing, implementing, maintaining and improving the system over time. Others in this team included the Map administrators, IT programmers and managers, academic specialists and the Associate Dean of Education (Watson et al., 2007). Her other academic roles in the UMP during this study included being a teacher and a member of various groups and committees.

The researcher's role in this study was as investigator of the Map's use by staff members involved in the UMP. Her dual role as researcher and as Map designer and staff member allowed her insider status and a close engagement with the research subject. As recognised by Nandhakumar and Jones (1997), this close engagement has its benefits in interpretive Information Systems (IS) research but also its drawbacks since it can potentially lead to conflict of interest, researcher bias and impartiality. It can also compromise a study's authenticity, plausibility and criticality (Schultze, 2000).

As the educational designer of eMed Map, the researcher's main interest was to complete the instructional design cycle by conducting a comprehensive evaluation of the system's use following its full implementation (see next section). The initiative to conduct this study was her own, and her academic position and roles were not dependent on the results of this study so there was no actual conflict of interest in this respect. Any potential researcher bias, impartiality or conflict of interest which could have arisen from her close proximity with her colleagues was safeguarded by the study's triangulated research design (Chapter 4).

Issues of authenticity, plausibility and criticality as defined by Schultze (2000) were safeguarded in the following ways. The study's authenticity was supported by the researcher's pre-understandings of curriculum mapping and of the UMP, and her experience in educational technology designer. Its authenticity was further enhanced by the researcher's disclosure of her various roles and relationships with different groups of participants, her immersion in the field as a participant observer for many months, her detailed description of the research methods used, the amounts and variety of data collected, the comprehensive reporting of findings, the emergence of hypotheses from the qualitative findings, and the testing of these hypotheses through quantitative methods (Chapter 4 and Part 3). The study's plausibility was enhanced by adhering to academic research standards, and by justifying the study and its contributions through the identification of gaps in the curriculum mapping literature including calls for comprehensive case-studies on curriculum map use (Chapter 2). The study's criticality was enhanced by exploring the use of the Map from the perspective of various users as well as from the perspective of the researcher as educational designer and UMP teacher. Criticality was also achieved by encouraging the reader to think about the findings, and re-examine his/her own curriculum mapping assumptions, practices and views in relation to a selected theoretical framework and the relevant literature (Chapter 8). The next section provides relevant background information on the design, development and implementation of eMed Map.

Overview of eMed Map

This section provides an overview of eMed Map and of the goals, principles, theories, models and approaches which influenced its design, development and implementation. This background information contextualises this research within the medical program at UNSW, the instructional design discipline, and the educational, organisational and information systems theories and approaches which influenced the design of eMed Map. For a detailed description of the eMed development process see Watson et al. (2007).

eMed Map is a web-enabled, database-driven curriculum mapping system developed on the IBM Lotus Domino platform. It operates as the master source of curriculum information in the eMed curriculum management system. It is used to hold and retrieve standardised data and learning resources for all courses, activities, assessments and graduate outcomes of the UMP; and it contains features and functions to browse, search and export data. The Map is composed of a series of standardised online forms which contain fixed terms and free-text fields to capture curriculum data; a browsing function which uses set views; and a search function with simple and advanced searching capabilities and an export function (Watson et al., 2007).

eMed Map was conceptualised and designed between mid-2001 and early 2003, prototyped in early 2003, built in mid-2003 and released to staff in late 2003 and to students in early 2004, and briefly evaluated at the end of 2004 together with other eMed tools and WebCT. The system was then progressively refined and up-graded over time, and the development of major system requirements was completed in late 2008 with the inclusion of a content management system, except for its graphical interface and data visualisation functions which remain under consideration. The data collection period for this research started in 2007 and ended at the end of 2010, although data from web logs stem back to 2004 and some of the textual documentation to 2001. See Appendix A for a chronology of events related to eMed Map and its associated systems, and to this research.

Origins and Criteria

The UMP is a fully integrated and outcomes-based six-year program which is divided into three Phases, with each phase lasting approximately two years. Its design and development commenced in 1999 using a 'blue sky' approach. In 2001 the Medical Faculty embarked on conceptualising a curriculum management system to support the development and delivery of this new medicine program. In March 2004, the first year of the UMP was implemented with approximately 226 students and 160 staff. The web-enabled curriculum management system it developed was titled eMed, and it consisted of a suite of integrated tools used for managing graduate outcomes, content, activities and assessment in the new program (McNeil, Hughes, Toohey, & Dowton, 2006; Watson et al., 2007). Currently, the eMed system includes the following tools: curriculum map, timetable, student portfolio, project registrations, assessment tracking and results, peer and teacher feedback, assessment item bank, integrated learning project, student placements and help. Descriptions of these on-line tools are provided in the glossary of terms.

The curriculum map was designed to fulfil a number of educational, organisational, administrative and technical criteria. These were as follows (adapted from Watson et al., 2007):

Educational criteria:

- Support the outcomes focus of the UMP
- Assist in the alignment of graduate outcomes, learning activities and assessments
- Manage curriculum content
- Capture the curriculum structure and its controlled vocabulary
- Support self-direction and collaboration in students
- Support curriculum development, implementation, review and administration
- Support incremental curriculum change to keep the curriculum up-to-date.

Organisational and administrative criteria:

- Enhance communication, collaboration and information sharing amongst staff and students located in various geographical locations
- Support organisational change by ensuring curriculum sustainability and a sense of ownership of the program by all UMP staff
- Promote a knowledge sharing culture
- Support data-driven decision making
- Support centralised information management and administration procedures
- Afford ease of use so training needs would be minimal.

Technical criteria:

- Provide access to all staff and students over the web
- Provide easy integration with other eMed tools, and with existing systems including UNSW's central authentication system
- Offer easy and reliable data capture and retrieval
- Reduce information duplication and redundancy
- Offer browse and search capabilities
- Provide system flexibility and extensibility
- Ensure system robustness and data security.

Currently, the key features of eMed Map are as follows:

- The master source of curriculum information
- Holds outlines of courses, activities and assessments for all years of the UMP
- Provides the aims, key concepts, key references, key words and content files for each learning activity, and some assessment activities (projects and assignments)
- Available to staff to develop, implement, evaluate and improve the curriculum
- Available to students to manage their learning
- Provides users with different levels of web access to view, update and/or create information
- Provides defined views to browse information, and a search function to retrieve specific information
- Allows data exports to other applications (e.g. word processing, statistical analysis)
- Provides an archive of completed courses, which also includes a search function.

From Conceptualisation to Evaluation

As the educational designer of eMed Map, the researcher commenced conceptualising a curriculum mapping system for the UMP in mid-2001 through the support of an Innovative Teaching and Educational Technology (ITET) Fellowship at UNSW (Russell & Lee, 2005). She worked in close collaboration with educational, library and technical staff at UNSW to design and develop a prototype which later became eMed Map. The system was designed while Phase 1 of the UMP was being developed, but without full knowledge of the curriculum structure in Phases 2 and 3 since they were yet to be developed.

The educational design of eMed Map primarily followed the instructional design approach (see for example Gustafson & Branch, 2002), while the information systems development or build followed a business systems approach (Alter, 1999; Cook, 1996). The area of design research in education (Herrington, McKenney, Reeves, & Oliver, 2007; Herrington & Oliver, 2000; Reeves, Herrington, & Oliver, 2004, 2005), and of design science research in information systems (Hevner, 2007; Hevner & Chatterjee, 2010; Hevner, March, Park, & Ram, 2004) were also explored as part of this research project. As noted by Boling and Smith (2008), the exploration and use of other design fields is a fruitful avenue for expanding the field of instructional design. Broadly speaking, these design approaches share the common ground of design thinking which is characterised by abductive thinking or, put simply, the logic of 'what might be', while deductive and inductive thinking are respectively the logic of 'what should be' and 'what is' (Breen, 2005; Dunne & Martin, 2006). The design thinking process is gaining popularity in the fields of education (e.g. Steinbeck, 2011) and of management (e.g. Dunne & Martin, 2006), where it is being applied to solve wicked problems through collaborative integrative thinking using abductive logic.

Instructional design is a systematic process employed to develop educational interventions, including educational technology systems, in a consistent and reliable way. Its unifying goal has been to bridge the gap between theories of learning (e.g. behavioural and cognitive) and practical application (i.e. instructional system development) (Branch & Merrill, 2012; Gustafson & Branch, 2002; Molenda, 1997; Ross et al., 2008; Tennyson & Schott, 1997). Instructional design aims to be learner-centred and goal-oriented and focuses on real-world performance. It seeks outcomes that can be measured in a reliable and valid way, and to be empirical, and it typically involves a team effort (Gustafson & Branch, 2002). Although there are many instructional design theories, models and processes (see for example Reigeluth, 1999b; Reigeluth, 1983, 1999c; Reigeluth & Carr-Chellman, 2009; Tennyson, Schott, Seel, & Dijkstra, 1997) descriptions generically include the following five elements: analysis, design, development, implementation and evaluation. Figure 1.2 shows the relationship between these core elements, which together are referred to as the ADDIE process or framework (Gustafson & Branch, 2002). The ADDIE process is not necessarily linear but instead is iterative and self-correcting. The five core elements inform each other as development takes place, and revision continues at least until the instruction is implemented. The evaluation phase is at the centre of the ADDIE process. This evaluation can be either formative or summative. The ADDIE process can be applied equally to the development of an educational technology product such as eMed Map as it can to the development of a course program or a single training activity (Chapman, 2008; Kali & Linn, 2008; Ross et al., 2008).

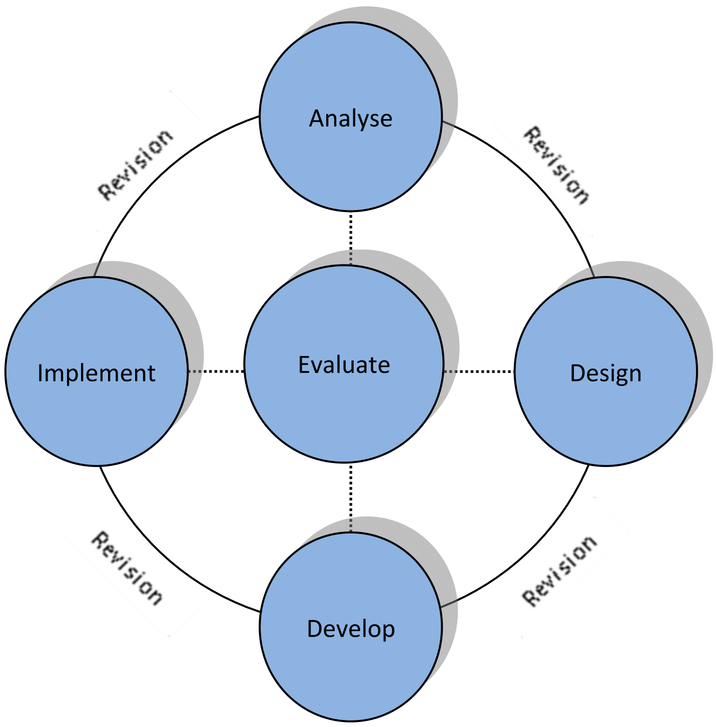

Figure 1.2: The instructional design cycle (ADDIE)
(diagram adapted from Gustafson & Branch, 2002).

During the conceptualisation phase of the design of eMed Map (the analysis and design phase of the ADDIE framework), the researcher explored the potential uses of an online curriculum map in learning and teaching, educational administration, knowledge management and organisational change by reviewing the relevant literature, and by trialling existing online systems used in curriculum or course management. Hence, a number of educational, organisational and information systems theories and frameworks underpinned the conceptualisation and design of the curriculum map prototype and ultimately of eMed Map.

The main educational theory which influenced the design of eMed Map was the instructional design elaboration theory of Reigeluth (Reigeluth, 1999a, 1983; Tennyson & Elmore, 1997; Van Patten, Chao, & Reigeluth, 1986), and the main organisational theory was the community of practice theory of Wenger on situational learning in organisations (Lave & Wenger, 1991; Wenger, 2006, 2009; Wenger, McDermott, & Snyder, 2002; Wenger, White, & Smith, 2010). The main curriculum mapping model followed was that of Harden (2001a), and the most influential curriculum mapping system reviewed was the Curriculum Management and Information Tool (CurrMIT) by the Association of American Medical Colleges (AAMC) (Cohen, 2000; Cottrell, Linger, & Shumway, 2004; Salas et al., 2003); both are described in the Literature Review chapter. These theories, approaches and models gave rise to the researcher's own ideas of how a curriculum mapping system could be used in the UMP as a learning and teaching tool, an administration and management tool, and a knowledge management tool. It was at this stage that she started developing the list of potential uses of a curriculum map included in Appendix B, which then went on to form part of this research.

The development of eMed Map predominantly followed the business systems design approach of Cook (1996), under the guidance of a business systems analyst (Watson et al., 2007). This approach ensured that the users' needs were formally identified and specified in the system-requirements documentation, and that the main user needs were met on time, within the Medical Faculty's budgetary constraints, and within the capabilities of the software development application selected (Lotus Domino) and of the programmers employed to build the system. The implementation phase included the appointment of a Map administrator, the provision of an online help site, a telephone help line, an information leaflet and face-to-face training sessions for staff and students. Administrative documents were developed to identify (a) the Map tasks to be performed by various categories of staff (course convenors, principal teachers, Map administrators, computer programmers and the eMed business owner), and (b) the Map functions available to different user roles (student, reader, teacher, designer, administrator, developer). An evaluation of the eMed system and of WebCT conducted in mid-2004 amongst staff and students showed a high level of approval of the various tools. However, general observations, anecdotal evidence, and eMed Map search results conducted by the researcher in mid-2005 in her capacity as the system's designer showed that while the use and data quality of eMed Map were generally satisfactory for Phase 1 of the UMP, this was not so for Phase 2 and the reasons for this were unclear (at that time Phase 3 was under development and not yet mapped). Hence, a research project beckoned—one sufficiently large and important to form the basis of this PhD thesis. This doctoral evaluation of the use of eMed

Map has at its heart the ADDIE cycle (see Figure 1.2) and aims to identify if and how staff members used the system, as well as the incentives and barriers to its use within the context of the UMP, the Medical Faculty and UNSW.

Conclusion

In essence, the design of eMed Map was based on the need to support UMP staff and students in the learning and teaching process, and also to support curriculum administration and management. The main areas underpinning the conceptualisation phase of the Map's design were curriculum mapping in medical education, instructional design and situational learning in organisations. The identification of users' needs was paramount to the design, development and implementation of eMed Map. In relation to the ADDIE cycle, this research equates to the evaluation phase which follows the full implementation of an educational innovation.

Chapter 2 provides a critical review of the literature on curriculum mapping, and identifies the gaps in the literature which are addressed by this thesis. Chapter 3 introduces the supporting theory and associated approaches used in this thesis—namely GST, systems thinking and system dynamics. Chapter 4 describes the overall research design and the justification for using this design, and provides an overview of the research methods used in each of the three studies. Chapter 5, 6 and 7 respectively provide a detailed description of the research methods used in each study, the empirical findings for each study, and a discussion of these findings. Chapter 8 synthesises the results from all three studies using a post-hoc evaluation process based on systems theory, discusses those results using a systems thinking approach, and concludes by discussing practical implications about curriculum mapping in higher education based on the empirical findings from this research and system dynamics principles. Appendix C provides online screen captures of eMed Map which show its general user interface, navigation menus, data capture forms and their content, and search functions.

Chapter 2 : Review of the Curriculum Mapping Literature

Overview

This literature review covers the area of curriculum mapping in education, with a particular focus on medical and higher education. Section 1 provides a review, analysis and synthesis of the curriculum mapping literature. Section 2 looks at the current deficit in the evaluation of curriculum maps and at the role of this research project in addressing this deficit.

Section 1: Review and Analysis of the Literature

This section covers the search strategies used to review the literature, a brief history of curriculum mapping, three commonly cited mapping models, the types of mapping systems described in the literature, a comparison of eMed Map to the models and systems described, the benefits and challenges of mapping, and the relation of curriculum mapping to other educational technologies and to knowledge management.

Curriculum Mapping Terminology

A comprehensive literature search was conducted using the terms 'curriculum mapping' or 'curriculum management system', as well as a combination of the terms 'curriculum' and/or 'education' with the terms 'map', 'mapping', 'management', 'analysis', 'administration', 'knowledge', 'system' and/or 'database'. International and Australian bibliographic databases were used to search the fields of health sciences (Medline, PubMed, Embase, Australian Medical Index), education (ERIC, Proquest Education Journals, Australian Education Index, A+Education, PsycINFO), science and technology (Proquest Science Journals, ScienceDirect, Web of Science, IEEE Xplore, Inspec, Computer and Information Systems Abstracts, Engineering Village 2, Computer Index Australasia) and the humanities and social sciences including business and management (e.g. JSTOR, Proquest Social Science Journals, Proquest Research Library, Emerald Fulltext, ABI/INFORM Global, Business Source Premier). Also searched were multidisciplinary databases (e.g. Scopus, DOAJ, Primo Central Index), the UNSW and Libraries Australia catalogues, the Association for Information Systems (AIS) Electronic Library, and Google Scholar.

Search results showed that while the term 'curriculum mapping' and 'curriculum map' have been used in the K-12 education literature since the mid-1970s mostly through the work of English (1978, 1980, 1987, 2010; English & Steffy, 1982) and later through the work of Jacobs (1997, 2000, 2004b), the term 'curriculum mapping' rarely appears in the higher education literature until after the publication of Harden's seminal guide to curriculum mapping in medicine (Harden, 2001a). Three worthy exceptions are the articles by Gjerde (1981), Wager (1976), and Hausman (1974).

Some authors have commented that the use of curriculum mapping in higher education is recent (e.g. Bell et al., 2009; Robley, Whittle, & Murdoch-Eaton, 2005), which is understandable since the term 'curriculum mapping' only started being used as an indexing term in higher education journals around 2004. However the curriculum mapping process and the development of systems to support this process have been reported in the higher education literature since the early 1990s, particularly in medicine and in dentistry (Eisner, 1993, 1995; Field & Sefton, 1998; Mattern et al., 1992; Nowacek & Friedman, 1995; Ross & Davies, 1999). What is not immediately obvious from the literature is that these curriculum mapping systems have not been referred to as such, but instead have been defined as curriculum databases (Field & Sefton, 1998; Mattern et al., 1992), curriculum management tools or systems (Cohen, 2000; Ramagli, 1982; Salas & Anderson, 1997; Salas et al., 2003), curriculum analysis tools (Eisner, 1993, 1995), curriculum information systems (Nowacek & Friedman, 1995), digital or electronic curriculum (Aabakken & Bach-Gansmo, 2000; Ross & Davies, 1999), database-driven information systems (Lee et al., 2003; Metz et al., 2001), curriculum knowledge management systems (Wigal, 2005); and automated concept mapping or knowledge mapping systems (Denny, Irani, Wehbe, Smithers, & Spickard III, 2003). Authors such as Harden (2001a) and Cottrell (2004) have referred to such systems used in medical education as 'curriculum mapping' tools. Less often, similar terms have been used in the K-12 education literature, such as curriculum management systems (Brooks & Simkins, 1999; Sapone, 1972); computer-based management systems (Herr, 2000); and instructional management systems (Renzulli, 2005). Therefore, these terms should be included when searching the curriculum mapping literature.

Brief History of Curriculum Mapping

Hausman (1974) was one of the first to use the term curriculum mapping in the literature. He emphasised the advantages for teachers of expressing their curriculum plans in visual maps to help them conceive the curriculum as flexible, dynamic and interrelated. Soon after Wager (1976) used the term 'instructional curriculum mapping', which he defined as a set of guidelines for diagramming the relationships among learning objectives from different domains (e.g. cognitive skills, motor skills, attitudes) and as a visual tool for teachers to sequence instruction. Sapone (1972) was one of the first to describe a curriculum management information system (CURMIS) that provided a 'central depository' of data for developing and monitoring instructional programs. However, the first person to write extensively about curriculum mapping seems to have been English (1978, 1979, 1980, 1987; English & Steffy, 1982). Eisenberg (1984) developed a computer-based curriculum mapping system based on English's models, and Jacobs (1997, 2000, 2004b) expanded the curriculum mapping ideas of English and Eisenberg, and popularised the use of online curriculum maps in K-12 schools in the USA.

In medical education, the first reference to curriculum mapping appears to be by Gjerde (1981) who described a curriculum evaluation approach that was partly based on the educational models of Tyler and of Bloom to determine the degree of congruence between objectives, instruction and student evaluation which he called 'curriculum mapping' and was similar in role to current curriculum mapping. Nowacek and Friedman (1995) provide a history of the use of computer-based curriculum information systems in medical education. They trace the first computer-based system back to the early 1960s when Rosinski and Blanton developed a system using punch cards to store the coded information on instructional units. In 1984 Gotlib and colleagues developed a system on a mainframe computer, as did Buckenham and colleagues who started using Index Medicus keywords to describe curriculum content. Subsequently, Currie developed a 'textbase' system on a word processor, and finally micro-computer based systems appeared in the late 1980s (Nowacek & Friedman, 1995). In the early 1990s, Mattern and colleagues (1992) published a review of curriculum databases used in medical education, which was followed by articles by Eisner (1993, 1995) on a system used in dental education called CATs, and by Salas (1997) on a system used in medical education called CurrMIT. Harden's pivotal guide to curriculum mapping appeared in 2001, and caught the attention of medical and other health sciences educators as indicated by its regular citation in the health professions education literature (Harden, 2001a).

Reference to curriculum mapping in other higher education disciplines such as engineering, business, information systems and teacher education, started appearing in the early 2000s and was mostly driven by the requirements of professional agencies and national quality assurance agencies for university graduates to meet certain generic skills standards, particularly so in Australian universities (Oliver, 2011; Oliver et al., 2010).

Main Curriculum Mapping Models

The three curriculum mapping models commonly cited in the education literature are the model by English, by Jacobs and by Harden. The models by English and by Jacobs were designed for K-12 schools in the USA, and Harden's model was designed for medical education.

English is considered the 'father' of curriculum mapping and curriculum management audit. He has written extensively about curriculum mapping in K-12 schools (1978, 1979, 1980, 1987, 2010; 1982), as well as about curriculum alignment (English, 1978, 2010; English & Steffy, 2001), curriculum auditing (English, 1988), curriculum development and management (English & Larson, 1996; English & Steffy, 1982) and school leadership (English, 1978, 1999, 2007; Hoyle, English, & Steffy, 1998). His curriculum mapping model was developed in the 1970s, before the personal computer. Jacob's curriculum mapping model was developed in the 1990s by which time personal computers and the Internet were in use. Harden has written extensively about various areas of curriculum development in medical education such as curriculum integration (Harden, 2000; Harden, Davis, & Crosby, 1997), problem-based learning (Davis & Harden, 1999), the spiral curriculum (Harden & Stamper, 1999), task-based learning (Harden, Crosby, Davis, Howie, & Struthers, 2000), and the learning environment (Harden, 2001b). In his curriculum mapping guide, Harden (2001a) commented that one neglected aspect of curriculum development had been communication about the curriculum. Harden's curriculum mapping model incorporated concepts from English and Jacobs, from curriculum management databases developed by various medical schools, and from educational ideas on concept mapping and hierarchical frameworks. While there are many similarities between these three mapping models, there are also some important differences.

These models are similar in that all three authors agree that curriculum mapping is about the taught curriculum—what is taught, how it is taught and when it is taught and the assessment used to determine if students have achieved the learning outcomes. Mapping can be used to gradually make the written curriculum, the taught curriculum and the tested curriculum more congruent with one another (English, 1980). It can also be used to examine inconsistencies, gaps and duplications in the horizontal curriculum and the vertical curriculum (English, 1978; Jacobs, 1997). By making explicit what is covered, the map helps curriculum developers and teachers ensure there are no gaps or unnecessary repetitions in the curriculum. Mapping makes the curriculum more transparent by linking the different aspects of the curriculum and allows curriculum management, planning and evaluation to be more efficient and effective (Harden, 2001a). Web-based curriculum mapping allows educators to look at real-time data through effective and dynamic online systems (Jacobs, 1997, 2004b).

Where the models differ are in the primary purpose of curriculum mapping, the intended users and the source and representation of data within maps. For English, the main purposes of curriculum mapping are curriculum management, quality control and ensuring there is alignment between the planned, the taught and the tested curriculum, including the alignment of instruction with set learning standards and outcomes. English sees curriculum development as a management function, while noting that teachers have a pivotal role in 'mapping' what they teach in the classroom. The curriculum map is mainly intended for use by curriculum administrators, the curriculum committees and the school principal to audit and evaluate the actual curriculum being taught by teachers. Information on the taught curriculum is collected through standard forms completed by individual teachers or by classroom observers. While English (1978) sees the curriculum map as an auditing tool, he also distinguishes curriculum mapping from other auditing processes (e.g. surveys, interviews and document analysis).

For Jacobs, the main purposes of curriculum mapping are communication and collaboration amongst teachers, as opposed to auditing (Jacobs, 1997, 2000, 2004b). Information is collected and provided exclusively by each teacher based on what she or he teaches in the classroom. Curriculum mapping is about ownership, "and what enhances ownership is the teacher using the computer tool" (Jacobs, 1997, p. 54). Therefore, while both models focus on capturing the taught or operational curriculum taking place in the classroom (as opposed to the prescribed or planned curriculum present in curriculum guides), their primary purpose differs. One uses mapping primarily as an auditing tool for curriculum management purposes, while the other uses mapping primarily as a communication and collaboration tool for teachers to analyse and manage the curriculum as a group instead of through a curriculum committee which Jacobs describes as "one of the vestiges of the late 1800s" (Jacobs, 1997, p. 48).

Harden adopts many of the ideas of English and Jacobs, but goes beyond these by focussing on the pedagogical, cognitive and knowledge management aspects of curriculum mapping. He sees the curriculum map as a learning tool for students to identify what, when, where and how they can learn, as well as a tool for teachers, curriculum planners and administrators to develop, implement, evaluate and improve the curriculum. By incorporating educational ideas on concept mapping (Edmondson, 1995; Novak, 1990; Novak & Gowin, 1984), hierarchical frameworks and matrix structures (Kiewra, 2002; Robinson & Kiewra, 1995), Harden takes curriculum mapping into the realm of student learning, understanding, knowledge integration and knowledge application. Harden notes that curriculum mapping gives a broad picture of the taught curriculum by providing not only an overview of the curriculum (e.g. learning outcomes, content and assessment) but also of the links between the different components of the curriculum. Hence, in Harden's model the curriculum map becomes an integral part not only of curriculum management and teacher communication, but also of the student's learning processes. Jacobs also makes some reference to students using curriculum maps but only briefly (e.g. Jacobs, 2000).

Harden describes two types of curriculum maps—a simple version covering four key curriculum areas, and a complex version covering up to ten areas. The simple version covers the learning opportunities, learning outcomes, content and assessment, and provides a broad multi-dimensional overview of the curriculum through these four views or perspectives which he calls 'windows'. The complex version can also include information on the learning location, learning resources, timetable, staff, curriculum management and students, giving a total of 10 different windows. At the centre of Harden's complex map is the student as opposed to the teacher or curriculum administrator (see Figure 4 in Harden, 2001a).

Defining and Categorising Curriculum Maps

This literature review has confirmed Harden's observation that "workers in the field of curriculum mapping have placed their own emphases on what they see as the key role for the curriculum map" (Harden, 2001a, p. 130). Interestingly, while many authors have based their curriculum maps on the models of English, Jacobs or Harden, other authors have not cited these models or the literature based on these models. Although this may indicate that these models have diffused into common usage, a more apparent reason calls into question the general level of awareness of these curriculum mapping models.

Just as the term 'curriculum' is difficult to define (Harden, 2001b), so is the term 'curriculum mapping'. This is partly due to how 'curriculum mapping' is used to simultaneously describe a process (the action of capturing curriculum data), a product (a map containing various curriculum elements and data) and a tool (an information system used to support the process and generate the product) (Oliver et al., 2010). In reference to medical education, Harden describes a curriculum map as being:

> ... more than just a timetable, a list of contents, a syllabus or even a map of what is to be learned. It includes all of these and more. A curriculum map provides a multi-dimensional view of the curriculum and allows the user to look at the curriculum with different lenses or through the different windows described. (Harden, 2001a, p. 130)

In reference to K-12 education, Hale defines curriculum mapping as “An ongoing, calendar-based process involving teacher-designed operational and planned-learning curriculum, collaborative inquiry and data-driven decision making” (Hale & Dunlap, 2010, p. 283).

Many different types of curriculum mapping perspectives, approaches and systems are described in the literature. Table 2.1 summarises the main characteristics of curriculum maps and some of the mapping options described in the literature. While this table is comprehensive it is not exhaustive, and mainly serves to provide an overview of the various types of curriculum maps described.

Table 2.1: Curriculum mapping purposes, processes, products and systems described in the literature.

Dimension	Characteristic	Options [1]			
Purpose (the use)	Intention	Managerial & administrative	Teaching	Learning	Community of practice
	Function	Curriculum auditing, evaluation, accreditation, quality control/assurance	Curriculum implementation and improvement, teacher communication, pedagogy	Understanding, self-directed learning, cognition	Collaboration, knowledge sharing and management
Process (the action)	Curriculum captured	Planned curriculum	Taught curriculum	Tested curriculum	Future curriculum
	Data source	Documents, interviews, surveys, observations	From taught activities	From learnt activities	
	Timeframe captured	Retrospective	Current	Future	
	Time period captured	Calendar period	Course	Teaching session	Topic area
	Data entered by	Support staff	Teachers	Students	Observers, evaluator, researchers
	Users	Managers (curriculum developers, administrators, committees, accrediting bodies)	Teachers	Students	Parents, general public
	Data revision	Never (e.g. one-off exercise)	Occasional	Regular	Live, and in real time
Product (the map)	Education level	K-12	Higher education	Undergraduate, pre-clinical	Postgraduate, clinical
	Curriculum elements	Learning outcomes (skills, competencies, standards)	Learning opportunities (courses, activities)	Assessments (methods, items)	Content (topics, disciplines) and other potential elements
	Number of linked elements	One or two	Three	Four	More than four
	Visual format	Lists (plain text or hypertext)	Matrices	Concept maps, hierarchical frameworks	Analytical graphs or charts with statistics
	Archive of previous years	Not available	Available		
System (the tool)	Information system	Paper or word processor	Spread sheet	Database	Online
	Indexing	Nil	Use of a controlled vocabulary (ontology, taxonomy)	Manual indexing	Automated indexing
	Query function	Nil	Browsing tool	Search tool	Report and export tools

[1] A map may include one or more options per characteristic.

To interpret the curriculum mapping literature it is important to understand which types of curriculum maps are being described and discussed. With this in mind, the researcher has used the following two dimensions in Table 2.1 to classify curriculum maps: (a) the purpose and (b) the system. The options for each dimension are represented on a continuum. The purpose of curriculum mapping can range from quality assurance (managerial), to teaching (pedagogy), to learning (understanding and cognition). The curriculum mapping system can range from basic (static word document), to intermediate (spread sheet with graphs), to advanced (dynamic online database). These two continua are shown in Figure 2.1 along with the range of options for each domain, and the relation of these options to the curriculum mapping model of English, Jacob or Harden.

Purpose (the use)	Auditing	Teaching	Learning
	For administration & management, and quality assurance / control	To enhance teaching, and communication amongst teachers (pedagogy)	To enhance student learning (understanding, cognition, knowledge management)

Quality assurance ....*Curriculum Map Purpose*........... Teaching & Learning

Curriculum mapping models	Mapping model by English (K-12)	Mapping model by Jacobs (K-12) Mapping model by Harden with 4 windows (higher education)	Mapping model by Harden with 10 windows (higher education)

Basic ....*Curriculum Map System*.............................. Advanced

System (the tool)	Word, spread sheet, survey file	Online database	Online learning management system
	Static (one-off exercise) Tick-box form, surveys	Dynamic (continuous) Free text data Indexed data	Dynamic (continuous) Controlled vocabulary, ontology
	Textual lists or tables	Hyperlinked matrix	Visual maps, charts, graphs

Figure 2.1: Range of curriculum mapping uses, systems and models described in the literature.

The intersection of these two curriculum mapping dimensions provides a simple way of categorising the variety of curriculum maps described in the literature into one of four quadrants, as shown in Figure 2.2.

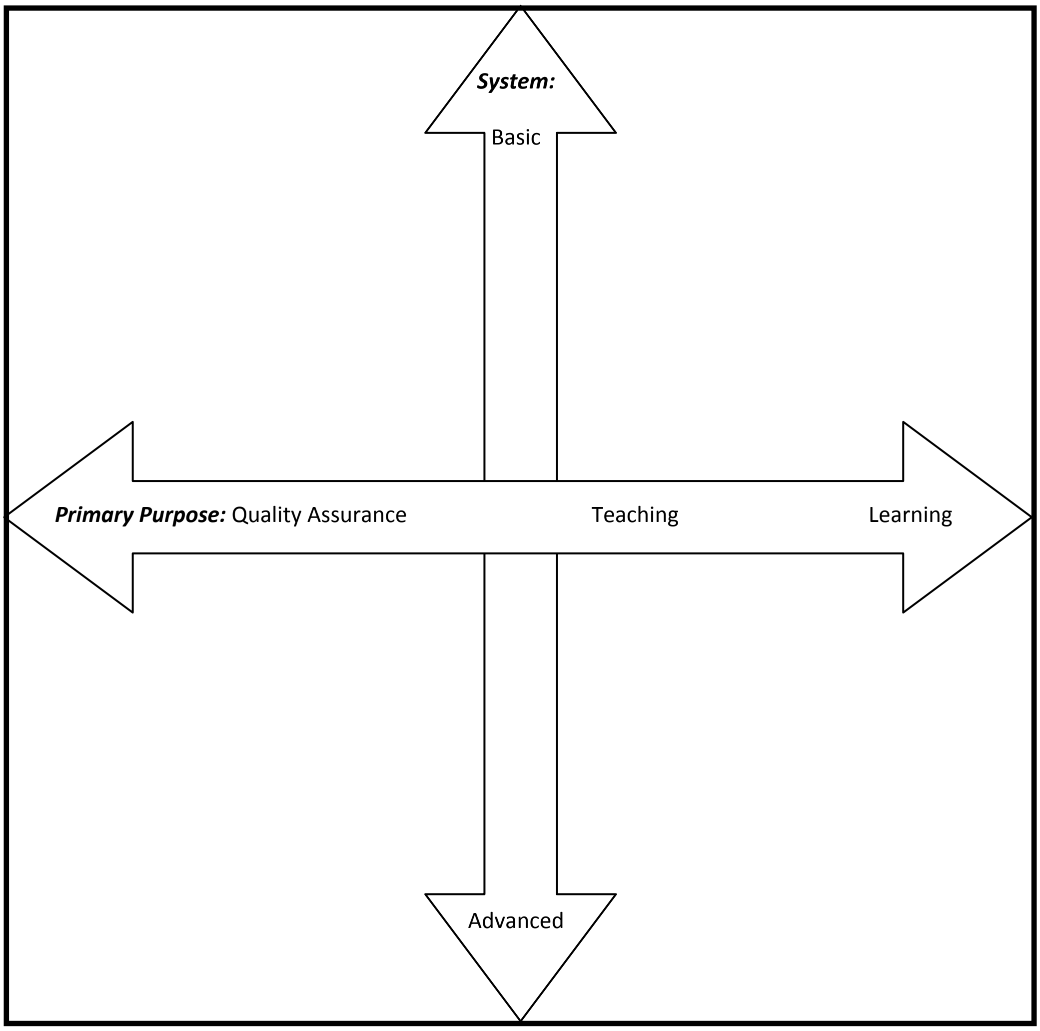

Figure 2.2: Method for categorising curriculum maps into one of four quadrants.

The horizontal axis in Figure 2.2 represents the range of options for the primary purpose of a curriculum map. For example, if the primary purpose of the map was to audit a curriculum element (e.g. generic skills) for accreditation, then the map would be placed to the left of the continuum even though authors may also report that the mapping exercise prompted teachers to reflect on how to enhance the student's learning experience since this would be a secondary outcome of the mapping exercise. Alternatively, if the primary purpose of a map was to design, develop or improve a curriculum for learning and teaching reasons then it would be placed to the right of the continuum. These four quadrants will be used to describe and categorise the type of curriculum maps described in literature from the mid-1970s to 2012. Maps are first categorised into basic or advanced information systems and then sub-categorised according to their primary purpose.

Basic Curriculum Mapping Systems

These are simple, uni-dimensional and static maps used to collect data through tables or matrices developed in a word processing file (e.g. MS Word), spread sheet file (e.g. MS Excel) or a survey tool (e.g. SurveyMonkey). Although these maps are often computer-generated, they essentially simulate a paper-based system and are generally not database-driven systems. The simplest maps cover one to two curriculum elements (or part of an element), and more complex maps cover two to three elements. Data collection methods vary but tend to include surveys, interviews and document analysis, and often involve course teachers completing a tick-box form to indicate if they had taught or assessed certain generic skills, content or other such curriculum element. An interview sometimes follows completion of the survey or form. Based on the mapping models by Harden, Jacobs and English, it is somewhat questionable if mapping only one to two elements (or part of) is in fact curriculum mapping, or if it should be referred to as the mapping of a specified curriculum element (e.g. generic skills mapping). However, since the higher education literature describes it as curriculum mapping, particularly in relation to generic skills, the same is done in this thesis. Note that the term 'generic skills' is also known in the higher education literature as 'transferable skills, lifelong learning skills, core skills, generic outcomes, graduate attributes and graduate capabilities' (Spencer, Riddle, & Knewstubb, 2011; Sumsion & Goodfellow, 2004), and is differentiated from discipline-based graduate skills and knowledge (Oliver et al., 2010). This thesis uses the term 'generic skills' to clearly differentiate it from the term 'graduate capabilities' which is used in the UMP to mean all the graduate outcomes of the students including the knowledge outcomes specific to medicine and also the generic outcomes (even though as noted by Oliver (2011) 'generic outcomes' are generally referred to as 'graduate attributes' in the Australian higher education literature).

Primarily for quality assurance and accreditation

This type of curriculum map is located in the top left quadrant of Figure 2.2. These basic maps were primarily developed to audit one or two curriculum elements (or parts of) for accreditation or quality assurance purposes (e.g. to audit generic skills covered in courses). Mapping was generally done as a one-off event that was often described as an 'auditing and mapping' exercise.

In the healthcare professions, these accreditation and quality assurance maps have been used in some postgraduate programs such as environmental health (Talbot, James, Verrinder, &

Jackson, 2007), and public health (McNutt, Furner, Moser, & Weist, 2008; Perlin, 2011) but they are generally not used in undergraduate programs. Other higher education programs that have used this type of audit and mapping exercise include business (Stivers & Phillips, 2009), information systems (Matveev, Veltri, Zapatero, & Cuevas, 2010; Stivers & Phillips, 2009; Veltri, Webb, Matveev, & Zapatero, 2011), engineering (Brodie, Bullen, & Jolly, 2011; Carew, Lewis, & Letchford, 2008), teacher training programs (Sumsion & Goodfellow, 2004) and various other higher degree programs (Tariq, Scott, Cochrane, Lee, & Ryles, 2004).

In Australian higher education, curriculum mapping has become intimately linked with the auditing of generic skills and the accreditation of higher education studies by government agencies through national quality assurance programs (Hughes & Barrie, 2010; Tertiary Education Quality and Standards Agency, 2012; The University of Sydney Institute for Teaching and Learning, 2012b) and international programs (Tuning, 2012). Hence, curriculum mapping in Australia has often been equated to a managerial exercise as opposed to a pedagogical exercise (Sumsion & Goodfellow, 2004). There are mixed views about the usefulness of curriculum mapping in Australian universities, where scholarship about curriculum mapping is somewhat limited, there is 'tick and flick' mapping mentality, and there is fear that the purpose of curriculum review is course-cutting rather than improvement (Oliver, 2011; Oliver et al., 2010).

Interestingly, many of the authors who have developed these 'audit maps' have cited the generic skills literature, their professional standards literature, quality assurance agency documents and/or the educational alignment literature, but they have rarely if ever cited the curriculum mapping literature of Harden, Jacobs, English or their contemporaries (e.g. Hale, 2008; Koppang, 2004; Willett, 2008). It is important that those interested in curriculum mapping differentiate these one-off 'tick and flick' mapping exercises done primarily for managerial reasons from the more comprehensive and long-term curriculum mapping activities done primarily for pedagogical reasons.

Primarily for teaching and learning

This type of curriculum map is located in the top right quadrant of Figure 2.2. These basic curriculum maps were primarily developed to design or improve a curriculum for pedagogical reasons as opposed to accreditation/managerial reasons. In general, the paper-based curriculum maps described by English in the 1970s and 1980s belong to this group. Although English saw curriculum maps as auditing tools, he also expected teachers (or classroom observers) to provide comprehensive information on the taught curriculum, and not just complete a tick-box form on one element of what they taught or planned to teach. Authors who have developed such maps have tended to cite the curriculum mapping literature of Harden, English, Jacobs and/or their contemporaries. These basic maps were developed for teachers, curriculum evaluators or educational researchers to use, but were generally not developed for students or made available to them.

Since the type of curriculum maps used in medical education tend to be advanced database systems, only a few basic systems have been described in the medical literature (Kies, 2010; Robley et al., 2005; Wachtler & Troein, 2003; Wong & Roberts, 2007). However, other health professions have used basic systems more frequently including nursing (Latimer & Thornlow, 2006; Wendt, 2003), pharmacy (Draugalis, Slack, Sauer, Haber, & Vaillancourt, 2002; Kelley, McAuley, Wallace, & Frank, 2008; Plaza, Draugalis, Slack, Skrepnek, & Sauer, 2007; Schafheutle, Hassell, Ashcroft, Hall, & Harrison, 2012) and radiology (Baker, 2012).

Other higher education programs that have used this type of mapping include music (Bath, Smith, Stein, & Swann, 2004), management information systems (Downey, McMurtrey, & Zeltmann, 2008), engineering (Campbell et al., 2009; Wigal, 2005), law (Moss Curtis & Moss, 2010; Spencer et al., 2011) and various educational programs (Kopera-Frye, Mahaffy, & Messick Svare, 2008; Liu, Wrobbel, & Blankson, 2010). Bath et al (2004) make a point of moving beyond the Australian Universities Quality Agency (AUQA) audit requirements into an 'action learning' process for teachers to create a valid and living curriculum. Some university websites suggest that teachers interested in curriculum mapping start by developing a simple map using a word table or spread sheet, while noting that electronic curriculum mapping systems are also available for later use (The University of New South Wales Teaching Gateway, 2012; The University of Sydney Institute for Teaching and Learning, 2012a).

Advanced Curriculum Mapping Systems

These curriculum mapping systems are complex, comprehensive, multi-dimensional, database-driven, dynamic, online and updated regularly or continuously and in real-time. These systems are generally web-based and are available to all levels of staff, often to students and sometimes to the wider community.

Primarily for quality assurance and accreditation

This type of curriculum map is located in the bottom left quadrant of Figure 2.2. This category includes a central curriculum portal being developed by the University of Sydney, which the authors define as ‘curriculum mapping’, which links the individual subjects (or courses) in numerous degree programs to the generic skills and requirements for each program (Gluga, 2010; Gluga, Kay, & Lever, 2010). As noted by Gluga (2010), learning management systems such as Moodle and Sakai have developed extensions which can partially model the links between parts of a subject and the overall learning outcomes for that subject. Another example is the system developed by Rudzajs, Kirikova, Strazdina, and Sukovskis (2011) to support the mapping of learning outcomes (set by universities and industry) to qualification or competency standards (from professional organisations and universities) and to accreditation criteria. Once again, these authors do not tend to cite the curriculum mapping literature of Harden, Jacobs or English or their contemporaries.

Also in this category are some commercially available information technology (IT) systems especially developed for higher education accreditation (Weave, 2010). The curriculum mapping application developed by Worldwide Instructional Design System (WIDS) looks to be designed primarily for accreditation and quality assurance more so than pedagogy and, therefore, would also sit in this category (WIDS, 2012).

Primarily for teaching and learning

This type of curriculum map is located in the bottom right quadrant of Figure 2.2. These multi-dimensional, database-driven and dynamic online curriculum mapping systems were primarily developed for pedagogical reasons. They include four or more curriculum components such as graduate capabilities (i.e. discipline-specific and generic skills), learning outcomes, learning opportunities, assessment, content covered, learning resources, teacher information and the like. These comprehensive curriculum mapping systems are primarily used for curriculum implementation, evaluation and improvement. They serve as a communication and collaboration tool for teachers to deliver educational programs with aligned learning outcomes, activities and assessments, that are integrated both horizontally (within school years) and vertically (across school years), and that cover the required content. If open to students, these curriculum maps also serve as a learning tool to support understanding and cognition. While these systems are also used as an auditing tool for curriculum evaluation, accreditation and quality assurance, this would be described as their secondary purpose.

This category includes the curriculum mapping systems proposed by Jacobs for K-12 education (Jacobs, 1997, 2000, 2004b) and implemented in many K-12 schools in the USA (e.g. Decker, 2003; DeClark, 2002; Hale, 2008; Hale & Dunlap, 2010; Koppang, 2004). Some authors have stressed the work of school librarians (Howard, 2010; Willcoxon, 2001) and others the importance of professional development and cultural change (Anonymous, 2006; Mills, 2001, 2003). Often these K-12 schools have used curriculum mapping systems that have been integrated with (or defined as) curriculum management systems (Brooks & Simkins, 1999; Garten, 2005; Herr, 2000; McIntire, 2006; Phelps, 2005; Renzulli, 2005; Tramaglini, 2005). The use of curriculum mapping and management systems in these schools is closely associated with the data-driven decision making movement in K-12 education in the USA (e.g. Anonymous, 2004; Bernhardt, 2004; Doyle, 2003; Kennedy, 2003; Ramnarine, 2004; Salpeter, 2004; Streifer, 2002; Villano, 2007; Weinstock, 2009).

This category also includes the curriculum mapping system for medical education proposed by Harden and developed by a number of medical and other health sciences schools worldwide since the mid-1990s when, as previously mentioned, they were often described as curriculum management or analysis tools, curriculum databases, electronic curriculum systems and the like. Some of the earliest examples of these database-driven curriculum management systems used in medical and dental education include those described by Mattern et al. (1992), Eisner (1993, 1995), Nowacek and Friedman (1995), Field and Sefton (1998), Cohen (2000) and Aabakken and Bach-Gansmo (2000). One of the earliest systems shared with other schools is CATS (Curriculum Analysis Tools) (Eisner, 1993, 1995), which was developed by a consortium of dental schools in America and Canada, and used by many dental schools (e.g. McGrath, Comfort, Luo, Samaranayake, & Clark, 2006). Another similarly shared system is CurrMIT which was developed by the AAMC and is used extensively in medical schools in the USA and Canada (Association of American Medical Colleges, 2012a; Cohen, 2000; Cottrell et al., 2004; Jacobs, Salas, Cameron, Naguwa, & Kasuya, 2005; Salas et al., 2003). Since the early 2000s, many other medical and health sciences schools have developed their own curriculum mapping and management systems (e.g. Bell et al., 2009; Britton et al., 2008; Hege, Nowak, Kolb, Fischer, & Radon, 2010; Hege, Siebeck, & Fischer, 2007; Lee et al., 2003; Mazurat & Schonwetter, 2008; Metz et al., 2001; Souza & Lawrence, 2004; Watson et al., 2007). Most of these equate to Harden's simple curriculum map model composed of four key elements (learning opportunities, learning outcomes, content and assessment) although some contain more elements. eMed Map is a good example of such a curriculum mapping system. In recent years, some other higher education schools have started developing this type of curriculum map

(Chen & Wu, 2009; Uchiyama & Radin, 2009), including in Australia where they are generally linked to national generic skills programs (Thompson, 2009). University-wide curriculum management and mapping tools are also starting to appear in Australia (Lai, Wood, & Marrone, 2012).

This category also includes the automated curriculum mapping systems which use algorithms and concept analysis of curriculum documents, such as the system developed by Vanderbilt University's medical school known as KnowledgeMap (Denny, Irani, et al., 2003; Denny & Smithers, 2002; Denny, Smithers, Armstrong, & Spickard, 2005; Denny, Smithers, Miller, & Spickard III, 2003). Other examples include the system developed by the University of Queensland's School of Pharmacy which uses Leximancer as the analysis tool (Noble, O'Brien, Coombes, Shaw, & Nissen, 2011) and the system developed by Drexel University's College of Information Science and Technology which analyses commercial bibliographic databases as a source of evidence for curriculum review (White, 2001). Technologically, these systems are very different to the advanced mapping systems cited above, but their primary purpose is the same (i.e. identifying curriculum gaps and redundancies, facilitating learning and understanding etc.) and, therefore, they sit in the same bottom right quadrant of Figure 2.2.

The more advanced functionalities of curriculum maps provide a visual representation of curriculum data in the form of statistical graphs, histograms and charts for curriculum management and data-driven decision making, as for example the CATs reports (McGrath et al., 2006) or the AAMC MedAPS curriculum reports (Association of American Medical Colleges, 2012b). Few curriculum maps represent curriculum elements and their links visually in the form of concept maps for use in student learning, as proposed by Harden (2001a) and in line with the concept map ideas of Edmondson (1995) , Prideaux (2003), Novak and colleagues (Coffey et al., 2003; Novak, 1990; Novak & Cañas, 2008; Novak & Gowin, 1984) and Kiewra and colleagues (Jairam & Kiewra, 2010; Kiewra, 2002; Robinson & Kiewra, 1995). To date, the only example found has been the Dynamic Learning Maps project at Newcastle University in the UK (JISC The Design Studio, 2010; McGill, 2011; Newcastle University UK, 2010). These dynamic web-based maps fuse formal curriculum maps, personal learning records and community-driven maps by using the 'semantic web' and 'Web 2.0' approaches, and represent the information as concept maps and as hierarchical frameworks.

This category can also include the systems used for mapping or tracking the clinical encounters experienced by senior medical students (Benjamin, Robbins, & Kung, 2006; Crouch, Richardson, & Reid, 2005; Hatfield & Bangert, 2005), and by medical interns and residents during clinical and specialty training programs (Prince, Ross, Fertleman, & Watson, 2011; Wardle et al., 2011). Use of curriculum mapping to develop clinical activities or field experiences in non-medical higher education programs are also starting to appear in the literature (Baecher, 2012).

As noted by Harden, his comprehensive curriculum map model consisting of 10 elements or 'windows' is more akin to a learning management system. While such a system is likely to contain a curriculum map, it would be much more than just a curriculum mapping system. A good example of such a system is the eMed curriculum management system which contains tools for both content and assessment management, and which is also integrated with a course management system (originally WebCT and now Blackboard), library systems, and staff and student databases (Watson et al., 2007). Other such integrated systems include the Tufts Health Sciences Database (HSDB) (Lee et al., 2003; Metz et al., 2001) and Ilios 2.0 (University of California San Francisco, 2011).

Curriculum mapping and management systems in medical education in particular continue to evolve and are being refined, combined and merged into more comprehensive systems which resemble not only Learning Management Systems but comprehensive Knowledge Management Systems. An example of this is the Curriculum Inventory Portal (CIP) being developed by the AAMC as part of their Medical Academic Performance Services (MedAPS) project together with the international group MedBiquitous, universities that have developed curriculum management systems such as Ilios 2.0 (University of California, San Francisco), TUSK (Tufts University) and KnowledgeMap (Vanderbilt University) as well as commercial vendors (Association of American Medical Colleges, 2011). By 2014 the AAMC's CurrMIT system is likely to be integrated with the new MedAPS resources (Association of American Medical Colleges, 2012a).

Comparing eMed Map

The design of eMed Map was directly influenced by the curriculum mapping model of Harden, in particular by his emphatic insistence that a curriculum map be used not only by staff but also by students. The use of a curriculum map as a communication and collaboration tool, as noted by Jacobs, also influenced the design of eMed Map except that, in line with Harden's ideas, communication was necessary not only amongst staff but also between staff and students in order to make the curriculum transparent to both. Also important was Harden's concept of having a curriculum map that could show users the 'complete picture' by assembling and linking the different pieces of the curriculum together. As Harden noted “a curriculum is a programme of study where the whole is greater than the sum of the individual parts” and therefore “This complete picture is more meaningful to the teacher, the student and the manager than the picture presented by the random collection of pieces which is often what they have” (Harden, 2001a, p. 123).

As shown in Figure 2.3, eMed Map contains information relating to five of Harden’s curriculum map windows: learning opportunities, learning outcomes, content, resources and assessment; and as in Figure 3 of Harden’s article (2001a), learning opportunities are at the centre. eMed Map also contains some curriculum management elements (e.g. name of course convenors and principal teachers), and it links to other eMed systems and central databases which equate to other windows in Harden’s model including timetable, other components of student assessment (participation, portfolio and progress) and personal information on students and staff (for a detailed description of the various eMed tools and related system see Watson et al., (2007)).

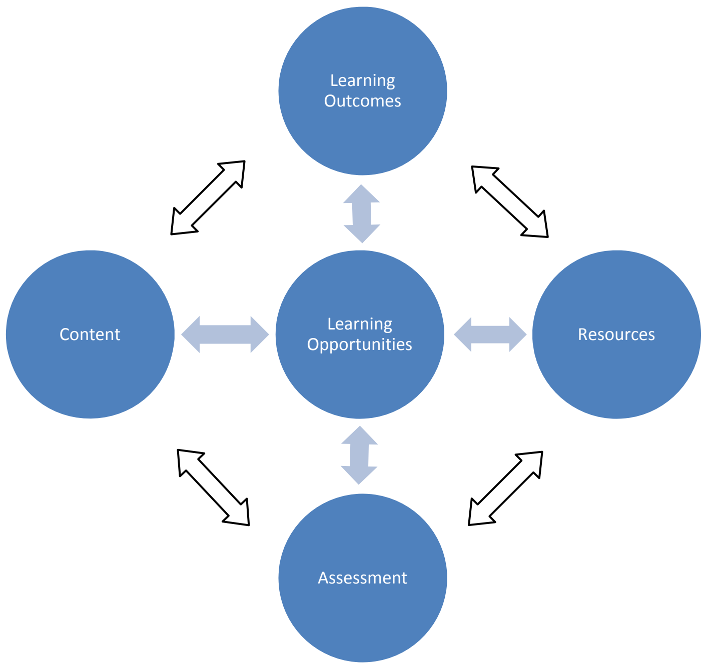

Figure 2.3: The five key curriculum elements (windows) of eMed Map (diagram adapted from Harden, 2001a).

The information in eMed Map is displayed as a two-dimensional matrix through its browsing views and search result views. Its standardised online data-capture forms contain various automated, drop-down or free text fields which are equivalent to many of the windows and nodes in Harden’s curriculum mapping model (see Appendix C). Table 2.2 shows the data capture forms and fields in eMed Map, their relation to Harden’s curriculum map windows, and the links between eMed Map and other eMed tools which equate to other windows in Harden’s model. Hence, Harden’s ‘windows’ are equivalent to the actual fields in either the eMed Map forms or other eMed tools (e.g. Timetable, Portfolio, Results, Assessment Item Bank, Teamwork); his ‘nodes’ are equivalent to the content within those fields; and his ‘links’ are equivalent to the hyperlinks in the tables or matrices of browsing views or search results in eMed Map.

Table 2.2: eMed Map forms, fields and links, and their relation to Harden’s curriculum map windows.

eMed Map data-capture form	Harden’s windows in relation to data capture fields in eMed Map	Harden’s windows in relation to eMed Map links to other tools
Learning Activity Form (LAF)	• Learning opportunities • Learning outcomes • Content • Learning resources • Curriculum management (course convenors and principal teacher for learning activity)	• Timetable (links to students and teaching staff) • Assessment components (items in MCQ tests, OSCE stations etc.)
Assessment Activity Form (AAF)	• Learning outcomes • Content • Assessment approaches used • Assessment components (assignments and projects for portfolio assessment) • Curriculum management (principal teacher for the assessment)	• Student (participation, portfolio, progress)
Learning Context Form (LCF)	• Learning opportunities • Content	
Course Outline Form (COF)	• Curriculum organisation (course convenors) • Learning opportunities • Content	• Timetable

As a whole, the eMed system covers all 10 major windows of Harden’s comprehensive curriculum mapping model. As noted by Harden, his comprehensive 10-window model represents more of a learning management system than a curriculum map. Therefore, eMed Map is mainly a curriculum content database, while the eMed system with all its integrated tools is considered a curriculum management system. Combined with a commercial course management system (originally WebCT and now Blackboard), the eMed system forms the UMP’s learning management system or virtual learning environment.

While eMed Map is a comprehensive system (Watson et al., 2007), it does not have all the functionalities proposed in Harden's model or available in other advanced curriculum mapping systems previously mentioned. For example, eMed Map does not currently have a concept mapping or data visualisation function, as suggested by Harden and as available in Dynamic Learning Maps (JISC The Design Studio, 2010; McGill, 2011; Newcastle University UK, 2010); and although this functionality was included in the original design and remains under consideration, it has not yet been developed. There is no graphical representation of search results as seen in some curriculum mapping systems that incorporate a dashboard for data mining and statistical analysis (e.g. CATs reports (McGrath et al., 2006) or the AAMC MedAPS curriculum reports (Association of American Medical Colleges, 2012b), although eMed Map search results can be manually exported to Excel and from there displayed graphically and analysed statistically. It does not have an automated indexing function for documents, as for example does KnowledgeMap (Denny, Irani, et al., 2003; Denny & Smithers, 2002; Denny et al., 2005; Denny, Smithers, et al., 2003). It currently captures only limited information about clinical activities in Phase 3 of the UMP, and does not capture information about senior students' clinical encounters as do some systems (Benjamin et al., 2006; Crouch et al., 2005; Hatfield & Bangert, 2005; Prince et al., 2011; Wardle et al., 2011).

Curriculum Mapping Benefits and Challenges

Various factors have driven the development and use of curriculum mapping and management systems in K-12 schools since the 1970s, in medical education since the mid-1980s, and in other higher education since the 2000s. Much has been written about the expected benefits and challenges of curriculum mapping in relation to education (e.g. curriculum design, implementation and evaluation, pedagogy, learning, cognition), organisation and management (e.g. organisational culture, staff development, leadership, cost) and information systems (e.g. information technology, human-computer interface, data management, user access). What follows is a summary of issues derived from the curriculum mapping literature in medical education, other higher education and K-12 education from the mid-1970s to mid-2012. Many of these issues are generic to all curriculum mapping types described in the previous section, while some only relate to advanced curriculum mapping systems and others to medical education only.

Educational Benefits and Challenges

A number of educational drivers of curriculum mapping have been described in the literature. These have included an interest in curriculum transparency (Harden, 2001a); the move toward outcomes-based, problem-based, integrated and spiral curricula, as well as student-centred learning and resource-based learning (Harden, 2001a); an increased interest in the constructive alignment model of Biggs and Tang (2007) and in the development of generic skills in higher education (Oliver, 2011; Oliver et al., 2010); and the desire to increase communication and collaboration amongst teachers (Hale, 2008; Jacobs, 1997, 2004b; Kallick & Wilson, 2004).

Many educational benefits of curriculum mapping are described in the literature. One of the most commonly reported benefits is that it supports curriculum alignment. This includes the alignment of the written (declared), taught (real) and tested (assessed) curriculum (English, 1984, 1987, 1988; Harden, 2001a), the alignment of learning outcomes, activities and assessments (Biggs & Tang, 2007; Kopera-Frye et al., 2008; Robley et al., 2005), and the alignment of the horizontal and vertical curriculum (Hale, 2008; Jacobs, 1997). Curriculum mapping also assists with curriculum design, planning and evaluation by allowing educators to edit, review, validate, develop and assess the curriculum in context and in real-time (Jacobs, 1997), and it serves as a data source and an improvement tool (Cottrell et al., 2004). It facilitates educational trends such as outcomes-based education, integrated learning and teaching, and the core curriculum (Harden, 2001a). It can be used to show key curriculum elements (e.g. learning opportunities, outcomes, content, assessment, resources, educational methods, sites etc.) and the relationships and links between these elements (Cottrell et al., 2004; Harden, 2001a; Salas et al., 2003). It can help identify curricular gaps, overlaps or repetitions (Jacobs, 2000; Jacobs et al., 2005; Kelley et al., 2008; Uchiyama & Radin, 2009). It can make the curriculum explicit and transparent to staff and to students (Cottrell et al., 2004; Harden, 2001a; Veltri et al., 2011) and it can provide a multi-dimensional and 'big picture' view of the curriculum (Harden, 2001a; Jacobs, 1997). It can promote knowledge sharing by encouraging students to engage in discussions with teachers about the educational program (Harden, 2001a; Veltri et al., 2011) and about related materials in other courses (Lee et al., 2003). It can help faculty members share learning and assessment innovations (Cottrell et al., 2004). It can help determine if the curriculum meets specified academic and professional standards, and whether the curriculum is congruent with the expected learning outcomes (Harden, 2001a; Kopera-Frye et al., 2008). It can inform students how graduate attributes are developed over the course of their studies (The University of Sydney Institute for Teaching and

Learning, 2012a). It can offer students an overview of their prior, current and future learning and help with revision and contextualisation (McGill, 2011; Newcastle University UK, 2010). In medical education, it can help make the curriculum more integrated and interdisciplinary, and it can encourage students to see the application of the basic sciences and the social sciences to clinical practice (Harden, 2001a).

The educational challenges of curriculum mapping reported in the literature include ensuring complete curriculum coverage (Willett, 2008), the difficulty of mapping vague or incongruent learning outcomes (Kopera-Frye et al., 2008) and the difficulty of not allowing students in problem-based learning (PBL) curricula to look ‘ahead’ and see their future ‘health care problems’ although technological solutions have overcome this particular problem (Jacobs et al., 2005). In medical education, the use of curriculum mapping to provide information about the clinical curriculum, enhance clinical skills training and evaluate program quality across learning sites was proposed some years ago by Eisner (1993) and by Mattern et al. (1992). However, clinical curriculum mapping in medicine has been particularly challenging since it is difficult to define what should be the instructional unit in a clinical setting, what data should or should not be captured and what clinical skills taxonomy to use (Nowacek & Friedman, 1995). Even so, mapping the clinical curriculum remains a requirement (Ruddlesdin, Wentworth, Bhat, & Baker, 2010; Wardle et al., 2011; Wenrich et al., 2010), and some basic and advanced systems have been developed for medical students (Crouch et al., 2005; Hatfield & Bangert, 2005; Kies, 2010; Ross & Davies, 1999) and for medical internships and residencies (Benjamin et al., 2006; Dornan, Lee, & Stopford, 2001; Prince et al., 2011).

Organisational Benefits and Challenges

The main organisation and management drivers of curriculum mapping described in the literature include the need to meet certain educational standards (or proficiency targets) set by various school bodies, quality assurance government bodies, professional organisations and national policies (Hale, 2008; Jacobs, 2000; Oliver, 2011; Oliver et al., 2010). Also influential has been the move towards data-driven decision making and evidence-based education (Anonymous, 2004; Salpeter, 2004; Streifer, 2002), and the trend in medical education towards more centralised and less departmentally-based curricula (Harden, 2001a).

The organisational benefits of curriculum mapping often cited in the literature include: a continuous curriculum management process (as opposed to a rotational process) to adjust the curriculum for school improvement and student achievement (Harden, 2001a; Tramaglini, 2005); the ability to document the content, activities and organisation of an educational program, and to quickly and easily respond to surveys or queries that concern the curriculum (Salas et al., 2003); and the ability to determine the allocation of resources in a school, and to find staff members engaged in teaching activities of particular interest (Salas et al., 2003). Electronic curriculum mapping can replace manual curriculum tracking (i.e. tracking through surveys, interviews, document analysis etc.) and can provide more effective curriculum management for accreditation, collaboration between course directors and teaching staff, and continuous quality improvement. Mapping can break down 'silos of instruction', and can facilitate the curriculum committees' task of overseeing the curriculum implementation, evaluation and improvement cycle (Jacobs et al., 2005). It can help monitor and assure the development of graduate attributes, as is increasingly being required in higher education by government agencies (e.g. AUQA/TEQSA in Australia) and professional bodies (e.g. in medicine, pharmacy, engineering etc.) (Britton et al., 2008; Kelley et al., 2008; Oliver et al., 2010; Veltri et al., 2011). The curriculum mapping process is reported to increase communication, collaboration and collegiality amongst staff members on issues such as instructional strategies, course content, assessment methods and expected program outcomes, and can help ensure that the curriculum reflects the goals of the academic institution and the professions (Britton et al., 2008; Jacobs, 1997; Kallick & Wilson, 2004; Lee et al., 2003; Sumsion & Goodfellow, 2004; Uchiyama & Radin, 2009). It is proposed that, by curriculum mapping, teachers no longer work in isolation and understand the benefits of collegiality; and the very process of coming together to work on the curriculum is powerful professional development that can encourage reflection and dialogue (Carew et al., 2008; Hale & Dunlap, 2010; Harden, 2001a; Jacobs, 1997; Mills, 2003; Sumsion & Goodfellow, 2004). As well, if curriculum mapping and evaluation is conducted in a positive and constructive way, it can alter the culture in an academic institution by promoting a spirit of inquiry and an open and objective dialogue about an educational program (Britton et al., 2008; Oliver et al., 2010). A curriculum map can become the medium of organisational memory, the mechanism for diffusion of practices, and an archive of the best curriculum assets to diffuse amongst other teachers, so that a professional community of learning emerges (Kallick & Wilson, 2004). In medical education, mapping areas of expertise of required knowledge, skills and attitudes (expertise mapping) can equate to communities of practice (Harden, 2001a). Curriculum mapping can be used as an empowering tool that can help all teachers be leaders in the curriculum they deliver (Hale & Dunlap, 2010; Moss Curtis & Moss, 2010; Oliver et al., 2010). It can stimulate and organise collective thinking and cause systemic change in an organisation (Hale, 2008; Veltri et al., 2011). The ongoing faculty dialogue can result in a high level of content integration and collaboration (Lee et al., 2003). Curriculum maps can support a data-driven decision making process, be the voice of reform, and become the hub for making decisions about teaching and learning (Jacobs, 1997; Kallick & Wilson, 2004; Moss Curtis & Moss, 2010; Weinstock, 2009). Finally, by integrating mapping data with assessment data teachers can produce new types of knowledge that can give new types of instructional solutions (Jacobs, 2004a).

Many organisational challenges to curriculum mapping have been reported in the literature. Curriculum mapping is not a passing educational fad (Mills, 2003) or a simple, unproblematic task as often portrayed in the generic skills literature (Sumsion & Goodfellow, 2004) but instead is a complex task that requires coordination, communication and teacher involvement so that better use of teachers' time and school resources can be made (Mills, 2003; Tramaglini, 2005). Some teachers may find the map a threat to their autonomy and course ownership or be intimidated by its perceived complexity and reliance on technology (Harden, 2001a; Kopera-Frye et al., 2008). Others may find it a threat due to its role in auditing and quality assurance which can evoke overtones of instrumentalism and managerialism, and may paradoxically achieve the opposite of its intended use in course-improvement if perceived as a course-cutting measure. This can lead to limited faculty buy-in due to concerns over how the map might be used, and can become a political football if cross-currents of suspicion exist about its ultimate purpose (Britton et al., 2008; English, 1978; Kopera-Frye et al., 2008; Moss Curtis & Moss, 2010; Oliver et al., 2010; Sumsion & Goodfellow, 2004). Its use in auditing can also lead to a compliance culture where a staff member's engagement in mapping is limited to a superficial 'tick and flick' exercise associated with top-down directives, and therefore has no effect on improving learning, teaching, communication or collaboration (Carew et al., 2008; Oliver et al., 2010; Thompson, 2009). This problem has been particularly obvious in Australian higher education (Thompson, 2009), and has led some to comment that the best tool used poorly will not engage staff, and the process will not be worthwhile if teachers see it as bureaucratic 'busywork' (Oliver et al., 2010). Curriculum mapping is a large undertaking requiring the involvement of many faculty members, and can be very time-consuming and tedious for teachers who can see it as an added burden. This can lead to limited buy-in unless teachers also accept it as necessary to improve an educational program (English, 1978; Jacobs et al., 2005; Oliver et al., 2010; Willett, 2008). Working with staff to get their content online can be a lengthy and at times difficult process, and faculty development is a key issue which requires the use of support staff beyond the core project team (Metz et al., 2001). While substantial amounts of educational data are being collected through mapping and assessment tools, a systematic plan for reviewing and using the data for curriculum revision and improvement may not be in place (Draugalis et al., 2002; Hale & Dunlap, 2010). Finally, finding funds to develop (or purchase) and maintain a curriculum mapping system and to support the mapping process is a major challenge since these are labour- and resource-intensive endeavours (Bell et al., 2009; Willett, 2008).

Information Technology Benefits and Challenges

The main technological drivers of electronic curriculum mapping described in the literature include: the major advances in Information and Communication Technology (ICT) such as the Internet and Web 2.0 which have provided real-time communication, have supported knowledge sharing, organisational learning and communities of practice, and have heralded the end of the industrial age and the arrival of the information age in learning, teaching and instructional design (Reigeluth, 1999b; Wilmarth, 2010).

The technological benefits of curriculum mapping gained by using an online and database-driven system (as opposed to simple 'paper-based like' computer systems) include: the ability to share curriculum information with various stakeholders (teachers, students, administrators, researchers, accrediting bodies etc.) in real-time, to include digitised materials such as readings, websites, lecture notes and the like (Lee et al., 2003; Maxwell, 1997; Willett, 2008), and to easily edit and review the data (Jacobs, 1997). Database-driven maps also allow the indexing of curriculum content using metadata, controlled vocabularies and formal taxonomies so that content can be searched and retrieved easily (Carr, Olmos, Bushnell, & Bushnell, 2008; Eisner, 1993, 1995; Nowacek & Friedman, 1995; Salas et al., 2003; Willett, Marshall, Broudo, & Clarke, 2007; Willett, Marshall, Broudo, & Clarke, 2008). Data can be presented at different levels of depth or granularity, and links between the content can be recorded and represented visually, therefore providing students with a learning structure to improve understanding (Harden, 2001a; McGill, 2011).

Reported technological challenges include: capturing the right level of detail or granularity (Willett, 2008); meeting the information needs of different users (Nowacek & Friedman, 1995); drilling down to infinite detail which can seem overly bureaucratic to teachers whose engagement is needed for success (Oliver et al., 2010); and not capturing enough information (e.g. only linking graduate outcomes to courses) to reveal content gaps, overlaps or redundancies (Kelley et al., 2008; Veltri et al., 2011). Staff members also need to become accustomed to using the curriculum database rather than paper (Willett, 2008). Another problem has been the quality of data provided by staff or imported from other systems (Gluga et al., 2010; Sumsion & Goodfellow, 2004). Curriculum mapping methods that use retrospective data collection (e.g. teacher or student recall of generic skills or content covered over a given year) are subject to recall bias (Plaza et al., 2007). Mechanisms to update the data following curriculum changes can also cause problems (Willett, 2008). Other challenges have included: making the maps truly interactive and dynamic, designing a simple and logical framework that meets all users' needs (Willett, 2008) and providing a user interface that is easy to navigate (Jacobs et al., 2005). Other difficulties have included changes to technologies and tools used or supported by the main campus (Willett, 2008) and a lack of suitable software applications particularly for higher education since many commercial curriculum mapping applications are designed for K-12 schools (Bell et al., 2009; Moss Curtis & Moss, 2010). A particular challenge for medical education has been finding a standard medicine taxonomy or ontology that is broad and comprehensive yet simple enough for staff members to use when indexing their content in the map (Willett et al., 2007; Willett et al., 2008).

From Curriculum Mapping to Knowledge Management

Various educational technology systems are used in learning and teaching, and these systems are constantly adapting, changing and merging in line with the advances in ICT. A good example of this is CurrMIT and its potential incorporation into the MedAPS Curriculum Inventory Portal (Association of American Medical Colleges, 2011, 2012a). Some authors have attempted to classify the various educational technology systems in use (Marshall et al., 2003; McKenney, Nieveen, & Strijker, 2008; Woodell, 2001). For example, in discussing systems to support the complex task of curriculum development, McKenney et al. (2008) distinguish three types of IT tools: (a) Electronic Performance Support Systems such as computer-based training or systems to support educational designers (e.g. CASCADE); (b) Knowledge Management Systems (KMS) such as course management systems (e.g. Blackboard) and instructional systems for managing knowledge across multiple courses, subjects and disciplines; and (c) digital repositories (e.g. Merlot) for the storage and re-use of curriculum materials (learning objects).

Marshall et al. (2003) note that in some ways educational systems are like KMS since both are involved in knowledge creation from information or data found in resources. In citing Accenture, they note the following six knowledge management functions: acquire, create, synthesise, share, use to achieve organisational goals and establish an environment conducive to knowledge sharing. Spector (2002) notes that a KMS can have a positive impact on the work of instructional design groups, which often involves “a collection of complex tasks and activities typically accomplished by multiple individuals working on different aspects at different times and perhaps in different locations” (Spector, 2002, p. 42). He goes on to say:

> ... the use of knowledge management tools in instructional design can improve the quality of instruction and add to what we know about the relationship between the design of instruction and learning outcomes. The future of KMS in instructional design appears bright. (Spector, 2002, p. 45)

He defines Lotus Notes as a widely used KMS in university settings which has all the required key features plus the added advantage of an underlying database (Lotus Domino). Douglas (2008) adds that research into knowledge systems such as how to ensure knowledge quality, and evaluating the effect of the technology on individuals, organisations and society need to be addressed, and those in the field of instructional design have much to contribute to this research. He adds that knowledge systems and learning systems should be seen “as integral components of systems for supporting human performance and the development of human society” (Douglas, 2008, p. 247).

Sharma et al. (2011b) have noted that the first wave of e-learning was characterised by Learning Management Systems (LMS) which focussed on administering web-based classroom training, while the second wave of more sophisticated e-learning is characterised by Learning Curriculum Management Systems (LCMS) that are being increasingly used across medical faculties worldwide. These LCMS focus on the learner’s needs for self-regulation and life-long learning and on the potential of the Internet as a new learning paradigm, and “are ideally suited to create content-centric learning strategies, supporting multiple methods for gathering and organizing content, leveraging content for multiple purposes, and achieving educational goals and objectives” (Sharma et al., 2011b, p. 387). The evolution of curriculum management systems had also been discussed by Watson et al. (2007) in comparing the eMed system to other similar integrated curriculum management systems used in medical faculties. It is interesting to note that the eMed system, of which eMed Map is a component, has been recently described by Rudzajs et al. (2011) as a “vivid implementation example” of the newly emerged area of educational informatics, which they define as “bringing together aspects of information science, computing, education, instructional systems technology, and learning sciences; and building on, integrating, and extending these areas of endeavour” (Rudzajs et al., 2011, p. 1). Also worth noting is how the eMed system has been cited as an example of a system that can provide “a holistic view of a student’s progress, aided by a whole-of-program view of where the (graduate) attributes are being taught, developed and assessed ...” (Housego & Parker, 2009, p. 412), a process supported not only by eMed Map but also by the associated eMed Portfolio, eMed Teamwork and eMed Tracking databases (Hughes, Toohey, & Velan, 2008; O'Sullivan et al., 2012; Watson et al., 2007) and most importantly by the integrated and program-level educational approach of the UMP (McNeil et al., 2006). Hence, an advanced curriculum mapping system such as eMed Map which has been developed in the KMS application Lotus Notes/Domino can be regarded as a learning, teaching and knowledge management system that forms part of a comprehensive curriculum management system (eMed). eMed Map can be used not only for quality assurance or to map what is being taught, as well as when and how it is being taught but also as a system that can promote student learning and knowledge sharing, communication and collaboration amongst users, coordination of curricular activities and control of processes. The use of such a curriculum mapping system in medical education warrants a close and comprehensive evaluation, and this is discussed in the next section.

Section 2: Curriculum Mapping Research Deficit

This section covers the current deficit in the evaluation of curriculum maps, and how this research project starts to address this deficit.

Evaluation of Curriculum Maps

Based on the educational and organisational benefits of curriculum mapping described in the previous section, particularly those of advanced web-based and database-driven curriculum mapping systems and of their role in learning, teaching and knowledge management, it is not surprising that Harden wrote “No good curriculum can afford to be without one” (Harden, 2001a, p. 136). However, to date much of the literature on curriculum mapping in higher and K-12 education has described the *expected* or *assumed* benefits and challenges of curriculum mapping. Less often, this literature has reported the *actual* benefits, challenges and requirements based on empirical evidence from formal evaluations of long-term curriculum map use in either higher education or in K-12 schools.

This gap has been noted by writers such as Bartoo (2005) who, in reviewing one of Jacobs’ books (2004b), observed that while the book contains helpful ideas and suggestions for those considering curriculum mapping, in the book's prologue Jacobs suggested that a criterion of curriculum mapping success is a measurable improvement in student performance, and yet nowhere in the book was there any verification that any significant level of such improvement had occurred in over 10 years of experience with the technique. He added:

> When Jacobs talks of "research", she means information to pave the way for successful implementation of mapping, not investigating the results of implementation. Although her suggestions are congruent with all that we know about successful administrative implementation of an innovation and her continual defense of the need for teachers to work collaboratively is consonant with good leadership practices, this book is not a sober assessment of the value of curriculum mapping. (Bartoo, 2005, p. 2440)

While Harden suggested that curriculum mapping in medical education can be of great benefit to students and staff and can lead to more effective and efficient education, he also noted "It has to be recognised, however, that experience with curriculum mapping in education is limited" (Harden, 2001a, p. 124) and that it is important to "evaluate the use made of the map and to collect the response of staff and students to the map once it is in action" (Harden, 2001a, p. 134). Naik et al. (2011) observed the need to evaluate the impact of educational innovations and interventions such as curriculum mapping in a scholarly manner, to promote best evidence medical education and the scholarship of teaching, and to share these results publicly for review and critique by peers and for eventual adoption. Oliver (2010) also commented on the limited scholarship on curriculum mapping in higher education.

Sumsion and Goodfellow (2004) observed that curriculum mapping is a complex task and that if its potential is to be realised it will need to be the focus of more extended methodological discussions, and added:

> First, we believe it is imperative that future studies recognize and attempt to address the constraints, tensions and dilemmas associated with curriculum mapping that are beginning to emerge in some of the more candid accounts of generic skills initiatives. The challenges involved will require a broader paradigmatic framework than has characterized much of the generic skills literature to date. In other words, we need to utilize a wider range of research designs and theoretical lenses than the existing technicist paradigm that continues to predominate. (Sumsion & Goodfellow, 2004, p. 344)

They propose that adopting a different perspective may assist in developing an appreciation of the complexity of curriculum mapping and of the tensions encountered during curriculum mapping endeavours:

> These perspectives could usefully inform case study investigations of the multiplicity of ways in which these phenomena and issues play out, and to what effect, preferably across a range of diverse cultural, pedagogical and institutional contexts. Such case studies could be instrumental in shifting the existing focus on often simplistic attempts to measure curriculum content and generic skills development to multi-layered description and analysis that documents the complexity and non-linearity of the processes involved (Sumsion & Goodfellow, 2004, p. 344).

The only empirical evaluations of curriculum maps found in the literature up until August 2012 have been five doctoral dissertations based on curriculum mapping in K-12 schools in the USA (Browne, 2009; Lucas, 2005; Lyle, 2010; Mathiesen, 2008; Wilansky, 2006), and an evaluation conducted by Willett (2008) on the use of curriculum maps in Canadian and UK medical schools. However, no in-depth case-study evaluation of the use of curriculum mapping in medical education or other higher education has been found to date.

The five doctoral dissertations on curriculum mapping in K-12 schools explored various aspects of curriculum map use by teachers. Lucas (2005) showed that teachers found the mapping process particularly effective in curriculum alignment and long range planning but somewhat less useful for short range planning. Wilansky (2006) found that teachers overwhelmingly agreed that curriculum mapping would improve the districts' instructional program and ability to identify gaps and redundancies, that teachers believed mapping was directly impacting on their instructional practices on professional collaboration, standards alignment and assessment, and that teachers perceived that a web-based system would facilitate the process more so than a paper-based system. Mathiesen (2008) found that teachers appeared to be using the mapping tool to organise and manage the curriculum and were reporting that their instruction was aligned to state content standards, and that teachers needed administrative support and communication about the purposes and processes of curriculum mapping and additional training to produce data reports to use in collegial conversations about the curriculum. Browne (2009) found that active and supportive leadership was essential in fostering commitment to professional development initiatives such as curriculum mapping, and that educational leaders need to provide teachers with opportunities to engage in authentic dialogue and collaboration in a trusting environment. Lyle (2010) found that for a large-scale reform such as curriculum mapping to be successful, education leaders need to identify and address potential change barriers, assume non-traditional leadership roles and responsibilities, such as raising teachers' awareness about the need for curriculum alignment with state standards, and the importance of collaboration to address curricular gaps and redundancies to improve student learning.

The evaluation by Willett (2008) reported the quantitative and qualitative results of a survey he conducted in mid-2007 of Canadian and UK medical schools to determine "the current status, characteristics, and challenging and successful aspects of their efforts in curriculum mapping" (Willett, 2008, p. 786). Of the 13 Canadian and 18 UK medicals schools who responded to his survey, 19% had completed maps and continued to upgrade them, 55% were in the process of building maps, 16% were planning maps, and 10% did not have map construction as a priority. A large number of schools were using custom-build solutions (e.g. web programming languages, databases, spread sheets, XML), or were customising open-source or commercial solutions (e.g. CurrMIT, Blackboard, ThinkingCap, Moodle). The type of curriculum elements mapped varied, and clustered around different functionalities (scheduling; teaching and assessment methods; links to learning outcomes; searching by topics, themes or concepts). Of the 29 schools that provided comments about their successes and challenges in planning, constructing and maintaining their curriculum maps, more reported challenges than successes. Although the benefits experienced seem to justify the development of curriculum maps, Willett observed that the time and resources required to map was an obstacle for many schools, and that more research was needed into successful strategies for curriculum mapping. He noted:

> Few reports on curriculum mapping or research studies into mapping exist in the medical education literature... Research into effective policies for map construction and maintenance, as well as evaluative studies on map use and impact, is needed. (Willett, 2008, p. 787)

This literature review shows that, although there is much written about the *expected* or *assumed* benefits of curriculum mapping, there is very little empirical evidence in the current educational literature that has been derived from comprehensive, longitudinal case-study evaluations on curriculum mapping, and limited quantitative and qualitative information on how many staff members actually use the map, how often, for what purpose(s), what benefits they have gained, what problems they have encountered and the like.

Filling the Research Deficit

This evaluation of eMed Map starts to address the deficit in the higher education curriculum mapping literature described above and is unique in a number of ways. First, it is a comprehensive evaluation of an advanced, database-driven online curriculum mapping system that has been in continuous use by staff and students of a medical faculty since 2004. This eMed Map study follows on from a smaller evaluation by staff and students of the whole eMed system (including eMed Map) which was conducted in mid-2004 (and partly updated in 2006) to measure the overall usability of eMed and of WebCT, which was then used as a basis for system improvements (Watson et al., 2007). Second, this research evaluates the use of a curriculum map that was designed primarily for learning and teaching purposes (e.g. pedagogy, cognition, knowledge management) as opposed to curriculum administration and evaluation (e.g. audits and quality assurance), and was based on Harden's curriculum mapping model (Harden, 2001a). Third, except for one or two cases reported in the literature (Marshall et al., 2003; WIDS, 2012), few curriculum mapping systems appear to have been explicitly designed around instructional design theories or organisational learning theories as was eMed Map. The most commonly cited educational theories reported in the curriculum mapping literature are those on curriculum alignment such as the constructive alignment theory (Biggs & Tang, 2007), and Bloom's taxonomy. In contrast, this research evaluates a curriculum mapping system that was designed not only around specific administrative needs (e.g. curriculum management and quality assurance) and educational needs (e.g. the constructive alignment of learning outcomes, activities and assessments) but also around Reigeluth's instructional design elaboration theory (Reigeluth, 1999a, 1983; Van Patten et al., 1986), and Wenger's social learning theory and communities of practice (Lave & Wenger, 1991; Wenger, 2006; Wenger et al., 2002). Fourth, this case-study uses a triangulated, mixed-methods evaluation approach consisting of qualitative and quantitative methods to gather empirical evidence on eMed Map's use. Finally, this research is unique in that it uses a formal theory and approach—namely GST and systems thinking—to synthesise the evaluation results, to explain the findings from an educational, organisational and technological perspective, to identify the cause of problems, and to recommend potential solutions using a holistic and systemic approach. To date, no similar comprehensive evaluation of a curriculum mapping system has been found in the literature. Therefore, this thesis is an important and unique addition to the educational literature and fills a significant research gap.

Conclusion

This chapter has provided an overview of the curriculum mapping terminology and of the three main mapping models described in the literature. It has then discussed the wide spectrum of curriculum mapping systems and processes described in the literature, and classified the variety of maps available. It then synthesised the drivers, benefits and challenges of curriculum mapping described in the literature from the mid-1970s to mid-2012. Finally, it identified the research deficits in the curriculum mapping literature and explained how this thesis starts to address this deficit. The next chapter presents the theoretical framework used in this thesis to evaluate the use of eMed Map by staff members involved in the UMP.

Chapter 3 : Theoretical Framework

Overview

This chapter provides an overview of the theoretical frameworks which guided this study—namely general systems theory (GST), systems thinking and system dynamics.

Evaluation Theory

From the outset of this thesis, the researcher had noted that the supporting theory selected for the evaluation of eMed Map would need to be holistic enough to include the educational, organisational and information systems domains, descriptive enough to explain the combined results from the triangulation of research methods used, and prescriptive enough to offer practical suggestions based on those findings. Many candidate theories were reviewed and it was determined they had less relevance or fit with the case-study's aims. These included formal theories on learning (e.g. see Bigge, 1982; Learning-Theories.com, 2008), multimedia learning (e.g. see Mayer, 2005), instructional design (e.g. see Reigeluth, 1997, 1983, 1999c; Tennyson et al., 1997), organisation and management (e.g. see Pugh, 1997; Value Based Management net, 2011), and information systems (e.g. see Wade, 2010). Since the information systems discipline is positioned at the confluence of technology, humans and organisations (Avison & Fitzgerald, 1995; Bacon & Fitzgerald, 2001; Hevner et al., 2004), the researcher focussed her attention on the theories and models used in this field. This relatively new discipline uses a diverse range of 'imported' theories from reference disciplines such as education, sociology, psychology and management (Barkhi & Sheetz, 2001; Lee, Lee, & Gosain, 2004; Wade, 2010) as well as its own 'native' theories (Moody, Iacob, & Amrit, 2010) to explain the technical, personal and organisational aspects of information systems use such as user acceptance, IT adoption, training needs and the like.

Various information systems theories and models listed by Wade (2010) were explored and some were considered as potentially useful (e.g. socio-technical theory, diffusion of innovations theory, technology acceptance model, Delone and McLean information systems success model, work systems theory, GST). After analysing and reflecting on the findings of the qualitative study, the researcher concluded that the systems thinking approach of GST and the methods used in the system dynamics field could best explain the multi-faceted, interrelated and complex nature of the qualitative findings. The holistic and synergistic approach of the systems thinking paradigm, of GST and of the systems sciences would allow the researcher to bring together the organisational, educational and personal issues affecting the use of the Map in a way that the other information systems theories she had explored did not appear to offer. It is interesting to note that some information systems researchers have proposed that the systems thinking approach could unify and integrate the various theories, models and frameworks used in the information systems discipline which is seen by some to be fragmented (e.g. Checkland, 1988; Mora, Gelman, Forgionne, Petkov, & Cano, 2007a; Mora, Gelman, Forgionne, Petkov, & Cano, 2007b). What follows is an overview of systems thinking, GST and system dynamics, and of their application in this thesis.

Systems Thinking

While the notion of systems, systems thinking and holism can be traced back to ancient Western philosophers such as Aristotle and his statement that the whole is more than the sum of its parts, and to Eastern philosophers such as Lao Tsu, the modern systems thinking concepts originated from the philosophical arguments between the mechanistic and organismic models of the 19th and early 20th century (Bertalanffy, 1971, 1972; Cabrera, Colosi, & Lobdell, 2008; Checkland, 1993, 1999; Checkland & Haynes, 1994; Kast & Rosenzweig, 1972; Skyttner, 1996). Hence, parallel to the philosophical and methodological debate between positivists and constructivists, there has been a similar paradigm debate between the mechanistic/linear world view and the organic/systems view. Over the past 40 years since the publication of Bertalanffy's classic book 'General System Theory' (1971), much has been published about systems theory and applied systems research, some of it being highly quantitative and involving computer applications and simulation, and some of it depending heavily on qualitative inquiry (Patton, 2002).

Systems thinking was largely codified through the works of Bertalanffy on GST with its focus on living systems, and also by the work of Wiener and Ashby on Cybernetics with its focus on machines, man-machine relations and information processing (Bertalanffy, 1971; Checkland, 1999; Francois, 1999; Olsson, 2005). The systems thinking movement has given rise to many different systems thinking versions, schools, methodologies and thinkers which a number of authors have attempted to categorise in various ways (e.g. Checkland & Haynes, 1994; Olsson, 2005; Ramage & Shipp, 2009). Many researchers have shaped the modern systems approach, including the hard/functionalist/ positivist stream (e.g. Forrester), the soft/interpretivist stream (e.g. Checkland), the critical/emancipative stream (e.g. Flood), and the critical realism systemic stance (e.g. Mingers) (Mora et al., 2007b).

Numerous disciplines and fields have adopted the systems thinking approach, including education (Cohen, Manion, & Morrison, 2007; Watson, Reigeluth, & Watson, 2008; Zylinski et al., 1998), organisation and management (e.g. Ackoff, 1994; Duffy, 2006; Gharajedaghi, 2007; Kast & Rosenzweig, 1972; Senge, 2006; Senge & Scharmer, 2006), information systems (Mora et al., 2007b; Wolstenholme, 2003), program evaluation (e.g. Hummelbrunner, 2011; Jokela, Karlsudd, & Östlund, 2008; Patton, 2002) and medicine (De Simone, 2006), which are the disciplines and fields encompassed by this particular research project. Systems thinking has had profound implications for program evaluation where the parts are often evaluated in terms of strengths, weaknesses and impacts using a one-level, reductionist approach without consideration for how the parts are nested in and interdependent with the whole program, and hence without the insights gained by exploring the dynamics in both downward and upward directions, and the interconnections of these system dynamics (Patton, 2002).

A review of the systems thinking literature revealed that there is no clear definition of what constitutes 'systems thinking' (Ackoff, 1994; Boardman, Sauser, John, & Edson, 2009; Cabrera & Colosi, 2008; Cabrera et al., 2008; Checkland & Holwell, 1998; Maani & Cavana, 2007; Patton, 2002; Rapoport, 1976; Richardson, 1994; Richmond, 1994; Senge, 2006; Sterman, 2000) or even of what constitutes a 'system' (see for example Mora et al., 2007a, 2007b; Rapoport, 1976). Richardson (1994) notes that there are many fields which use patterns of thought and problem solving that fall under the generic label 'systems thinking'. Some of these fields have the word 'system' in their names (e.g. systems analysis, general systems theory, soft systems methodology, critical systems science, socio-technical systems, system dynamics) and some do not (e.g. operations research, hierarchy theory, management cybernetics, cognitive mapping, complexity theory). In reference to the use of systems thinking in evaluation, Cabrera et al. (2008) note that some scholars and evaluation practitioners view systems thinking as a specific methodology, such as system dynamics, others believe it is a plurality of methods, others see it as systems science or as GST, while still others see systems thinking as a social movement. Cabrera et al. (2008) see systems thinking as being informed by systems ideas, systems methods, systems theories, the systems sciences, and the systems movement, but as different from each of these. They define it as a pattern of thinking or cognitive process consisting of four universal rules or structures (distinctions, systems, relationships and perspectives) and the dynamic interactions between them (Cabrera & Colosi, 2008; Cabrera et al., 2008). Richmond (1994) is also of the opinion that systems thinking is not the same as GST, soft systems, systems analysis, system dynamics, chaos theory or operations research although he notes that it has elements in common with all of these.

This research project has adopted the systems thinking definition provided by Richmond (1994), which has some similarities to the definition by Patton and also to that by Cabrera. Richmond considers systems thinking to be both a paradigm with its own vantage point and set of thinking skills (similar to Patton), which is supported by a learning method with its own process, language and technology (similar to Cabrera), with the two parts supporting each other and forming a synergistic whole. Richmond defines the systems thinking paradigm as being 'bifocal' and allowing those who employ it to be able to see both the forest and the trees from both a structural and behavioural perspective. Structurally, systems thinkers see both the generic and the specific (not just the latter) and behaviourally, they see both the pattern and the event (not just the latter). There were two reasons why the researcher adopted this definition of systems thinking over others. First, this definition considers systems thinking to be a paradigm which encompasses various systems-oriented theories (e.g. general systems theory, social systems theory, dynamic systems theory, complexity theory) and systems-based fields (e.g. system dynamics, soft systems methodology, socio-technical systems, management cybernetics), as opposed to considering systems thinking to be a methodology that belongs to one particular systems theory or field. Second, this definition sees systems thinking as a new way of thinking that can be learnt through the acquisition of particular thinking skills (e.g. system-as-cause thinking, closed-loop thinking, operational thinking) that can be applied to resolving complex, non-linear problems consisting of multiple interrelated variables.

This research project also adopted the following definition of a system: "A system is a representation of an entity as a complex whole open to feedback from its environment" (Ryan, 2008, p. 28). This definition was chosen because, while brief, it incorporates all aspects of the systems approach including the requirement of a system to be open to its environment (i.e. systems have an effect upon and are affected by their environment) while keeping in mind that, since the observer sets the boundaries of a system, an open system can be reframed as closed by expanding the system boundaries to include its environment (Ryan, 2008). Systems can come in many forms including natural systems (e.g. climate), technical systems (e.g. communication networks), educational systems (e.g. curricular systems, educational technology systems) and human systems (e.g. individuals, groups, organisations).

General Systems Theory

GST was first formulated by Ludwig von Bertalanffy who proposed a more organismic approach to the study of complex systems, objecting to the narrow reductionism and mechanistic approach of classical science (Bertalanffy, 1971, 1972). GST is seen as either a meta-theory (Skyttner, 1996) or a grand theory (Gregor, 2006), with a highly abstract set of assumptions or rules that can be applied to many fields of study to understand systemic change. GST was "founded on the assumption that all kinds of systems (concrete, conceptual, abstract, natural or man-made) had characteristics in common regardless of their internal nature." (Skyttner, 1996, p. 24). Bertalanffy saw systems as organised wholes comprising component parts that interact in a distinct way and endure over time, and intended GST to be used in understanding systems in general, whatever the nature of their component elements and the relations between them (Bertalanffy, 1971). Over time Bertalanffy and other eminent persons of the systems movement formulated the hallmarks of GST, and today there is agreement that the following properties together comprise GST:

- *Interrelationship and interdependence of objects and their attributes.* Unrelated and independent elements can never constitute a system.
- *Holism.* Holistic properties not possible to detect by analysis should be possible to define in the system.
- *Goal seeking.* Systemic interaction must result in some goal or final state to be reached or some equilibrium point being approached.
- *Transformation process.* All systems, if they are to attain their goal, must transform inputs into outputs. In living systems this transformation is mainly of a cyclical nature.
- *Inputs and outputs.* In a closed system the inputs are determined once and for all; in an open system additional inputs are admitted from its environment.
- *Entropy.* This is the amount of disorder or randomness present in any system. All non-living systems tend towards disorder; left alone they will eventually lose all motion and degenerate into an inert mass. When this permanent stage is reached and no events occur, maximum entropy is attained. A living system can, for a finite time, avert this unalterable process by importing energy from its environment. It is then said to create negentropy, something which is characteristic of all kinds of life.
- *Regulation.* The interrelated objects constituting the system must be regulated in some fashion so that its goals can be realized. Regulation implies that necessary deviations will be detected and corrected. Feedback is therefore a requisite of

effective control. Typical of surviving open systems is a stable state of dynamic equilibrium.

- *Hierarchy.* Systems are generally complex wholes made up of smaller subsystems. This nesting of systems within other systems is what is implied by hierarchy.
- *Differentiation.* In complex systems, specialized units perform specialized functions. This is a characteristic of all complex systems and may also be called specialization or division of labour.
- *Equifinality and multifinality*. Open systems have equally valid alternative ways of attaining the same objectives (divergence) or, from a given initial state, obtain different, and mutually exclusive, objectives (convergence). (Skyttner, 1996, pp. 33-34)

According to West Churchman the characteristics of a system are the following:

- It is teleological (purposeful).
- Its performance can be determined.
- It has a user or users.
- It has parts (components) that in and of themselves have purpose.
- It is embedded in an environment.
- It includes a decision maker who is internal to the system and who can change the performance of the parts.
- There is a designer who is concerned with the structure of the system and whose conceptualization of the system can direct the actions of the decision maker and ultimately affect the end results of the actions of the entire system.
- The designer's purpose is to change a system so as to maximize its value to the user.
- The designer ensures that the system is stable to the extent that he or she knows the structure and function. (Churchman as cited in Skyttner, 1996, p. 32)

Churchman's interpretation of the role of the 'designer' of a system is in line with the researcher's own role as the designer of eMed Map, and his interpretation of the role of the 'decision maker' is in line with the role of the senior managers of the UMP, such as the Associate Dean of Education who is the business owner of the eMed system, and the Learning Resources Manager who is the business owner of eMed Map.

As an applied science GST became 'systems science', which Skyttner defines as "a *metadiscipline* with a content capable of being transferred from discipline to discipline. Its equivalent to the classical laboratory becomes the computer. Instead of designing experiments with real materials, the computer itself became a viable substrate for experimentation." (Skyttner, 1996, pp. 24-25). Hence computers have become instruments for calculations, simulations and modelling of a virtual reality which is neither actual nor imaginary. The aim of systems science is not to replace traditional science or its analytical approach but to complement it, and to help scientists unravel the growing complexity of all systems (Checkland & Holwell, 1998; Rapoport, 1976; Skyttner, 1996). Specific individual methods have developed, many of which include computer modelling, simulation and gaming. Systems theory is applicable to both the hard and the soft sciences. Hard systems thinking is appropriate for closed, engineered systems, while soft systems thinking is appropriate for the complexities of social systems (Watson et al., 2008). As put succinctly by Jokela and Karlsudd:

> Systems theory is a theoretical approach for formulating general laws for systems, system components, and the hierarchical structure of the different components and relations between them ... One of the key principles in the systems approach is holism, which can be understood in terms of synergistic effects. (Jokela & Karlsudd, 2009, p. 327)

Embracing the applications of systems theory and systems science is the concept of systems design. Skyttner defines systems design as "a formal procedure where human resources, artefacts, techniques, information and work procedures are integrated into a system in order to facilitate its performance" (Skyttner, 1996, p. 26). In relation to the field of education, Salisbury defines systems design as "the application of systems thinking to the process of designs" and adds "When we design systems, we are designing structures in which people, processes, tools and machines combine to accomplish a predetermined purpose" (Salisbury, 1996, p. 45). In education, GST has been used as the basis for the development of a wide variety of instructional design theories and models such as Reigeluth's elaboration theory (Branch & Merrill, 2012; Molenda, 1997), and educational change models and approaches (e.g. Salisbury, 1996; Watson et al., 2008) including data-driven decision making (Kennedy, 2003; Streifer, 2002), and has been directly applied to the learning environment (e.g. Chen & Stroup, 1993; Jokela & Karlsudd, 2009).

Jokela et al. (2008) have applied the principles of GST, systems thinking, systems science and evaluation research to develop an evaluation model for examining organisations which make use of ICT for their core activities, and have used their model to evaluate the e-learning environment for physicians training in emergency medicine (Jokela & Karlsudd, 2009). The model, which is known as the SUV evaluation model, is based on an open-systems framework (the abbreviation 'SUV' stands for 'Systematisk Utvärdering på Vetenskaplig grund' in Swedish, which translated means 'systematic evaluation on a scientific basis'). The model's system structures and processes are divided into seven categories and three levels, as shown in Figure 3.1. The seven categories incorporate the GST principles described above, and give stability and direction to the evaluation activity. The three levels show the layered structure of an organisation, and are described as follows:

> Complexity increases successively when one moves towards higher levels... The innermost level includes individuals and interactions between them. The technology level comprises individual, computer systems and networks, as well as human-computer interactions. Finally, the organisation level illustrates how the individuals and IT systems are embedded in the organisational structure. (Jokela & Karlsudd, 2009, p. 237)

Figure 3.1: The seven categories and three levels of the SUV evaluation model (diagram reproduced with permission from copyright owners, Jokela et al., 2008).

In the SUV model, the definitions of system boundaries and of separate system levels are the result of the goals and attitudes of the evaluator. It is important to evaluate the relationships and interactions between the different subsystems and also between the system and its environment. The various activities within an organisation are considered as processes: "In such a process, an open system imports inputs in the form of human and technological resources, and the system converts inputs in a transformational process and then exports outputs" (Jokela & Karlsudd, 2009, p. 328). The evaluation of the outputs can then be used to develop and improve the organisation and its activities through a regulation subsystem which can ensure that transformation processes are directed towards the goals established for the system (Jokela & Karlsudd, 2009). The SUV evaluation model can be used with both qualitative and quantitative approaches, and can be incorporated in deductive and inductive studies including the *post factum* categorisation of previously performed evaluations. It is not restricted to any one method for gathering data, and explicitly encourages the use of multiple methods so as to gain a multi-perspective view of the organisation and/or activity under scrutiny (Jokela et al., 2008). The authors note that an evaluation based on systems theory is broader and more open to an analytical, critical and reflective approach which is more descriptive and explanatory than confirmatory. However, they also emphasise that the SUV evaluation model does not focus on causal connections but instead focuses or pointing to a number of possible influential factors (Jokela & Karlsudd, 2009; Jokela et al., 2008).

This research uses the SUV evaluation model in a *post factum* manner to analyse and synthesise possible influential factors affecting the use of eMed Map as identified through the empirical results from its three individual studies, namely the observational study, the web log with data linkage study, and the survey study. It then goes on to explore the causal connections between these factors by employing system dynamics methods which focus on complex, nonlinear and dynamic interactions. This system dynamics approach, which is also based on GST and systems thinking, is described next.

System Dynamics

System dynamics is an approach for appreciating the behaviour of and in complex systems particularly through an analysis of feedback loops, stocks and flows. It originated in 1956 through the work of its founder Jay Forrester on industrial dynamics in which he applied systems engineering, feedback control systems and computer science to the field of business and management (Forrester, 2007). System dynamics was influenced by cybernetics and by GST although some dispute the latter (Lane, 1994; Richardson, 1996). System dynamics is seen as an element of the broad field of systems thinking and not the opposite (Lane, 1994; Richmond, 1994). Even though there are substantial overlaps between systems thinking and system dynamics, these two terms are not synonymous. System dynamics is a particular systems science with its own methods, models and tools while, as previously noted, systems thinking is a paradigm or world-view based on holism and synthetics thinking, as opposed to reductionism and analytic thinking characterised by the classic scientific paradigm. System dynamics is applied to systems in a variety of fields including business, organisations, education, information systems, health, ecology, economics and the like.

The system dynamics field was first envisioned by Forrester in 1956 as a quantitative method based on feedback loops and computer simulation modelling for resolving business problems, but it then evolved in various ways. By the mid-1980s, qualitative system dynamics modelling methods based on inference or causal loop diagrams and archetypes began to evolve through the work of Wolstenholme, Coyle and others (e.g. Coyle, 1999; Wolstenholme & Coyle, 1983; Wolstenholme, Henderson, & Gavine, 1993). Qualitative system dynamics was then popularised by Peter Senge (2006) through his book 'The Fifth Discipline' which was first published in the early 1990s (Richardson, 1996).

The system dynamics methodology was designed to examine the behaviour of complex systems over time, which it does by representing the processes, structure, strategies and information flows of systems. The following definition of system dynamics covers both the qualitative and quantitative methods:

> A rigorous method for qualitative description, exploration and analysis of complex systems in terms of their processes, information, organisational boundaries and strategies; which facilitate quantitative simulation modelling and analysis for the design of system structure and control. (Wolstenholme et al., 1993, p. 31)

Hence qualitative system dynamics comprises the diagram construction and analysis phase, while quantitative system dynamics comprises the computer simulation phase. System dynamics uses diagrams as a medium for transmitting mental models and discussing change. This type of medium is useful because it provides a less ambiguous and more condensed form of communication than a written description. Particular types of diagrams which use a small, sound and rigorous set of symbols or generic building blocks fulfil this role well (e.g. stock-and-flow diagrams, and causal-loop diagrams).

Although, as noted by Akcam, Guney, and Cresswell (2011), system dynamics has been using qualitative data to study complex social systems since its inception, it does not have detailed protocols to describe the use of qualitative data or research methods in the systems modelling process. However, they note that researchers who have been using mixed-methods approaches with system dynamics have found that the coding and categorisation of qualitative data can successfully deliver enough information to develop a causal understanding of the phenomenon being researched and a dynamic hypothesis or theory that can be stated through causal loop diagrams, stock and flow diagrams, generic structures or archetypes, reference modes and dynamic models. This confirms that the mixed-methods approach used in this thesis is compatible with the use of qualitative system dynamics methods.

In this eMed Map study, the researcher used the Systems Thinking and Modelling (ST&M) methodology of Maani & Cavana (2007) which is based on system dynamics and which is similar to the methodology describe by Meadows & Wright (2009) and by Senge (2006). The ST&M methodology consists of a set of modelling and learning technologies which are defined as follows:

> The modelling tools can be used to understand the structure of a system, the interconnection between its components, and how changes in any area will affect the whole system and its constituent parts over time. System models can be used to study and foresee the behaviour of systems, as well as to facilitate and accelerate group learning. (Maani & Cavana, 2007, p. 8)

The ST&M methodology uses the following system thinking tools: causal loop maps, stock and flow models, microworlds (computer simulation), learning laboratory, and group model building. The methodology follows seven universal principles that embody systems thinking and collectively provide a framework for its theory and practice: (1) seeing the big picture (the forest AND the trees); (2) using short and long term solutions; (3) using 'soft' indicators (e.g. morale, burnout, commitment etc.) to measure the internal vitality of an organisation and not only 'hard' indicators (e.g. key performance indicators); (4) seeing the system as a cause of the problem (due to unintended consequences of our decisions and actions, and our mental models—our assumptions, beliefs, values etc.); (5) considers time and space delays (cause and effect are often not close in time and space, so cause-effect connections are often masked by time delays and chain effect of actions); (6) considers system versus symptom (first one needs to understand the system that generates the problem); and (7) considers multiple-causality thinking ('and–or' thinking) as opposed to single causality thinking ('either–or' thinking).

The ST&M methodology also includes the following four levels of thinking (Maani & Cavana, 2007; Meadows & Wright, 2009):

1. **Events**: basic information on what happened, when, where, how, who was involved etc. (many individuals are satisfied with this shallow level of thinking). Events are the most visible aspect of a complex system, but not always the most important.
2. **Patterns of behaviour:** a deeper examination of the trends and patterns of events and data over time (a deep level of thinking). The behaviour of a system is its performance over time.
3. **Systemic structures:** an even deeper examination of <u>how</u> trends and patterns relate to and affect one another over time, and <u>how</u> the interplay of different factors brings about the observed outcomes (an even deeper level of thinking). The structure of a system is its interlocking stocks, flows, and feedback loops.
4. **Mental models:** thinking of the mental models of individuals and organisations that influence <u>why</u> things do or do not work (or should or should not work). These mental models are based on our beliefs, values and assumptions, and underlie our reasons for doing things the way we do or should do them (the deepest level of thinking).

These four levels of thinking are often represented by the analogy of an iceberg whereby the event level of thinking (shallow thinking) is visible above the water level, and the patterns, systemic structures and mental models of thinking (deeper thinking) are hidden below the water level, as depicted in Figure 3.2. As noted by Meadows "systems thinking goes back and forth constantly between structure (diagrams of stocks, flows, and feedback) and behaviour (time graphs)" (Meadows & Wright, 2009, p. 89). Hence, systems thinkers strive to understand the connections between the events, the resulting behaviours and the structure or characteristics of the system, meaning the 'event-behaviour-structure' analysis as opposed to the more commonly used 'event-event' analysis (Meadows & Wright, 2009).

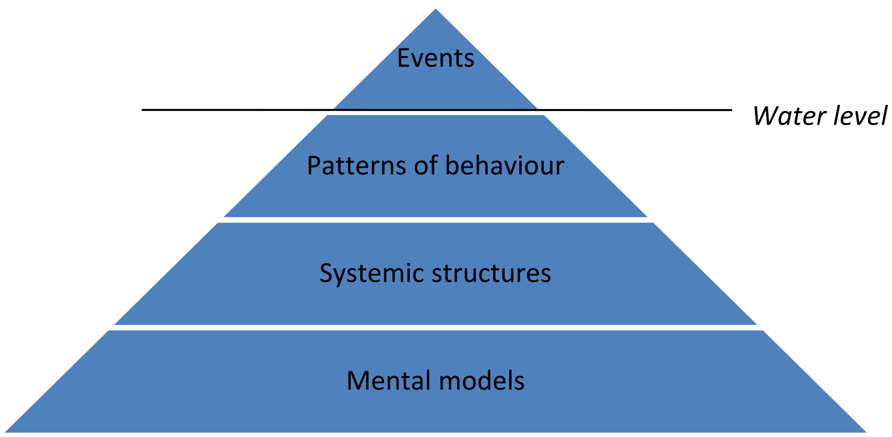

Figure 3.2: The four levels of thinking used in system dynamics (iceberg analogy) (diagram adapted from Maani & Cavana, 2007).

The five major phases of the ST&M methodology are: (1) problem structuring, (2) causal loop modelling, (3) dynamic modelling, (4) scenario planning and modelling, and (5) implementation and organisational learning (learning lab). These phases follow a specific process, and each involves a number of steps. The phases and steps included in a particular ST&M intervention will depend on the issues or problems being explored, the type of data available and the level of intervention. Not all phases or steps need to be included in a study. The first two phases of the ST&M methodology tend to represent the qualitative modelling phase of system dynamics, and the remaining three phases the quantitative modelling phase. The first two phases of the methodology include the following steps:

Phase 1: Problem structuring:

- Identify problems or issues of concern to management and main stakeholders
- Collect preliminary information and data
- Conduct group sessions for creative problem structuring

Phase 2: Causal loop modelling:

- Identify main variables
- Prepare behaviour over time graphs (reference mode)
- Develop causal loop diagram (influence diagram)
- Analyse loop behaviour over time and identify loop types
- Identify system archetypes
- Identify key leverage points
- Develop intervention strategies

This eMed Map study makes use of most steps in these two phases to identify and analyse the variables affecting Map use and to synthesise the results of its three studies in a holistic and systemic way, with the aim of providing intervention strategies for improving use of the Map and of similar curriculum mapping systems. The researcher is aware that while some system dynamics practitioners find it appropriate to use only the qualitative phase of the system dynamics methodology (Coyle, 1999; Maani & Cavana, 2007; Wolstenholme & Coyle, 1983; Wolstenholme et al., 1993), others believe that the quantitative phase is also essential (e.g. Forrester, 1994; Homer & Oliva, 2001; Sterman, 1994). The researcher’s reasons for using only the qualitative phase are: (1) the evaluation approach adopted in this research project is exploratory and descriptive as opposed to confirmatory, (2) the need to restrict the size of the project and (3) the desire to involve the UMP management staff in reviewing the results of the qualitative system dynamics modelling before potentially proceeding to the quantitative modelling phase and ultimately the organisational learning phase. The researcher envisages that the quantitative modelling phase could follow this research, and could be done in collaboration with management to promote a learning organisation based on the systems thinking approach proposed by Senge (Senge, 1996; Senge, 1995, 2006; Senge, Kleiner, Roberts, Ross, & Smith, 1994) and on a Community of Practice (CoP) as proposed by Wenger (Wenger, 1998, 2010; Wenger et al., 2010). This particular issue will be discussed further in the final Discussion chapter of this thesis.

Causal loop modelling includes the identification of system archetypes and leverage points to develop intervention strategies for a system. Since these two concepts are extensively used in the final Discussion, they are briefly explained below.

System Archetypes

System dynamics practitioners have developed a series of commonly use generic models known as system archetypes which provide a high-level map of dynamic processes representing a wide range of situations (Kim, 1993, 1994, 2000; Kim & Anderson, 1998; Maani & Cavana, 2007; Senge, 2006). System archetypes are referred to by name and are represented using causal loop diagrams. A causal loop is "… a conceptual tool that reveals a dynamic process in which the chain effect(s) of a cause is/are traced, through a set of related variables, back to the original cause (effect)" (Maani & Cavana, 2007, p. 30). In general, the reinforcing or positive feedback loop and the balancing or negative feedback loop represent the generic feedback processes for all causal loops. The origins of these processes can be found in feedback theory. The best starting variable in the loop is the key condition of the system (Maani & Cavana, 2007).

Leverage Points

In discussing ways of creating change in complex and dynamic systems, Meadows identifies specific places in the system where a small change can lead to a large shift in behaviour (Meadows, 2005; Meadows & Wright, 2009). Her ideas were first published in the 1990s mostly in relation to complex global-scale systems. In 2005, they caught the attention of software developers who republished her article in a magazine for software professionals (Read, 2005). As noted by the magazine's editor: "Perhaps if we understand both the software and the surrounding social structures fundamentally as systems, we could continue to improve our ability to create not merely “usable” software, but rather software that enables and inspires humans to improve and innovate” (Read, 2005). It is in this same vein that the researcher makes use of Meadows’ leverage points in the final Discussion chapter to identify where best to intervene in a curriculum mapping system to improve its use.

In system dynamics, leverage refers to actions or interventions that can have a lasting impact on the system by reversing a trend or breaking a vicious cycle. Hence, leverage points are seen as “points of power” (Meadows & Wright, 2009, p. 145). Finding a leverage point is not the same as finding a solution to a problem. Conventional problem solving does not explicitly consider the *context* of the problem, while systems thinking “… acknowledges the *messiness* of the world and views a problem within the context of its environment” (Maani & Cavana, 2007, p. 39). Leverage requires fundamental and long-term changes to the system as opposed to removing the symptoms of the problem. Systems thinking and modelling make it easier to see the leverage points in order to create relevant intervention strategies.

Meadows observes that leverage points are frequently not intuitive because as a system becomes more complex its behaviour becomes more surprising. Even if those deeply involved in a system intuitively know where to find leverage points, they often push the change in the *wrong direction* and systematically worsen whatever problem they were trying to resolve. In an effort to think more broadly about systems change, Meadows developed a list of leverage points which she numbered in descending order from the least to the most powerful leverage point for interventions; these points follow (Meadows, 2005; Meadows & Wright, 2009):

12. Numbers and constants (last on the list of powerful interventions)
11. Buffers
10. Stock and flow structures
9. Delays
8. Balancing feedback loops
7. Reinforcing feedback loops
6. Information flows
5. Rules of the system
4. Self-organisation of the system
3. Goals of the system
2. Paradigms or mindset out of which the system arises
1. Transcending paradigms (first on the list of powerful interventions).

Meadows' explains that her list is tentative and that its order is "slithery". She adds:

> The higher the leverage point, the more the system will resist changing it… Magical leverage points are not easily accessible, even if we know where they are and which direction to push on them. There are no cheap tickets to mastery. You have to work hard at it, whether that means rigorously analysing a system or rigorously casting off your own paradigms and throwing yourself into the humility of not-knowing.
> (Meadows & Wright, 2009, p. 165)

This concludes the description of the theoretical framework used in this research project. The next chapter provides a description of the project's research design.

Part 2: Research Strategy

Chapter 4 : Research Design and Methods

Type of Research Project

The design of this Map study was guided by the research literature on the evaluation of programs, educational technology and information systems, as well as by the qualitative and mixed-methods research literature. Since there have been many different approaches to evaluating education, IT and social phenomenon over the years, there have been many definitions of the term ‘evaluation’ (see for example Guba & Lincoln, 1989; Øvretveit, 1998; Patton, 2002; Stufflebeam & Shinkfield, 2007; Weiss, 1998). The definition favoured in this thesis, drawn from program evaluation, follows:

> … evaluation is the systematic collection of information about activities, characteristics and outcomes of programs to make judgements about the program, improve program effectiveness and/or inform decisions about future programming. (Patton, 2002, p. 10)

The importance of the research nature of evaluation studies has been emphasised by a number of authors such as Weiss (1998), Patton (2002) and Kelly (2004). As noted by Patton:

> When one examines and judges accomplishments and effectiveness, one is engaged in evaluation. When this examination of effectiveness is conducted systematically and empirically through careful data collection and thoughtful analysis, one is engaged in evaluation research. (Patton, 2002, p. 10)

Kelly (2004) goes on to note that all research has a theoretical basis which influences the methodology and frameworks used to conceptualise the problem under study. She indicates that while theory is not always made explicit in evaluation research, this is changing and it is becoming more common for evaluations to identify a theoretical model and methodological approach in the study design and their influence on the collection of data and the analysis and interpretation of results. However, she also argues that providing detailed, theoretically informed descriptions (qualitative or quantitative) does not go far enough for the purpose of evaluation research, since this does not provide insights into practical and ethical ways of addressing or solving the problem. She notes the importance of social and organisational change in evaluation research, and how the focus is to formulate a model to *alter* a phenomenon as opposed to developing a causal model to *explain* the phenomenon. Øvretveit (1998, 2002) also emphasises that the purpose of evaluation is practical action, and uses the phrase 'evaluation for action' or 'action evaluation' which he defines as "a broad umbrella term for a variety of different approaches which can be used for the purpose of practical improvement" and notes that it goes beyond research-oriented evaluations since "evaluation for action pays attention to how to assist the practical actions which could follow from the data gathering" (Øvretveit, 1998, p. 16). These interpretations of evaluation fitted well with the aim of this thesis which was to explore not only *if* the Map was being used, but if so *how* and if not *why* not, and from there to suggest practical actions to improve the Map's use.

Just as there are many definitions of evaluation, there are also many evaluation approaches (for example, as cited by Øvretveit (2002, p. 15) Patton estimated over 100 distinguishable approaches). This Map evaluation study partly uses a case-study approach as described by Stufflebeam and Shinkfield (2007). As noted by these authors, a case-study is a focussed, in-depth description, analysis and synthesis of a particular program; the investigator does not control the program but instead looks at it as it is occurring or as it occurred in the past. Its main thrust is to delineate and illuminate the program but not necessarily to guide its development or assess or judge its merit or worth. This case-study description neatly characterised the Map evaluation study:

> The study looks at the program in its geographical, cultural, organizational, and historical contexts, closely examining its internal operations and how it uses inputs and processes to produce outcomes. It looks at the program's multiple levels and also holistically at the overall program. It characterizes both central dominant themes and variations and aberrations. It defines and describes the program's intended and actual beneficiaries. It examines beneficiaries' needs and the extent to which the program effectively addressed the needs. It employs multiple methods to obtain and integrate multiple sources of information. While it breaks apart and analyses a program along various dimensions, it also provides an overall characterization of the program. (Stufflebeam & Shinkfield, 2007, p. 182)

There was also a strong ethnographic element to this thesis due to the researcher's dual role as the evaluator in this project and as a full-time academic involved in the UMP. Her academic work allowed her to spend a significant amount of time as a participant observer and general observer 'in the field' immersed with a variety of staff members involved in the UMP who were or were not using the Map, and in the culture of the UMP and the Faculty. As noted by

Patton (2002), ethnography has also emerged as an approach to program evaluation, applied educational research and the study of organisations and their cultures. He notes the centrality of culture and participant observation in ethnography, how programs and organisations develop their own cultures, and how improving a program may well include changing its culture.

In many ways this evaluation resembled the mixed-methods study defined by Stufflebeam and Shinkfield (2007) since it employed a range of complementary qualitative and quantitative methods to address the research questions. As noted by these authors, using both types of methods allows for important cross-checking of findings and greater confidence in the overall findings.

Finally, as noted by Myers (1997) both case-studies and ethnography are well accepted evaluation methods in the qualitative information systems research field. He observes that although most information systems researchers do either qualitative or quantitative research work, some have combined one or more methods in the one study. This is typically defined as ‘triangulation’ which, as noted by Creswell and Plano Clark (2007), is part of the mixed-methods research approach.

Research Design

The generic evaluation design checklist by Stufflebeam and Shinkfield (2007) ensured that various evaluation operations were considered. The following represent this research project’s key considerations.

Purpose: the ultimate purpose of this thesis was to investigate the use of a complex curriculum mapping system in a way not accomplished previously in any multi-method, triangulated study, and to improve the use of the Map as a learning, teaching and administrative tool. This would be done by evaluating if, how and why staff members were using the Map. Based on the results of the evaluation, a series of field, research and practical recommendations would be provided.

Audience: The first audience was the academic research community in general. Within the University, the second audience consisted entirely of staff members involved in the UMP and the third audience comprised the senior academic and general administrators involved in the UMP since they would be in a good position to consider the results of this evaluation and its proposed recommendations and act on them. In this respect, as noted by Øvretveit (1998), this evaluation had a managerial perspective since its primary users were the UMP managers.

Boundaries of evaluation: while the Map was also used by UMP students, this evaluation targeted the use by staff members. There were two reasons for this focus. One was to ensure project manageability. The second was because of a strong belief that unless the Map was populated with up-to-date and useful information by staff members there was little point in students using it. Since populating the Map was the responsibility of UMP staff members, in particular course convenors and principal teachers, it was important to evaluate staff members' use of the Map.

Domains and criteria: since the research took a holistic approach, it considered the educational, organisational and information system domains of Map use. A list of potential uses of the Map as a learning, teaching and administrative tool developed by the researcher during the Map's conceptualisation phase was refined and used as criteria for the types of Map use (see Appendix B).

Context: when the research project commenced in mid-2007 the eMed Map system and the UMP were still under development, organisational changes were occurring in the Faculty, and central IT changes were underway in the University. Hence, as observational data were being gathered, changes were occurring to the Map and to the context in which it was being used. Therefore, since the object being evaluated was a 'moving target', it was important to capture key events which directly or indirectly affected the use of the Map (see Appendix A for a chronology of these events).

Researcher's roles: the researcher was not only the investigator, but also a full-time academic involved in the UMP as the Map's designer, a teacher and a member of various groups and committees. Having designed the Map, she had her own ideas on its intended use in the UMP as a learning, teaching and administration system. Changes to the Map occurred out of necessity and most had been planned prior to this evaluation study. Any interventions by the researcher to complete the Map's development or to encourage its use was not part of this evaluation study but instead was part of her academic work. This research project did not intend to change the Map or its users *during* the evaluation, as for example occurs in developmental evaluations using action research (Stufflebeam & Shinkfield, 2007). Instead, it simply aimed to observe, survey, quantify, analyse, interpret and document who was using the Map, how and why or why not, and the benefits or barriers they were experiencing during this process.

Ethical considerations: all participants were staff members of the UNSW Faculty of Medicine, or of an associated Faculty or organisation involved in teaching UMP students. Ethics approval was granted for all parts of this research. The first approval was granted by the UNSW Human Research Ethics Advisory Panel (medical/community group) in April 2007 for a period of 12 months (HREAP number 2007-7-15), and covered the participant observation method and the web log with data linkage method. The second approval was granted by the UNSW Human Research Ethics Committee in May 2009 for a period of 5 years (HREC number 09084), and covered all methods used in this research. The type of consent sought from participants depended on the research method used in each study. Between 2007 and 2009, the researcher obtained verbal and written consent from staff members for participant observations. No consent was required for general observations relating to the Map or for textual documentation. In 2012, written consent was sought and attained to report identifiable quotes or comments from passive observations and textual documentations (no consent was required to report small non-identifiable quotes or comments). On 13 May 2009 all Faculty staff members (approximately 2700 staff) were informed through a Faculty-wide email announcement about the eMed Map study, and were given the opportunity to opt-out of the web log and data linkage study only or of the whole Map study. The announcement and online forms remained available to staff members via the eMed Map homepage from May to October 2009. There were 36 staff members who opted out of the whole Map study, and two staff members who opted out of the web log and data linkage study only, giving a total of 38 staff members who opted out of all or part of the Map study. On 26 February 2011 a similar email announcement was sent to new staff members who had started working in the Faculty between October 2009 and December 2010 and had used the Map (new staff members who had not used the Map were not contacted). None of these staff members opted out of the Map study. To retain the anonymity of staff members all information reported in this thesis has been de-identified.

Mixed Methods Research Design

This evaluation study used a mixed-methods research approach consisting of qualitative and quantitative methods (Creswell & Plano Clark, 2007), and in accordance with the ethics approval for the research. This method is defined as follows:

> Mixed methods research is a research design with philosophical assumptions as well as methods of inquiry ... Its central premise is that the use of quantitative and qualitative

> approaches in combination provides a better understanding of research problems than either approach alone. (Creswell & Plano Clark, 2007, p. 5)

Mixed methods research is generally (but not exclusively) associated with the paradigm or worldview known as pragmatism, which is oriented towards practice and what works, the consequence of research, the questions asked rather than the methods used, and using multiple methods of data collection and analysis to inform the problems under study. Creswell and Plano Clark note that “In pragmatism, the approach may combine deductive and inductive thinking, as the researcher mixes both qualitative and quantitative data” (Creswell & Plano Clark, 2007, p. 23). In some disciplines the mixing of methods in the one study is still surrounded by some controversy although the pragmatic approach to research is overcoming these controversies (Creswell & Plano Clark, 2007; Patton, 2002). In this respect, Patton notes:

> Yet, the practical mandate of evaluation... to gather the most relevant possible information for evaluation users outweighs concerns about methodological purity based on epistemological and philosophical arguments. (Patton, 2002, p. 252)

The mixed-methods research approach used in this Map study included a triangulation of qualitative and quantitative data and methods, and combined inductive and deductive thinking processes. Such an approach helped to: (a) gain a more complete picture of Map use by noting not only the general patterns of use and the number and characteristics of users but also the users’ perspectives about the Map, (b) identify the types of Map use and the variety of factors affecting its use, and then draw on a suitable theory that could explain what was happening, and (c) develop a survey instrument to validate the qualitative and quantitative findings, explore them more in-depth and test any emerging propositions. Patton described the advantages of triangulation as follows:

> Triangulation, in whatever form, increases credibility and quality by counteracting the concern (or accusation) that a study’s findings are simply an artifact of a single method, a single source, or a single investigator’s blinders. (Patton, 2002, p. 563)

The reasons for using the mixed methods research approach was to provide more comprehensive answers to the research questions posed, to complement qualitative and quantitative data, and to provide more credible results by counteracting the potential biases caused by using only one method or data source, or by the researcher’s own biased views. This approach was in line with a pragmatist view of research methods.

The mixed-methods design used in this Map study consisted of a convergent triangulation of qualitative data (using observations and textual documentation methods) with quantitative data (using web log reports and data linkage methods) whereby each data set was collected separately and the different results were triangulated to enrich the interpretation of results. An exploratory sequential structure was used whereby the qualitative data results helped to inform the development of items in a survey instrument that was used to verify the qualitative findings and explore them more in-depth, and also to explain some of the quantitative findings. All three methods had equal weight in the final interpretation of results. Figure 4.1 summarises this mixed-method design (Creswell & Plano Clark, 2007).

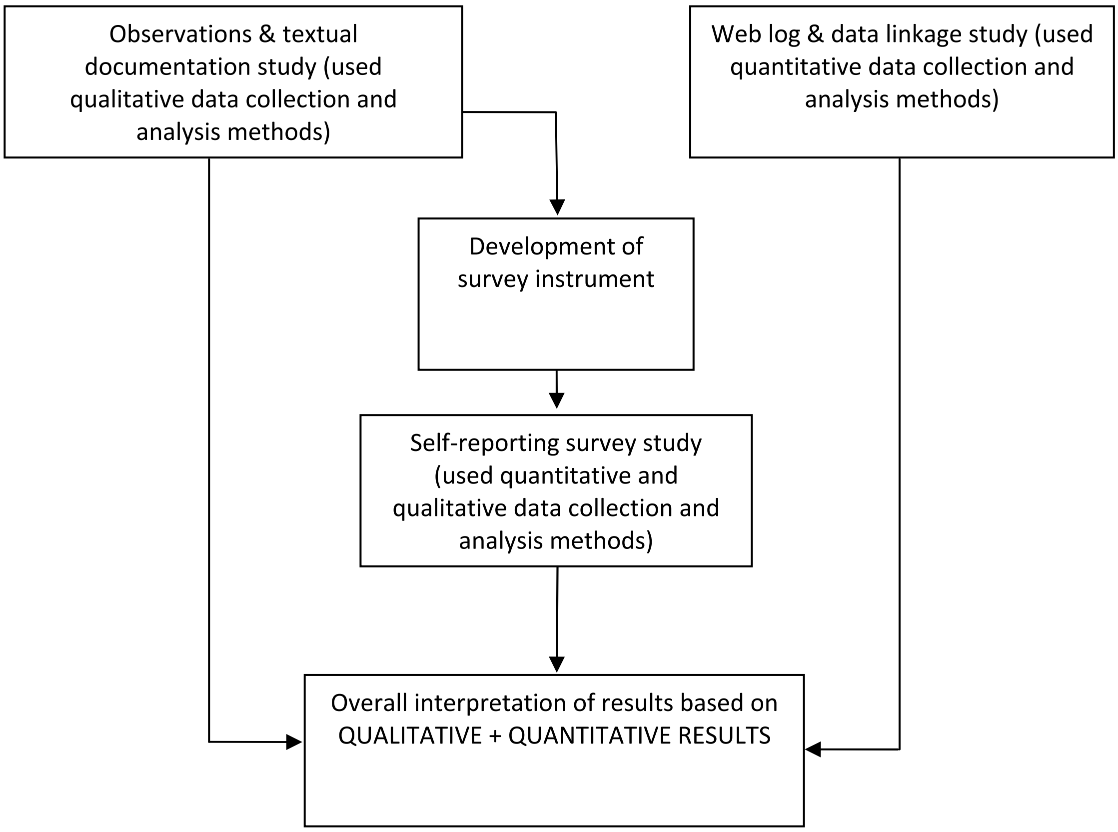

Figure 4.1: Research design showing a convergent triangulation of mixed-methods.

Researcher as Instrument

In quantitative research, validity depends on careful construction of the instrument (e.g. survey questions, test items or measurement tools) to ensure it measures what it is supposed to measure, while "in qualitative inquiry **the researcher is the instrument**" (Patton, 2002, p. 14). Patton therefore recommends that a qualitative report include some information about the researcher: “**The principle is to report any personal and professional information that may have affected data collection, analysis and interpretation**—either negatively or positively—in the minds of users of the findings” (Patton, 2002, p. 566). Janesick (1994) also notes that qualitative researchers accept the fact that research is ideologically driven and biased, and that there is no value-free or bias-free design. She adds:

> The qualitative researcher early on identifies his or her biases and articulates the ideology or conceptual frame for the study. By identifying one’s biases, one can see easily where the questions that guide the study are crafted. This is a big difference among paradigms. (Janesick, 1994, p. 212)

Many qualitative researchers see bias not as something to be avoided but rather as an asset, since for them “it is precisely the individual qualities of the human inquirer that are valued as indispensable to meaning construction” (Greene, 1994, p. 539). Qualitative evaluators also tend to “acknowledge if not celebrate the influential presence of their own selves in the inquiry process” (Greene, 1994, p. 538). Hence, qualitative researchers are likely to state their biases openly as a mechanism of disclosure, and to use reflexivity and critical self-awareness of one’s perspective. This approach is justified by other qualitative research luminaries such as Brody, who said the following about the use of reflexivity:

> Since the naturalistic investigator is him- or herself the research “instrument”, naturalistic inquiry cannot avoid observer bias by using the instrument to insulate the experiment from the preconceptions of the investigator. Instead, open disclosure of preconceptions and assumptions that may have influenced data gathering and processing becomes an inherent part of the conduct of the inquiry. (Brody, 1992, p. 179)

To support the process of disclosure, reflexivity and acknowledging one’s biases and ideologies, the researcher indicates that in this study she was an insider who at various times had roles as staff member involved in teaching in the UMP, and team member to support the design, development and use of the Map. She began this journey as an advocate of the Map, but evolved over time to be a research-oriented evaluator and after, an independently minded investigator and executer of this Map study. The researcher was aware that her own personal views could influence how she interpreted some findings. While this indicates likelihood for bias, this by no means overburdened the product of the research findings. The triangulation of research methods aimed to enhance the credibility of the findings by neutralising any bias inherent in the researcher, the methods or the data. In particular the web log analysis and survey studies were executed with a range of safeguards against undue bias.

Grounded Theorising

This research commenced in 2007 with the qualitative observations and textual documentation study and the following **basic research questions**: are UMP staff members using eMed Map? If so how, and if not why not? While the researcher had some ideas on what could be hindering the Map's use, she had no specific hypothesis to test or particular theory or constructs to follow. The qualitative study did not use a theory-based evaluation approach as described by Stufflebeam and Shinkfield (2007) but instead used the process of inductive analysis, creative synthesis and grounded theorising as described by Patton (2002), and as commonly used in many qualitative research methods including the grounded theory methodology of Glaser and Strauss (1967). However, it is important to note that this study did not employ the methodology of Glaser and Strauss, but instead used what Patton describes as "grounded theorising" (Patton, 2002, p. 454) which is a generic method involving both inductive and deductive processes. Patton observes that qualitative analysis is typically inductive in the early stages when figuring out possible categories, patterns and themes. At this stage, the researcher is open to the data and becomes immersed or grounded in the data so that embedded meanings and relationships can emerge from the data. In Patton's own words "the resulting analysis grows out of that groundedness" (Patton, 2002, p. 454). Once the patterns, themes and categories have been established, the final stage of qualitative analysis tends to be confirmatory and deductive, and involves generating theoretical propositions or formal hypotheses. Patton remarks:

> One of the strengths of qualitative methods is the inductive, naturalistic inquiry strategy of approaching a setting without predetermined hypotheses. Rather, understanding and theory emerge from fieldwork experiences and are grounded in the data. (Patton, 2002, p. 129)

The grounded theorising approach used in the qualitative study allowed for a suitable theory and hypotheses to emerge from the qualitative analysis. This is in line with the last two strategies of Miles and Huberman's six analytic strategies in qualitative research, as cited by Morse and Richard:

- *Gradually elaborating a small set of generalizations* that cover the consistencies discerned in the database.
- *Confronting these generalizations* with a formalized body of knowledge in the form of constructs or theories. (Morse & Richards, 2002, p. 44)

The collection and analysis of qualitative data and the use of grounded theorising allowed for the identification of recurring themes, patterns and new insights into how the Map was being used and the factors affecting its use, and for a deeper examination of the issues identified. These new insights and understandings allowed for the emergence of three working hypotheses and a formal theory that could explain the qualitative findings. Through this research process, GST and the systems thinking approach were identified as a suitable theoretical stance that could explain the qualitative findings, and be used to inform the development of survey items and the interpretation of the overall evaluation results (see Chapter 3 for details).

Hence, this research took a pragmatist and real-world practice position on research theories and paradigms, and combined both inductive and deductive thinking processes, harnessing interpretive/constructivist and positivist research approaches. The need for a pragmatist and mixed-methods approach to using qualitative and quantitative research methods is often reported in the literature on information systems evaluation and on organisational evaluation (see for example Goldkuhl, 2008; Lee, 1991; Lewis & Byrd, 2005; Myers, 1997). Also reported in this literature is the use of more engaged forms of interpretive information systems research methods such as participant observations (see for example Nandhakumar & Jones, 1997).

Overview of Methods

This mixed-method research relied on case-study and ethnographic approaches to explore Map use from an educational, organisational and information system perspective. It evaluated the Map's use within the context of the UMP, the Faculty and the University. It was cross-sectional since it evaluated the Map's use at specific points in time through a qualitative study and a survey study. It was also longitudinal since it evaluated Map use over a seven-year period through a web log study. It was done in real-time by using observations and the survey, and also retrospectively by using textual documentation and archived web log reports. It was partly criterion-based since the types of Map use were evaluated against set criteria or indicators. The evaluation was mostly formative in that it was used to assist in improving the Map’s use.

The research project employed a triangulation of methods to measure the observed behaviours and practices of Map users, as well as their values, beliefs and attitudes towards the information system and the mapping process. It consisted of three separate but interrelated studies: (1) a qualitative study which used observations and textual documentations, (2) a quantitative study which used data from web log reports linked to Faculty staff data and (3) a self-reporting survey study consisting of quantitative and qualitative data. These three studies were interrelated since results from one study often informed the other (see Figure 1.1 in the Introduction). In essence, the qualitative study informed the development of the survey items, the survey validated the qualitative findings and explored them more in-depth while also validating some quantitative findings, and the quantitative study measured Map use and verified some of the qualitative findings and survey results. Table 4.1 shows an overview of the characteristics of each of the three studies, including the strengths and weaknesses of the methods used. Figure 4.1 shows the overarching research design of this thesis.

This concludes Part 2 of this thesis. Part 3 includes a detailed description of the methods and procedures used in each of the three studies along with each study’s results and a discussion of those results.

Table 4.1: Characteristics of each study in this thesis.

Characteristic of study	The three studies		
	Observations and textual doc. study	**Web log reports with data linkage study**	**Self-reporting survey study**
Research method	Qualitative	Quantitative	Mostly quantitative items (closed-questions) with some qualitative items (open questions)
Research paradigm	Interpretive	Positivist	Positivist
Research thinking	Inductive	Deductive	Deductive
Research style	Naturalistic and ethnographic	Descriptive	Descriptive
Research perspective	Exploratory	Exploratory and confirmatory	Exploratory and confirmatory
Main research questions	Was the Map being used? What was the Map being used for? What were users' perceptions of the Map? What were the factors affecting its use? What hypotheses and theories emerged?	Who was using the Map and who was not? What were the staff characteristics of users and non-users? What were the patterns of use, and what did these patterns show? Was Hypothesis 1 on Map use confirmed?	Who was using the Map and who was not? Were qualitative findings confirmed? Were quantitative findings explained? Were Hypotheses 1, 2 and 3 on Map use confirmed?
Time period captured	Observations: mid-2007 to mid-2009 Textual documentation: mid-2001 to mid-2009	January 2004 to December 2010	Survey implemented: 12 October to 23 November 2009 Map use timeframe: previous 1 to 3 years
Study timeframe	Independent time frame	Independent time frame	Followed qualitative study
Data collection procedures	Field-notes and textual documents	Map access web logs, and demographic data on Faculty staff and UMP staff	Survey items were based on qualitative findings (measured types, effects, factors of Map use), and the literature on information systems evaluation models (measured quality and impact)
Data analysis procedures	Coding and thematic development Grounded theorising	Descriptive statistics Measures of association Hypothesis testing	Descriptive statistics Measures of association Hypothesis testing Item reliability analysis
Strengths of method	Broad and contextual exploration of issues without preconceived ideas from a formal theory or hypothesis	Analysis of user behaviours and practices uncovered patterns of use over several years, Map sections used and some access-related issues	Comprehensive exploration of various issues relating to Map use (i.e. frequency, type, effect, factors, experiences and perceptions) from the user's own perspective
Weaknesses of method	Qualitative findings are open to the researcher's subjective interpretations	Only identified if the Map was used. Unable to identify a staff member's experiences in using it or what it had been used for	Users entrusted to complete the survey accurately and to return on time Comprehensive coverage of issues required a long survey

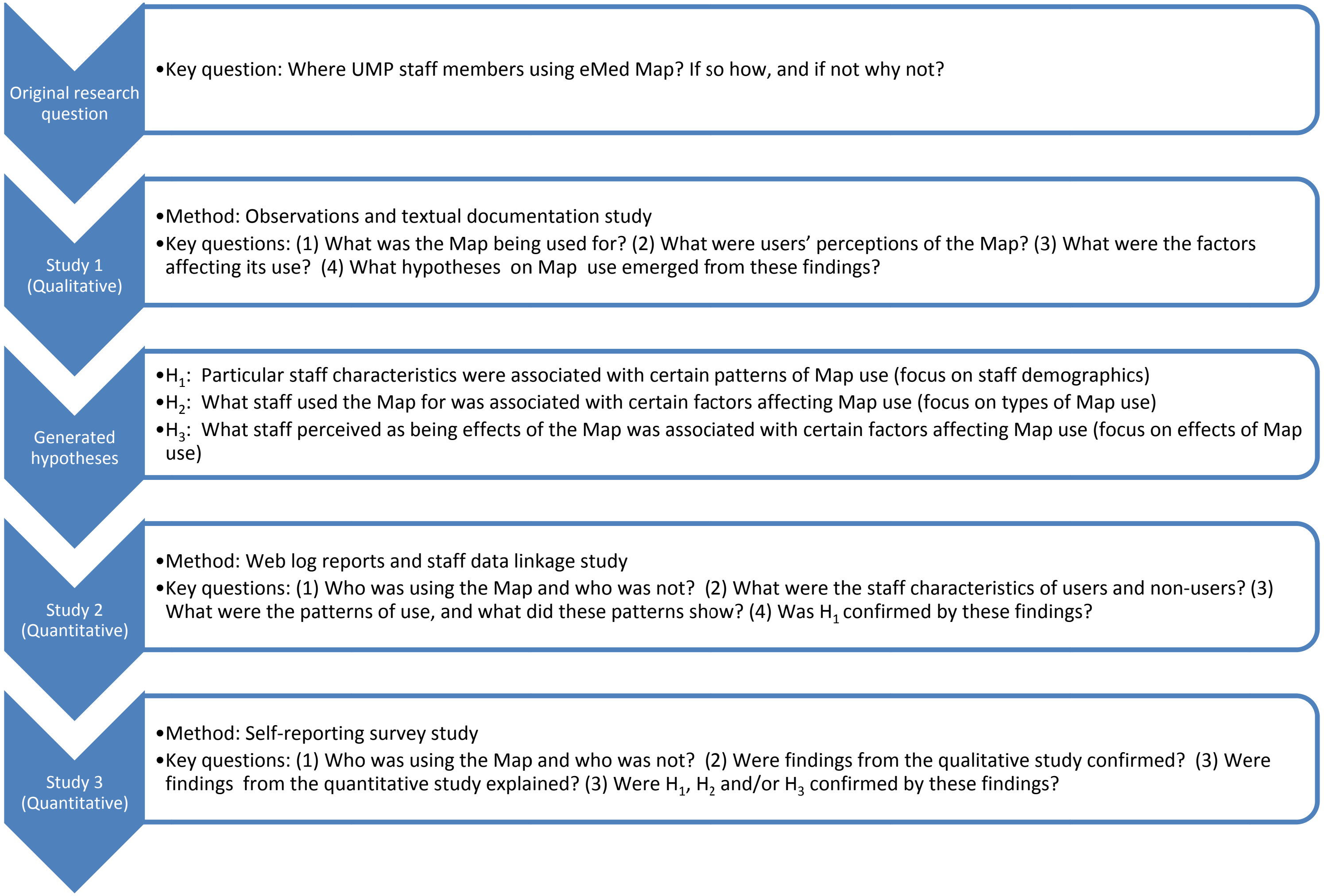

Figure 4.2: Overarching research design and general research logic.

Part 3: Empirical Work

Overview

This section covers the empirical work of this research and is divided into the following three chapters:

- Chapter 5: Observations and textual documentation study
- Chapter 6: Web log reports and data linkage study
- Chapter 7: Self-reporting survey questionnaire study.

Each chapter opens with a brief introduction to the purpose of the study and is followed by a detailed description of the study's methods and procedures. It then presents the results of the study, and closes with a discussion of those results.

Chapter 5 : Observations and Textual Documentation Study

Introduction

This study was qualitative, interpretive and inductive in nature, and was the first study in the evaluation of eMed Map. It used qualitative data and a grounded theorising approach to gain new insights into how the Map was being used and the factors affecting its use.

The purpose of this study was to:

- Observe if and how staff members were using the Map, and record their perceptions and experiences
- Extract meaning from the data by identifying common themes and patterns relating to the Map's use
- Develop working hypotheses to use with the more quantitative studies that were to follow
- Identify a suitable theory to make sense of the findings from the Map study as a whole.

The **main research question** of this study was: Is eMed Map being used by UMP staff members? If so, how is it being used and if not, why is it not being used? This question was explored by observing, listening to, participating in and reading about various situations which involved the Map, and then carefully documenting, analysing and reflecting about these qualitative findings, while also referring to the relevant literature. The data collection period extended from April 2007 to August 2009, and included archive data (e.g. textual documentation) from as far back as mid-2001.

Findings from this study were interpreted within the context of changes occurring to the Map, the UMP, the Faculty and the University during the data collection period (see Appendix A for a chronology of key events). As will be noted in the results, many of these changes were observed to have a direct or indirect impact on how staff members perceived or used the Map.

Methods and Procedures

This section explains the methods and procedures used in the study. This includes a description of the observation methods used and of the data collection and analysis procedures.

Groups, Individuals and Interactions Observed

This study used two types of observation methods: (a) participant observations and (b) passive or general observations. There was one participant observation group, three passive or general observation groups, and the passive or general observation of several individual staff members mostly from within the Faculty but also from outside. From here on passive observations are referred to as 'general observations'.

The participant observation group consisted of academic staff responsible for the design and implementation of one particular course in Phase 2 of the UMP. These UMP course design groups are known as Design and Implementation Groups or DIGs for short. This particular DIG was originally formed in 2003 and group membership change over time. In early 2007, the researcher and another academic joined the group at the request of a senior academic administrator, giving a total of four DIG members. The researcher's brief as a DIG member was to assist the group with 'all things eMed' and in particular with the Map. As well, she was to be involved in teaching, assessment and course review activities together with the other three group members. This was an ideal opportunity to observe how these group members used the Map, and the researcher sought and received their consent to participate in the study. The supporting administrative staff members of this course were not considered part of the participant observation group since their participation in regular group meetings and academic work was limited. However, their contributions and comments were documented as general observations.

The three general observation groups were all within the Faculty and included:

- An eMed reference group (formed in May 2007 and chaired by the Associate Dean of Education)
- One Phase Committee group (chaired by an academic with a clinical appointment)
- One School (there are nine separate schools within the Medical Faculty).

There were also many observations, interactions and email exchanges relating to the Map with individuals from across the Faculty, as well as a few with individuals from outside the Faculty and from other universities in Australia and overseas. Written consent was attained from individuals in the participant observation group, and to disclose textual documentation information that was extensive and potentially identifiable with an individual (as per ethics requirements). The close working relationship between the researcher and the DIG members in the participant observation group allowed the researcher to observe these members using the Map online. This was rarely possible with general observation groups, so instead the researcher relied on what individuals said about how they used the Map.

The types of interactions observed included:

- Meetings
- Course-review activities
- Map-update activities
- Map training sessions (in small groups or one-to-one)
- Teacher preparation sessions
- Teaching sessions
- Annual events (e.g. workshops for clinical teachers)
- Informal conversations.

Data Collection Procedures

Most of the data collected in this study originated between mid-April 2007 and early August 2009. Some of the collected textual documentation dated back to late 2003 (e.g. IT Issue Log entries, Map version release documents) and some to as far back as mid-2001 (e.g. documents from the researcher's work during a UNSW ITET Fellowship).

Field-notes were hand-written and later recorded in a Word table, along with the date and time when an observation or event occurred or a textual document was created, as well as the date and time of entry in the field-notes. The types of data collected in the field-notes were labelled, in four categories:

- Participant Observations (PO)
- General Observations (GO)
- Researcher's Reflections (Rx)
- Textual documentation (Txt).

Textual documentation included:

- Minutes of various group meetings
- Emails (either sent to or received by the researcher)
- Time-log entries (from the researcher's personal time-management spread sheet)
- eMed Issue Log entries (online system used to log IT development issues relating to eMed)

- Documentation about the Map system (e.g. version release documents and help sites)
- Other Map-related documents.

To retain the anonymity of participants, the researcher number-coded personal names in all her records and data, and password-protected the electronic documents containing these codes. See Appendix D for further details of the data collection procedures used in this study and Appendix E for the type and amount of qualitative data collected and analysed.

Content Analysis and Data Coding Procedures

Qualitative content analysis was used to analyse and code the data. While some coding of field-notes was done as events were recorded in Microsoft Word, the major coding of field-notes began in November 2008. The analysis and coding of qualitative data were done by using a combination of Microsoft Word 2007, Microsoft Excel 2007 and NVivo 8 by QSR.

A preliminary coding tree was developed in MS Word. The three major categories in this tree coincided with the three original research domains—namely education, organisations and information systems. This gave credence to some of the anecdotal evidence on the problems relating to the Map's use and was an indication of the inductive process taking place through the qualitative data analysis.

This preliminary tree had to be re-developed since many of its coding nodes were not mutually exclusive. A radically different approach was used for the new tree, which was aligned with a research framework based on questions formulated on the '*who, what, why, when, where and how'* of Map use (see Appendix F). Coding levels were purposefully limited to three-deep—namely **category, theme and topic**—and this level of granularity suited this study's analysis requirements. This new tree was progressively refined as it was used to code field-notes, emails and time-log entries for 2007, 2008 and 2009. Once the Word version of this tree was relatively stable, it was re-created in NVivo 8 and used to code and analyse all Word files. See Appendix D for further details of the data coding and analysis procedures used in this study.

Results

This section covers the results from the analysis of observations and textual documentation data collected in this study. First, it briefly looks at findings from the Map development process. Then, it looks in detail at various findings on the types of Map use and the factors affecting Map use.

Map Development Findings

Data from the eMed Issue Log, together with the Map's version release notes, proved useful to analyse the Map's IT development over time, and to identify periods of rapid or slow development. The initial development of the Map moved forward rapidly as evidenced by the results in Table 5.1 and by the five major releases which occurred between 6 April 2004 (version 1.1) and 24 June 2005 (version 2.1). Between 7 November 2005 and 1 August 2007 (a period of almost 21 months) the Map's development had slowed. There were no new Map releases in that period and, as shown in Table 5.1, only one item was resolved in 2006. The development of the Map resumed in August 2007 with a major release taking place on 27 November 2007 (version 3.0) when Boolean operators were added to the search tool, the Thesaurus was fully integrated as a Map tool, a new content topics menu was developed, and an Excel export feature was added to the search function for use by course designers and Map administrators. The final major Map release occurred on 8 September 2008 (version 4.0) when a file attachment function was built into Map forms and a Map archive tool was included, thereby completing the original design of the Map except for the data-visualisation function. By mid-June 2009 a total of 163 items had been resolved and only 4 items remained open for future development. Items included technical bugs or glitches, minor IT system refinements and major IT system improvements. Most items had been reported by the chief Map administrator, the researcher (as Map designer) or the chief IT programmer.

Table 5.1: Number of Map items in the eMed Issue Log.

Year	Number of Map items in the eMed Issue Log*		
	Created Items	Resolved Items	Open Items
2003	52	25	27
2004	148	86	89
2005	40	76	53
2006	8	1	60
2007	12	44	28
2008	75	93	10
2009	20	26	4
Total	**355**	**351**	**271**

*Time period: from 31 October 2003 to 5 June 2009.

Qualitative Findings

These qualitative findings are structures around the two main coding categories of the research framework (see Appendix F), namely the **types of Map use** and the **factors affecting Map use** by staff members involved in the UMP. Structuring the findings around these coding categories helped to present the diverse range of factors affecting Map use with respect to individual users, the organisation and the IT system. The key topics and themes in these findings have been bolded in the text for emphasis.

Specific information from observations or textual documentation is cited as follows: an individual's ID code and staff position (or group name), abbreviation of research method used, event and date of event (the researcher is identified as 'Case #1'). This method preserves the anonymity of individuals while meeting the requirements of qualitative research.

Types of Map Use

In late 2001, during the conceptualisation of a curriculum map for the UMP, the researcher had developed a list of potential uses for such a map. In late 2007, she revised this list to include a category for 'level of use' and another for 'manifestation of use' (see Appendix B). In early 2009, she further revised the list of uses and incorporated this list into the overall research framework under the coding category 'Type of Use' (see Appendix F). This category was then divided into the following four coding themes:

- Educational uses: included use of the Map in learning and teaching, curriculum development and improvement, staff development, and research.

- Information management uses: included use in curriculum data management, controlled vocabulary use, and integration with other information systems.
- Organisational uses: included use in curriculum governance and administration, and in organisational and cultural change.
- Other uses: included any use that had not originally been envisaged.

Each type of use was further categorised into one of three levels of use—namely a basic, intermediate or advanced level. These levels were mostly derived from the curriculum map uses described in the literature, and generally related to a user's level of knowledge and skill. The following findings are organised according to these four main coding themes and their respective topics.

Educational uses

The following findings on the types of Map use in education are organised according to the levels and topics outlined in Table 5.2.

Table 5.2: Types of Map use in education.

Levels of use	Education topics
Basic	Develop course activities
	Provide content (online resources, course guides)
	Prepare to teach or to assess or examine
	Review or revise activities (in courses, phases, program)
Intermediate	Check for gaps and redundancies
	Align outcomes, activities and assessments
	Explore whole program
Advanced	Research
	Staff development (e.g. help teachers to understand the UMP, teach activities)
	Learning and teaching tool for students (e.g. help students to integrate content covered)
	Meta-cognitive tool (e.g. to learn about the process of learning and teaching)
	Evidence-based education (e.g. data-mining for educational improvement).

Staff members were mostly using the Map to provide students with **course content**, and **to develop, review, revise and re-sequence course activities**. In 2007 the preferred method of providing course content was noted to be not through the web-based Map but through the paper-based course guides developed in Word and distributed to students and staff in hardcopy or online as PDFs. Since most of the information on learning and assessment activities in the course guides originated by exporting the Map data into MS Word, there was a compelling reason to update information in the Map. However, there was some reluctance by course convenors to do so since they preferred to update the course guide instead of the respective forms in the Map. The reasons for this will be explained in the section 'Individual-user factors affecting Map use'.

Evidence on the use of the Map in **aligning outcomes, activities and assessments** was limited. However, in a conversation with a course convenor in 2007 about the apparent misalignment in some courses of outcomes, activities and project and assignment assessments, it was noted that the staff member resorted to looking through the PDF of various course guides in WebCT Vista as opposed to looking at the Map. When the researcher suggested that it would be faster to use the Map to explore this alignment issue, the staff member's response was that it was preferable to look at the course guide because "what students see is the course guide" (Case #3, academic, PO, conversation 11/05/2007). This event also revealed that there was some confusion about what needed to be aligned. One interpretation was that the course objectives captured in the course description (i.e. the Map's COF) were the 'outcomes or objectives' that the course activities and assessments needed to be aligned with. Another interpretation was that the graduate capabilities were the 'outcomes or objectives' against which course activities and assessments needed to be aligned. This incident revealed some problems not only with the educational use of the Map but perhaps more importantly with the general interpretation of the curriculum and of what was required to be aligned. This educational alignment issue was noted as needing clarification by potentially using some simple instructions or a matrix to help course convenors understand what needed to be aligned, and how to use the Map to identify curricular alignments and misalignments.

There was some evidence that teachers were using or at least wanting to use the Map to **prepare to teach and to assess students**. At a meeting in mid-2007, a Rural Clinical School teacher asked where the content of lectures covered on campus in Phase 2 could be found so it could be used for teaching students in the rural setting (Case#25, academic, GO, meeting 29/05/2007). At that time this type of content was available in WebCT Vista and not in the Map. However, because WebCT Vista was a course-specific learning management tool, users had to be given access to each of the courses in Phase 2, which was cumbersome. Instead the teacher was advised to contact the UMP's Learning Resources Manager (who was also the chief Map administrator) who could provide copies of these lectures on CD. This incident not only indicated that some teachers wanted to know what students had learnt previously, but highlighted the need to make this process easy which at that time it was not. However, by September 2008 a new Map version was released (version 4) which had content management fields in all Map forms so that lecture notes, audio files and other such learning materials could be attached to these forms. Hence, the learning materials for all courses in all phases of the UMP became readily available in the Map from then on. In mid-2007, while preparing to mark student projects in Phase 2, the researcher had used the Map to explore where students had learnt about certain healthcare frameworks which needed to be applied in this project. A Map search soon revealed that there had been no apparent learning activity where these frameworks had been previously discussed. Thinking that this was a misalignment between the course activities and the project, the researcher asked the relevant course convenors only to find that this had been an intentional educational design since students were expected to learn about these frameworks through the project itself (Case #1, Rx 12/7/2007; Cases #1, #2 and #3, academics, PO, meeting 17/7/2007). This incident revealed the importance of conversation as well as computation (i.e. conversing with colleagues as well as Map searching) when exploring and interpreting assessment requirements and alignment issues. In early 2009 the researcher noted that she had not immediately used the Map to prepare to teach the case method tutorials in Phase 2 which were aimed at integrating what students had learnt in other learning activities that week, and that she had only looked at the activity titles in the Map as opposed to the whole learning activity form (LAF) or the lecture notes.

In mid-2008 there was an opportunity to use the Map to **explore specific content across the whole 6-year program**. A group of about 15 staff members involved in Phases 1 to 3 of the UMP as course convenors or DIG members had been invited to a group meeting in early August in preparation for a large school meeting that took place in late August of that year. The group meeting was intended to (Case #31, academic, GO, email 8/07/2008):

- Identify discipline or topic areas where the school had particular interest or responsibility
- Begin coordination of content areas to reduce overlap and duplication as well as to identify gaps or sub-optimal sequencing
- Identify issues to take to the school meeting about the future of undergraduate teaching in the school over the ensuing 5 years.

It was suggested in the same email that prior to the group meeting, participants should review their course guides, scenario group sessions and assessments, as well as a list of 16 topic or theme areas relevant to the UMP that had recently been developed by another UMP group in the school. It was also noted that copies of the course manuals would be available at the meeting. There was particular interest in looking at the development of themes across Phases 1, 2 and 3 of the UMP, at how well these were coordinated and at whether they could be mapped at present. However, this email made no mention of the Map even though its use would have helped with many of the proposed tasks. Since the researcher had been invited to the group meeting, she responded by accepting the invitation and by providing the list of 18 relevant content topics already existing in the Map which was almost identical to the new list that had been developed (Case #1, GO, email 4/08/2008). She also mentioned that the Map contained relevant thesaurus keywords and the four main themes of the UMP domain in question, all of which were being used (or at least should have been used) by course convenors and principal teachers to index their courses and activities in the Map. She also offered to prepare an Excel export of the relevant Map data by using the Map's search function which was available to all course convenors. The information provided was immediately accepted by the group's coordinator, and it was suggested that the researcher could say a few words "about how to influence the map during the afternoon session" and, if needed, how to search the Map (Case #31, academic, email 8/08/2008). However, mostly due to time constraints, the Map was not used at this meeting. Except for the actions of one other staff member (Case #3, academic, GO, email 21/08/2008) and the researcher, there was no obvious evidence of subsequent Map use by others in this group to prepare for the school meeting.

There was evidence of use of the Map **in research** and in writing articles and conference presentations. In 2007 the researcher received enquiries from four staff members who were individually conducting small research projects on how certain aspects of medicine were being taught in the UMP. One staff member was looking at the coverage of drug and alcohol issues (Case #12, conjoint staff, GO, meetings and emails April-June 2007). Another together with an ILP student was looking at how the social aspects of health were taught (Case #72, academic, GO, emails November 2007). Two other academics were preparing a conference presentation on how health promotion was taught (Case #81 and #4, academics, GO, meetings and emails May-June 2007). Finally another academic was looking at where indigenous health was being taught (Case #97, academic, GO, conversations and emails October 2007). All staff members sought the assistance of the researcher to use the Map to extract relevant data. While two of these individuals conducted their own Map searches after being shown how to use the search function, the researcher conducted the searches for the other two individuals who then analysed the data. In 2008 the researcher's own ILP student used the Map data to explore where UMP students learnt about teamwork and conflict resolution within the context of working on their UMP group projects. This study combined the use of data in the Map with data from the eMed Teamwork tool (later renamed eMed Feedback) which students utilised to provide each other with feedback on their contribution to group work.

Some teachers were exploring the potential of using the Map with students during **learning activities**. For example, at the beginning of each Phase 1 scenario, which on average lasted 2 weeks, students were required to identify their learning needs from the scenario plenary session. For one of these activities, the researcher got her students to draw a concept-map of their learning needs on the whiteboard, which they then checked against the activities in the Map to identify any gaps in their concept-map or in the Map's activities. Since some students appeared to benefit from this activity, the method was discussed with other teachers and tried with another group. At a meeting in mid-2009 during which the idea of including a data-visualisation function in the Map was discussed, an academic reported using concept maps with their Phase 3 students to teach them how to integrate various pieces of information relating to a patient case or pathological condition, and that the proposed Map data-visualisation function could well help in this process (Case #9, academic, GO, meeting 15/04/2009). Another example of using the Map in learning and teaching was to get ILP students to use the Map data in their research projects.

The researcher's own involvements in a Phase 2 DIG group allowed her the opportunity to use the Map in **staff development**. In 2007 the researcher used two approaches to show DIG members how to use the Map. In one instance she worked side-by-side with a DIG member revising the various Map forms for a particular course (Cases #1 and #3, PO, routine work, 12/4/2007). This activity took several hours and after some initial guidance, the DIG member revised most of the forms with no problems and very little assistance. When the researcher asked the staff member by email if she had found the mapping process useful, the staff member replied "Actually I did get quite a lot out of the mapping. It helped remind me of how it all hangs together …" (Case #3, PO, email 13/04/2007). A different approach was used with the other two DIG members whereby the researcher provided a 2.5 hour structured tutorial which covered various aspects of the Map including the forms, views, search function, export function and help site (Case #2 and #4, PO, training 23/04/2007). They then went through the Map tasks that needed to be done for the particular course such as creating, editing and deleting forms. While one staff member noted that the tutorial had provided a "good overview" of the Map, the researcher's own impression was that she had covered too much at once and had not managed to engage both members to the same degree. In 2008 there were some lost opportunities to use the Map in staff development. In one instance there was an exchange of emails where some staff members in one school were exploring how they could support the induction and mentoring of new staff around teaching in the UMP, however no mention was ever made of using the Map (Case #1, PO, meeting 22/08/2012). In another instance, while creating the clinical activity LAFs for the Phase 2 DIG course, some instructions for clinical teachers which existed in their manual were added to these LAFs and a suggestion was made to add some further teaching tips to these LAFs. However, this suggestion was not followed through (Case #1, PO, email 20/08/2008). A month later, a workshop was run for these clinical teachers but the researcher was discouraged from mentioning the Map at this workshop for fear that the clinical teachers could get confused since the Map was considered to be too complicated (Case #2 and #3, academics, GO, meeting 9/09/2008). Two similar workshops were run in mid-2009 at which the Map was shown, and written instructions were provided on how to access the Map, WebCT Vista and other online resources for clinical teachers. Feedback from one clinical tutor at the first workshop was that he had found the Map overwhelming and not intuitive to use and it simply contained too much information (Case #48, clinical teacher, GO, workshop 26/05/2009). Accordingly, at the second workshop WebCT Vista was used as the entry point to the course-specific activities in the Map. While this seemed to be better accepted by the clinical teachers present, the password protection features of both the Map and WebCT appeared to discourage some clinical teachers who told the researcher that they favoured using the open-access website for General Practice teachers instead of the password protected sites (various clinical teachers, GO, workshop 1/08/2009). This access issue will be discussed further under the section 'Organisational factors affecting Map use'.

There was no apparent evidence of the use of the Map as a **meta-cognitive tool** whereby staff members would use it to learn about the process of learning and teaching although a comment by one staff member appeared to imply that the Map could be having an effect on some aspect of meta-cognition. When the researcher asked this staff member if she had found the process of completing the LAFs useful, the staff member replied "Yes, it sharpens the brain" (Case #3, academic, PO, routine work 12/04/2007).

Use of the Map in **evidence-based education** and data-mining for educational improvement was starting to become evident in mid-2009 with the commencement of a major review of the UMP. In an email from a staff member involved in this UMP review to the researcher, the staff member wrote: "You will be pleased to know that the Map is playing a major part in identifying what is being taught and in the content review and realignment!" (Case #7, Txt, email to researcher 3/08/2009). This provided further evidence that the Map was starting to be used at the more advanced levels of educational use (levels 2 and 3) as originally envisaged. It also provided some evidence that what was necessary for this higher level of Map use to occur was time for the UMP and the information system to mature, an increase in the interest and skills of staff members to use it, and for the right opportunities for use to arise.

Information management uses

The following findings on the types of Map use as an information management system are organised according to the levels and topics outlined in Table 5.3.

Table 5.3: Types of Map use in information management.

Levels of use	Information management topics
Basic	Centralise information
	Keep information up-to-date
	Standardise language
	Index and catalogue courses and activities
	Search and retrieve information
Intermediate	Export data (to produce course guide)
	Audit data (for data quality control)
	Integrate with other systems
Advanced	Answer professional enquiries
	Prepare accreditation reports

Use of the Map as a **central repository of curriculum information** was varied. While this generally seemed to be the case for on-campus activities, this did not always appear to be the case for clinical activities. At a meeting in mid-2007 some Phase 2 course convenors noted that they did not generally use or update the Map because they updated their course guides instead since they found it easier to work from these guides than from the Map, and that their course guides captured the "living curriculum" while the Map did not (Case #24 and others, GO, meeting 29/05/2007). This meant that the Map information for some courses was **not accurate or up-to-date.** Those factors affecting clinical teachers' use of the Map will be explored under the section 'Individual-user factors'.

There was evidence of problems with the Map's controlled vocabulary developed to **standardise the language used to index** the UMP. In early 2007, the Map's content topics, themes and thesaurus keywords fields were reviewed, and the original list of about 20 systems-based topics was replaced with a new list of just over 100 discipline-based topics divided into biological, clinical, social and miscellaneous categories (Case #1, GO, email and minutes of meeting 15/05/2007). At the same time, an audit of Phase 2 Map data revealed inconsistencies in the indexing of clinical activity types across courses. Hence, the definition of each learning activity type was revised in the Map's drop-down menus and the Map Help site, and Phase 2 course convenors were then required to re-index their clinical activities accordingly. The researcher's own attempts at indexing LAFs for one Phase 2 course soon revealed that this task was not as easy as she had originally thought (Case #1, Rx, routine work 17-18/04/2007). The recommended procedure for completing a LAF was that first the course convenor or designer would complete the designer fields and then the principal teacher would complete the teacher fields. While in principle this process sounded feasible, in practice asking a course convenor to select content topics and graduate capabilities to index the LAF without having the activity notes to refer to was quite difficult. In fact, there was no guarantee that the principal teacher would agree with the indexing chosen by the convenor even after the convenor had read the teacher's lecture notes. In one instance, a principal teacher questioned the three graduate capabilities the activity had been indexed under based on the content of the teacher's lecture notes. In an email to the researcher the teacher noted that they would need a lot longer than two hours to cover all these graduate capabilities (Case #49, academic, Txt, email 24/04/2007). Hence, the graduate capabilities originally selected were revised. Further issues relating to the Map's controlled vocabulary and data quality will be discussed under the section on technical factors affecting Map use.

The evidence suggested that the Map was being used to **search and retrieve information**. The purpose of searching ranged from wanting to present at a meeting the coverage of a particular topic (e.g. indigenous health), needing to know what students had learnt previously about a topic before developing a new learning activity (e.g. on environmental health), needing to answer questions from clinicians about the coverage of particular clinical issues (e.g. trauma, neurology, gastroenterology), wanting to find the coverage of certain topics by certain schools (e.g. ethics, communication), needing to provide discipline groups with reports as part of the UMP review process, and answering professional enquiries from external medical colleges (e.g. the coverage of pathology in the UMP). However, there were also some instances observed where UMP teachers were asking each other where certain topics were covered instead of searching the Map, which indicated that Map searching was still not the first option or method of choice for a considerable number of UMP teachers.

The Map **data exports** were routinely used to prepare course guides and occasionally used to conduct Map data quality audits, although until late 2007 only a select number of Map fields could be exported which, therefore, restricted the usefulness of this export function. In late 2007 (in Map v3) a new Excel export function was added to the Map Search tool and made available to all course convenors. This function was further refined in early 2009 (minor version release) so that all fields in all forms in the Map could be searched and exported to Excel (Txt, Map v3.0 release notes 27/11/2007).

There appeared to be no **curriculum accreditation procedures** taking place during this study's data collection period so there was no evidence that the Map had been used for that purpose. However, there was some evidence that the Map had been used to prepare a Phase 1 annual review report in 2006.

The **integration of data** in the Map with other systems such as eMed Timetable, Portfolio, Tracking and WebCT Vista already existed, and this data integration continued along with the development of the Map. In mid-2007 new assessment forms were developed in the Map for Phase 3 of the UMP, including lesson plans, various assessment components, and course and phase assessments (eMed group, GO, eMed meeting and minutes 30/10/2007). Data in these new Map forms were integrated with the eMed Portfolio and Submissions systems. New Phase 3 LAFs for non-clinical activities were also developed and these integrated with eMed Timetable. Developing LAFs for Phase 3 clinical activities was discussed in 2007–2008, but due to the diversity of these activities it was decided that clinical activities would not be included in the Map. In late 2007 there was some discussion about integrating the Map with the eMed Placements system to capture some of the clinical activities although this did not eventuate. In 2008–2009 the idea of integrating the controlled vocabulary of the Map with the eMed Assessment Item Bank system which was yet to be developed was also discussed. The integration of the Map with the eMed Metrics system was also discussed in 2009. Other systems integration issues will be reported under the section on technical factors affecting Map use.

As mentioned previously, a review of the UMP had commenced in mid-2009 and the Map was being used in this process. In an email from a general staff member involved in this review to the researcher, and in relation to changes being made to UMP courses and activities as part of this review, the staff member wrote:

> The other thing with these proposed changes, you can imagine what a headache it is going to be moving things around etc. but the Map will certainly make it a lot easier. The activities can be easily moved to different learning contexts or courses without too much hassle. Makes it so much easier to see the big picture! (Case #7, general staff, Txt, email 3/08/2009)

This comment illustrated how useful the Map was proving to be as an information management system to review and refine the UMP. However, there was also evidence that its use as an information management system was limited by the quality of the data captured within. This same staff member also wrote in the same email:

> I have been through all the LAFs now to add 'Content topics' to any forms without them and we will be doing searches this week to provide the discipline groups with reports. (Case #7, general staff, Txt email, 3/08/2009)

Issues related to data quality and task allocation will be discussed under the sections on technical factors affecting Map use and on organisational factors affecting Map use respectively.

Organisational uses

The following findings on the types of Map use in organisation and management are arranged according to the levels and topics outlined in Table 5.4.

Table 5.4: Types of Map use in organisation and management.

Levels of use	Organisation and management topics
Basic	Provide a transparent curriculum
	Support the delivery of integrated curriculum
Intermediate	Break down discipline barriers and silos
	Promote self-responsibility (amongst staff and students)
Advanced	Facilitate shared ownership of curriculum
	Facilitate knowledge management and networks (e.g. CoP)

The **transparency of the curriculum** was evident by the Map's accessibility to all staff in the Faculty of Medicine database, most UMP staff and all UMP students. While the transparency of on-campus learning activities was evident in the Map, the diverse nature of learning activities in the clinical setting had not made it possible to achieve the same level of transparency with clinical activities. There was evidence that some clinical schools had previously captured their clinical activities in the old medical curriculum using paper-based forms, and that some of these were still being used. While clinical activities for Phases 1 and 2 of the UMP were captured in the Map, the possibility of capturing Phase 3 clinical activities in the Map was explored by the eMed reference group in 2007 but eventually it was decided not to capture these in the Map because of difficulties in capturing their diversity (Case #1, minutes of meeting, 31/07/2007).

There was also evidence that the Map was facilitating the **integration of learning and assessment activities** both horizontally (i.e. within courses) and vertically (i.e. across courses and phases), as could be shown by browsing or searching the information in the Map. As an indirect consequence of this curriculum integration the traditional **discipline barriers and silos** within medicine seemed to be disappearing. However, there was some evidence that some of the procedures used to invite principal teachers to complete or revise their Map forms could inadvertently be promoting **silo teaching.** For example, by providing a teacher with a direct link to the LAF which they were required to revise (as opposed to suggesting they use the principal teacher's view) the teacher's attention was focussed on that one specific activity in isolation from other course activities (Case #1, Rx, overview of events 18/04/2007 and 29/04/2007). The silo mentality was also evident amongst some course convenors who preferred to update their course guides which were not readily accessible to other staff until the release of Map v4.0 in September 2008, as opposed to updating their Map forms which were readily accessible to all Map users, including students (Case #1, Rx, reflections after meeting of 30/05/2007).

The transparency of the Map appeared to be indirectly encouraging some **sense of responsibility** amongst some staff members as well as students. For example, since the presence of incomplete LAFs could be seen by all, this could potentially diminish the reputation of the staff members responsible for the activity, while properly completed forms could potentially enhance their reputation. The Map's transparency allowed students to see what they were currently learning, had learnt and would learn and this Map function could potentially promote in students a sense of responsibility for their own learning. However, this transparency was seen as a problem by some teachers who claimed that students used past assignments described in the Map to develop their own negotiated assignments, or did the next course's assignment and project before commencing the actual course. In an apparent attempt to resolve this problem a course convenor had request that their AAFs be hidden when their course was not running, an action which would affect the transparency of the curriculum. This issue was raised at an eMed meeting in 2007 (eMed group, GO, eMed meeting and minutes 31/7/2007) and it was decided that AAFs would not be hidden and that students (and not staff) would be responsible for searching the Map to ensure their negotiated assignments were not similar to assignments included in the Map. Similarly it was decided that students were free to do assignments and projects for courses they had not yet started, but that there was no guarantee that those same assignments and projects would be part of the future course, as noted in the disclaimer on the Map homepage which read as follows: “The information in the Map is under continuous development and is therefore subject to frequent changes and updates without notification to users”. Hence, the responsibility was directed back to the student as the adult learner.

The sense of shared responsibility also extended to course convenors and principal teachers for ensuring all their Map forms were completed and up-to-date, to schools for teaching certain courses, topics and disciplines outlined in the Map, and to information system owners for the maintenance, improvement and testing of their eMed system. There was also some evidence that the sense of shared responsibility for the Map was promoting a sense of **shared ownership of the curriculum**. These issues will be discussed further under the section on organisational factors affecting Map use.

While there was good evidence that staff members viewed the Map as a content management tool for students, there was little evidence that they viewed it as a **knowledge management tool** through which staff could share information with each other about teaching methods and the like. While the ‘Instruction of Teachers’ field in the Map forms was sometimes being used for this purpose, the ‘Teacher-only file attachment’ field (hidden from students) included in version 4.0 of the Map seemed to be getting little use. However, this could have been a matter of time since there was some evidence that some teachers in Phases 1 and 2 had formed their own **small knowledge-network groups** and were sharing their lesson plans via email or through shared drives as opposed to via the Map.

Other uses

Other types of Map use which were noted in this study included the following:

- Workload calculations (to capture teaching hours and teaching workload)
- Use in other educational programs.

The Map was primarily designed as a learning and teaching tool and not necessarily as a staff administration and management tool, so the use of the Map in **tracking teaching workload**, though possible, was not originally envisaged by the researcher. In early 2007 there was some evidence that eMed was partly being used to track teaching workload. In a letter of support for an educational award, an academic administrator and teacher wrote the following about eMed:

> It provides a means for students and teachers to know the curriculum, to support course designers in aligning learning and assessment activities with the curriculum outcomes and to support students in documenting and monitoring their learning. It is also an administrative tool for managing student timetables and tracking teaching workloads. (Case #9, academic, Txt, letter 3/04/2007)

Around 2005 to 2006 one school commenced developing a teaching workload system for its academic staff (Case #1, PO, minutes of DIG meeting 12/03/2007; Case #29, general staff, Txt, emails 12/03/2007 to 14/03/2007). This workload system was subsequently found not to measure staff workload accurately due to the limited data it captured and its lack of data integration (either manual or automated) with other related Faculty and University systems (Case #1, and Cases #18 and #29, general staff, Txt, emails 4/07/2007 and 5/07/2007). One consequence of this workload system was that in 2007 eMed was mentioned at a school meeting as being the source of UMP teaching workload data (Case #1, GO, school meeting 19/06/2007). While the workload system was set aside, the school attempted to re-introduce a workload formula in mid-2008 and again in mid-2009 (Case #101, general staff, Txt, emails 4/8/2009 and 5/8/2009; GO, school meeting, 5/08/2009) and eMed continued to be mentioned as the source of information for UMP teaching hours. At the same time, in early 2009 the Faculty released a performance review system known as the Professional Development and Talent Management (PDTM) system. This system was included in eMed, however at a meeting held in March 2009 the eMed reference group decided to have it removed from the eMed framework since much of it was unrelated to the UMP or to learning and teaching. The system was removed from eMed in mid-August 2009 although by then and partly due to this system, eMed had been mentioned for a third time as the source of workload data at a meeting in this same school (Case #1, GO, school meeting 5/08/2009). Starting in mid-2007 there was evidence from comments made by staff members that eMed was developing a negative reputation in this school as an unintended consequence of its use in workload calculations and systems. Also, tracking such workload data seemed to be having an unintended negative effect on the teamwork aspects of curriculum mapping as well as on collaborative teaching and on the formation of small knowledge-network groups (e.g. Case #1, email to Cases #2 and #3, email, 27/06/2007). The idea of developing a workforce matrix at a Faculty level was discussed in early 2007 (Case #1, GO, eMed meeting, minutes 15/05/2007), and by early 2009 a workload system known as eMed Metrics was being developed by the Faculty to capture UMP teaching workload data for what were described as ‘pragmatic reasons’ (eMed group, GO, eMed meeting and minutes 7/4/2009 and 5/5/2009). By mid-2009 expressions such as “using eMed for good or for evil” were not uncommonly heard amongst some staff members (e.g. eMed group, GO, eMed Meeting 7/04/2009). These observed events indicated the importance of considering the unintended consequences of using curriculum maps for staff administration reasons; this issue has also been noted in the curriculum mapping literature. In relation to the process of counting teaching hours as evidence of one’s teaching workload, one senior academic quoted Albert Einstein who said: “Everything that can be counted does not necessarily count; everything that counts cannot necessarily be counted” (Case #44, academic, GO, conversation, 28/07/2009). This comment inferred that a staff member’s teaching workload included much more than the number of face-to-face hours he or she had taught.

Between 2006 and 2008, use of the Map in adapted form in other undergraduate and postgraduate **educational programs** offered by the Faculty was being considered (e.g. Case #1, #27, #76 and #33, academics, Txt, email 13/03/2006; Cases #9 and #1, GO, Map development meeting and minutes 19/04/2007; eMed group, GO, eMed meeting and minutes 18/06/2008) although this idea was not implemented. By mid-2008 there was some evidence that other Faculties within the University were interested in having a similar curriculum mapping system (e.g. Case #92, academic, GO, email, 4/09/2008). Interest from other universities both in Australia and overseas was also evident (e.g. Case #1, academic enquiries from an Australian university, email 12/07/2007, and from a USA university, email 2/08/2007).

Some of these findings on the types of Map use will be explored further in the web logs and data linkage study, and the self-reporting survey study. The next section will look at various factors affecting the use of the Map.

Factors Affecting Map Use

This section reports the factors that appeared to affect staff members' use of the Map. These findings are organised according to the following three main categories: individual-user factors, organisational factors and technical factors. Various themes and topics are reported under each of these categories and these were all part of the coding tree used to analyse the qualitative data (see research framework in Appendix F). This section includes key events and quotes that exemplify the type and range of factors affecting Map use. Appendix G contains summary tables of key factors that either enabled or hindered Map use (tables are based on the coding tree for the factors affecting Map use in Appendix F).

Individual-user factors

Factors affecting Map use from the perspective of an individual staff member included the following user-specific themes:

- Attitude
- Knowledge
- Needs
- Effect
- Rewards
- Perspectives
- Advocacy

The main findings for each of these themes are described here, and the key factors which enabled or hindered Map use from an individual-user perspective are summarised in table form in Appendix G.

It was observed that how staff members used the Map was influenced by their general **attitude, beliefs and behaviours** in relation to the Map, and also to the eMed system and IT in general; to their preference for other information sources such paper-based course guides and timetables, their own memory and other staff members; and to their **assumptions and perceptions** of how others would or would not use the Map. When principal teachers were invited to review their learning activity forms for a Phase 2 course in mid-2007 they did so promptly and properly regardless of their school location (campus or clinical). In mid-2008 at a special school meeting it was actually a clinical teacher who without any prompting mentioned that the Map was a valuable source of curriculum information (Case #43, academic, GO, meeting 22/08/2008). At a medical education forum in late 2008, it was again a clinical teacher who asked to be shown how to use the Map and who within 15 minutes of being shown became comfortable enough with the system to browse and search the Map without further guidance (Case #46, academic, GO, meeting 3/12/2008). Around the same time, at a workshop for Phase 2 and 3 clinical teachers and before any mention was made of any information technology, it was a General Practitioner (GP) involved in UMP teaching who asked about the possibility of accessing the program's online resources (Case #48, GP, GO, workshop 13/09/2008). So there was evidence that the general assumption by some campus staff members that clinical teachers did not use or want to use the Map was not entirely correct. However, some clinical course convenors mentioned using their paper-based timetables to capture their clinical activities instead of the Map or eMed Timetable because they found the Map forms "too inflexible" (Case #24 and others, GO, meeting 30/05/2007). So while some staff members appeared to have an affinity with the Map, the eMed system and IT in general others did not and instead preferred sourcing curriculum information by using paper-based resources such as course guides, asking colleagues or relying on their own memories. Based on enquiries about eMed received from other Australian and overseas universities following the 2007 publication about eMed, it appeared that the system was developing a better reputation outside the Faculty than within some of its own schools (e.g. Case #1, enquiry by an academic from an Australian university, email 12/07/2007, and from a USA university, email 2/08/2007).

In early 2007 it was noted that many staff members spoke about 'eMed' as one single system, and one or two staff members referred to it as a 'black box' of which they knew very little. Since eMed is made up of several distinct tools or systems (as for example is Microsoft Office), referring to it as one amorphous system indicated a lack of **understanding** of eMed in general and of eMed Map in particular. One course convenor mentioned having had an extensive Map training session along with a general staff member (Case #5) which was provided by the Map administrator in 2006 but had forgotten much of it (Case #2, PO, training, 23/04/2007). There was also reluctance by some staff members to do their own Map searches, relying instead on the assistance of the Map administrators or the researcher. Coupled with the need to understand the Map as an IT system, and perhaps more important, was the need to understand the structure, function and educational principles of the UMP and there was some evidence of conflicting interpretations of these amongst teachers and hence a need for clarification.

As noted previously, in general the Map did not **meet the needs** of course convenors or clinical teachers when it came to capturing clinical activities particularly in Phase 3. Even for Phase 2, the LAFs were considered by some to be “inflexible” and “user-unfriendly”, and unable to capture what happened in the clinical setting which by its nature was very variable (Case #24 and others, GO, meeting 30/05/2007). So while LAFs were observed to work well for the campus setting they did not work well for the clinical setting. One suggestion made in mid-2007 was to map the learning context or clinical attachment as opposed to the learning activity in the clinical setting, as had been done at one clinical school with the Faculty’s previous medical curriculum (Case #3 and #1, PO, routine work, 12/05/2007; Case #1, GO, committee meeting 30/05/2007). Another idea was to use eMed Placements to capture the learning context (Case #1 and #3, PO, conversation 12/04/2007; Case #30, general staff, GO, meeting, 19/09/2007). While these ideas were not pursued, the need for new Phase 3 assessment forms in the Map was met successfully by mid-2008. Prior to the release of version 4.0 of the Map in mid-2008, some of the Map’s unfinished design features (e.g. lack of Boolean operators in the search tool, of new content topics, of an integrated thesaurus, of attached lecture notes etc.) and existing IT glitches affected how the Map could be used. This was not only frustrating to users but awkward for those offering Map training. However, by mid-2009 all major Map features had been developed (except for the data-visualisation function) and appeared to be functioning correctly.

The **effect of mapping** on a user’s work and time, such as their workload, workflow and document management was also noted. Several Map-related issues were observed to waste time and decrease the Map’s data quality. One major problem was data duplication. The proposed Map workflow was that course convenors, DIG members, element convenors and principal teachers would enter the Map data online and from there the Map administrators would export the data to produce the course guides. However, some course convenors used Word documents to provide the Map data which was then entered by Map administrators, and other convenors updated their course guide but failed to update their Map forms, all of which invariably led to data quality problems.

There were valid reasons why the proposed workflow did not suit all courses or convenors. One was the need to spend too much time re-formatting course guides when created from the Map data which was formatted as simple text. Phase 2 courses were repeated every 8 weeks and it was easier for convenors to make minor changes to the course guide and add these to the Map than to update the Map and re-export the entire course data every eight weeks. Also, while Map forms could be revised at any time it was not appropriate to substantially change them while a course was running. However, this clashed with the need to slightly revise the Map for the next iteration of a Phase 2 course since there was often only one week between these courses. The archiving of Phase 2 courses presented similar problems. One observed solution was to use teacher-only fields (i.e. fields hidden from students) to temporarily capture revisions in the Map forms. Evidently, there was a need to adapt the proposed Map workflow according to the needs of courses and phase, and the readiness with which the Map administrators offered this flexibility enabled better use of the Map.

Planning and sharing the Map work amongst DIG members was observed as an effective way of reducing workload and increasing the quality of data indexing since this required good content knowledge. It was also noted that inviting teachers to revise their LAFs not only increased a course convenor's workload but also required some skill in producing personalised emails and letters, the need to check a teacher's access to the Map, the need to stagger invitations since many teachers taught across various UMP courses, and the need to use methods that discouraged silo teaching (e.g. use of the Map's program view by teacher instead of URL links to individual forms). Hence, as noted by the Phase 2 DIG members in late 2008, this task was better done by the Map administrators in consultation with the course convenors, and not by the course convenors or DIG members on their own.

Information duplication across the Map, the course guides and WebCT Vista was also problematic since the information was sometimes incorrect or incomplete in one or more of these resources, and this wasted the time and tested the patience of users such as Phase 1 facilitators who used these resources to prepare for teaching. Some staff members had often questioned the need for paper-based course guides together with an online Map and in mid-2009, mainly due to problems with carrying heavy paper-filled boxes, the Faculty proposed producing much smaller guides which could maybe be sold through the University bookshop. In late 2008 after much discussion amongst the Phase 2 DIG members about when and how it would be best to update the Map and the course guide, one course convenor wrote:

> As we have decided to do a manual update of the STP [summer teaching period] course guide in [the course name], I have solved the problem of having outdated/broken CMT [case method tutorial] links in the course guide by the simple artifice of deleting all CMT readings links and replacing with this text: "**Key References:** CMT case readings. Hard copy is supplied one week before the tutorial and can be downloaded from eMed Map. **Requirements for Activity:** Read the case before the

> CMT.” ...After we have updated all the LAFs and AAFs and [the Map administrator has] generated the TP1 [teaching period 1] course guide, the correct links to the key references will all be there again … Hope this suits you all. (Case #3, PO, email 10/11/2008)

This suggestion, which was strongly supported by the other DIG members, was a clear example of a simple and common-sense solution to decrease the workload of staff members by reducing the need to maintain multiple sources of the same information on paper and online. It also showed the limitations of paper-based resources and the advantages of a web-based map. Finally, it was also observed that the Phase 2 DIG members spent a number of weeks in late 2008 improving their file management procedures on their Faculty server’s shared drive, which had fallen into disarray. This observation acknowledged that course convenors and DIG members also needed to manage other course-related electronic documents which were not housed in the Map, and that doing so also took up time and required some skill.

Also noted was the need to consider the curriculum mapping work **in perspective** with other work related to convening and teaching a UMP course. This was most evident in the Phase 2 DIG meetings between 2007 and 2009, where once the Map was brought up-to-date it was rarely mentioned except at the end of a course’s iteration or the academic year when DIG members reviewed the whole course. Instead, most meetings revolved around teaching, assessment, student issues and like. Awareness of this intermittent pattern of Map work was important in knowing when best to target course convenors and teachers to update their Map forms. Another observation was that, although it was worthwhile having teachers understand the place of their learning activity within a course or the UMP as a whole, a teacher’s focus was on preparing and delivering the actual learning activity in question. Most UMP teachers had other demands on their time such as research, teaching other courses, patient care and the like and needed to prioritise their work, so it had to be acknowledged that using the Map was a peripheral task for many UMP teachers (Case #1, Rx, post-eMed meeting 6/12/2008; post-workshop 26/5/2009).

One of the observed **rewards** for convenors and teachers to complete their Map forms was that in so doing they were developing and improving not only their course but also their course guide since, as had been noted in mid-2007, at least 60% of a course guide came directly from the Map data. Good quality Map data could also be used for program improvements, educational research and to generate publications. Another observed reward was the kudos associated with having one’s name in the Map as a principal teacher or course convenor, although as previously noted having one's name against incomplete or out-of-date forms could have the opposite effect. It was also noted that, while technically anyone with designer access to the Map could change a principal teacher's name in a LAF, because of this kudos issue it was advisable that before such a change was made the course convenor discuss the proposed change with the principal teachers in question to avoid potential ill-feelings. Another reward noted was the potential allocation of workload points for having one's name in the Map (e.g. through eMed Metrics). However, one would then need to consider how to reward staff members involved in team-teaching or in completing Map forms as a DIG member or as a Map administrator, since having one's name in the Map was not necessarily an indication of who had done the actual curriculum mapping work.

As noted by a course convenor, the influence of a **Map advocate** within a group could not be underestimated when it came to how individuals in the group viewed or used the Map (Case #2, PO, meeting 28/07/2009). An advocate could not only help the group with the Map work, but also observe how members used the Map and suggest alternative work practices or system improvements. So having a Map advocate in each course DIG or at least in each Phase committee could prove useful. However, Map advocates also needed to acknowledge and accept that curriculum mapping was peripheral to the work of many teachers and administrators and could remain so for some time.

This concludes the description of key events that exemplified the individual-user factors affecting Map use. Also see Appendix G for a summary table of key individual-user factors which enabled or hindered Map use.

Organisational factors

Factors affecting Map use from the perspective of the Medical Faculty and the University as an organisation included the following organisation-specific themes:

- Communication
- Culture
- Management
- Administration
- Central services

The main findings for each of these themes are described here, and the key factors which enabled or hindered Map use from an organisational perspective are summarised in table form in Appendix G.

One of the main factors relating to **communication, consultation, coordination and shared perspectives** was observed to be the need to keep the Map users well informed. Information about the Map and other eMed systems was available through an open-access website developed for the general public, through a password-protected website developed for students and staff containing textual information and animations, through the eMed Map Help site available to staff only, via Faculty-wide email broadcasts when new Map versions were released, via Phase-specific newsletters for students and staff, and finally through word of mouth. The need for good communication procedures was particularly noted in September 2008 with the release of version 4.0 of the Map which contained the new content management fields and archiving function. This represented a major change to how learning resources were made available to staff and students, since up until then only WebCT Vista held the course content (e.g. lecture notes and audio files, readings etc.). This major change led to some confusion amongst some teachers and students but these were mostly resolved through the Phase 1 and Phase 2 newsletters and by word of mouth. Therefore, good communication was observed to be essential in reducing confusion amongst users. The provision of information was important not only for current Map users but also for potential users, as noted in mid-2009 when at a clinical teacher's workshop a one-page handout was distributed on how to access the UMP's online learning resources (Case #1, GO, workshop 1/08/2009).

Another observation from eMed meetings was that proposed solutions to existing problems with the Map or with eMed were often computational while further discussion of the problem often revealed a better and simpler solution that relied instead on conversation, compromise and common sense. These human-driven solutions, as opposed to system-driven solutions, were observed to be important in keeping the design of the Map and of eMed relatively simple. As well, it was noted that an unintended consequence of the automated email notifications from eMed was that many users ignored these due to notification overload. It was also through good communication that users such as teachers and Map administrators in particular shared their problems and solutions with using the Map. Good communication between users and IT developers (non-users) was also noted as being important, since their perspectives were often very different and conversation was essential in reaching a common understanding of the users' Map needs and the programmer's IT needs (Case #1 and #20, GO, conversation 7/04/2009). This issue is further discussed under the section ‘Technical factors affecting Map use’.

The **organisational culture** was also noted to influence how the Map was used. There was an apparent cultural divide between campus teachers and clinical teachers and a perception amongst some campus teachers (erroneous or not) that clinicians tended to do whatever they pleased when it came to teaching. Also as many clinicians (e.g. conjoint staff, affiliated staff) were not being paid to teach their sense of obligation to map their activities may not have been as strong as that of campus teachers, which some thought was the reason why in early 2007 the Phase 2 Map forms had not been properly completed. The vital role of administrators in clinical schools in organising clinical teaching sessions and in accommodating the ever-changing schedules of clinical teachers (mostly busy clinicians who are not paid to teach) was also mentioned by a staff member as a big difference between teaching in the clinical setting and the campus setting (Case #3, PO, routine work 12/04/2007).

The organisational culture of collaboration and teamwork in teaching was relatively new to the Faculty and mostly came about through the development and implementation of the UMP which, through its integrated and spiral approach to teaching, had broken down many of the discipline barriers. However, it was observed that while some teachers had embraced the collaborative teaching approach others seemed to retain the more individualistic and somewhat possessive approach towards their own courses and learning activities. Those more inclined to collaboration were willing to share the Map workload as well as their time, ideas and teaching resources, and this approach had positive effects on Map use as well as on the quality of teaching. This was most evident amongst the Phase 2 DIG members where there was a strong sense of teamwork and shared responsibility for the course and the Map, as well as good leadership. However, it was noted that the introduction of a teaching workload formula had the potential to affect collaborative teaching since hours of collaborative work were either not counted in the workload formula or were potentially allocated to only one team member. Hence, such teaching workload calculations could have an unintended negative effect on the collaborative completion of Map forms, on workload sharing and on quality teaching.

In addition the apparent move at a central University level towards research and away from teaching was noted as another potential barrier to the effective use of the Map and to quality teaching. The need to promote a “sense of collegiate belonging” amongst General Practice and Primary Care teachers was mentioned at a clinical teacher’s workshop in mid-2008 by a GP who was keen to access online information and resources for clinical tutors (Case #48, GP, GO, workshop 13/09/2008). When this clinical teacher was emailed information on how to activate the university password (Unipass) and access the Map and WebCT Vista, the teacher promptly emailed back thanking the workshop organisers and the school for their willingness to respond to the needs, opinions and feedback of clinical teachers (Case #48, GP, Txt, emails 30/10 and 31/10/2008). While a few months later at another workshop this same GP noted that he had found the Map overwhelming and not intuitive to use and that it had "too much information" none the less he was thankful for being given access to the Map and for its presentation at the workshop (Case #48, GP, GO, workshop 26/05/2009). He noted that General Practice clinical teachers often felt isolated from campus teachers because of their physical location in general practice, and that information sharing was important to them.

Also noticeable was the cultural divide between those academics who did their own Map data entry and retrieval and those who had it done for them, indicating a divide between the 'do it yourself' (DIY) culture and the 'do it for me' (DIFM) culture. While at times all that was needed for an academic to change from a DIFM to a DIY was a brief demonstration on how to use the Map, this was not always the case and some academics continued to rely on administrative staff for data entry and retrieval tasks, and often in relation to other eMed systems (Case #55, general staff, GO, conversation 5/06/2009; Case #1, Rx, post-conversation 8/06/2009). There was also an apparent difference between male and female staff members in their perception of the Map and IT in general in that males appeared to focus more on the IT itself (e.g. programming application, use of relational versus non-relational databases etc.) while females appeared to focus on the users' needs and the system requirements (Case #1, Rx, post-meeting 7/04/2009). By mid-2009 the researcher had also noticed a cultural difference between those staff members with a 21st century approach to education, organisations and information systems and those with a more traditional 20th century approach to these (Case #1, Rx, overview of events 8/06/2009).

The **management and governance** of the UMP and of the eMed system was another important factor affecting Map use. The Faculty had a UMP governance framework composed of various committees, as well as various learning and teaching groups and smaller working groups. The Faculty's Associate Dean of Education was the authority for the UMP and also the business owner of the eMed systems. Hence, there were opportunities to discuss the Map and the eMed systems at various levels of management. In mid-2007 an eMed reference group was formed to support the continued development and maintenance of the eMed systems including the Map. This group met about once a month, and was chaired by the Associate

Dean of Education and consisted of the Head of each UMP Phase committee, the Head of the Medicine Computing Support Unit (MCSU), the Map administrator, the eMed programmer, and the researcher as the group's administrator and Map designer (eMed group, GO, eMed meeting and minutes 15/05/2007). This group was instrumental in finalising the design, development and release of version 3 of the Map in November 2007 and of version 4 in September 2008, as well as a minor version released in mid-2009.

Changes in senior management, including personal styles and work interests were also noted to have some effect on how a school perceived the UMP and indirectly the eMed system and the Map. Also influential was the level of support for the UMP by those in senior academic management and leadership positions, and their own sense of shared ownership of the curriculum. It was observed that when other staff members sensed a lack of support for the UMP in their school they tried becoming strong UMP advocates at meetings but sometimes felt disempowered. The level of Map use by senior managers could be seen as an indicator of their level of interest in the UMP.

The perception of eMed from an organisation and management perspective varied within the Faculty. While in early 2007 the eMed system had been nominated for an educational award and was noted by one senior academic to represent "the successful use of technology to support student learning as well as mange a curriculum … " (Case #9, academic, Txt, letter, 3/04/2007), a few months later a general staff member working on a school's teaching workload project noted that people often comment that "eMed fails to meet our organisational needs" (Case 29, general staff, Txt, email, 5/07/2007).

The allocation of Map tasks to specific staff members, as well as having an informed workforce to manage the Map were also noted to have an effect on how the Map was used at an organisational level. As noted previously, course convenors and principal teachers were mostly responsible for mapping their learning activities and it was their incremental contributions over time that was meant to ensure the sustainability of the Map. However, as noted by some Phase 2 DIG members, some original learning activity designers no longer updated or taught the activity. In such cases the task should have been allocated to the next principal teacher or course convenor although this did not always occur so the Map data soon became out-dated (Case #2 and #3, PO, meeting 6/02/2007). Also, while it was the course convenor's task to update all course related Map forms, convenors often neglected to update their COF and LCFs so this data also became out-dated. As noted previously, sharing Map tasks between DIG members worked well, although this process ran the risk of being negatively affected by the introduction of workload calculations. Other Map-related tasks included updating the Map Help site for staff and the eMed websites for students, however in mid-2007 it was noted that information in both these sites were out-dated. The need to have at least two staff members responsible for Map-related tasks was noted, although also noted by an administrator in early 2009 was the need for a clear understanding between these two individuals on who would do what otherwise tasks could remain undone (Case #85, general staff, GO, meeting 7/04/2009). As well, as noted by a staff member in mid-2009, there was a need for senior managers to regularly remind academic staff that it was preferable that they enter the data in eMed themselves instead of asking administrative staff to do this for them (Case #55, general staff, GO, conversation 5/06/2009).

The maintenance and improvement of the Map as an IT system was observed to be an on-going and time-consuming task since not only did it require intervention at the conceptualisation and design level but also at the development, testing and release level, as well as consultation with the eMed reference group to ensure that the needs of all Map users were properly met. The chief Map administrator was well positioned to be a proactive advocate of the system and to ensure adequate time was allocated to its continued IT development and general improvement. Issues such as unclear task allocations, time-wasting tasks, tasks being done by academics that could be better done by administrators and vice versa, and tasks remaining undone were all factors that affected how staff members used the Map. Once Map tasks had been allocated, it seemed essential that senior academic management remind academic staff of their responsibility in keeping the Map data up-to-date. As noted by the researcher and other staff members involved in the design and development of the Map, data should be considered a “perishable commodity” which needs regular renewal (e.g. Case #1, Txt, ITET fellowship document titled “Student-centred electronic curriculum map” 22/10/2001). Neglecting to do so could soon render the data and the information system obsolete, making them of little value to any Map users. The availability of financial support also affected the continued development and improvement of the Map system and hence its use. Although educational and IT grant applications were submitted in 2006 and 2007 for the completion of the Map’s development, these were not secured so financial support had to be provided by the Faculty of Medicine.

Workforce management issues relating to teaching workloads were also noted to have an effect on how staff members used and perceived the Map and eMed in general. In 2007, there was a move in a Faculty school to provide a metrics on teaching workloads to act as a guide to individual staff members and the school. This was noted in an email from an academic administrator to staff members of the school, which contained a draft workload policy document for discussion. This workload policy aimed “to strike a balance and achieve equitable and fair teaching loads”, to ensure that all staff member had appropriate time for research and that the school’s teaching allocation was covered (Case #27, academic, Txt and GO, email 18/06/2007 and school meeting 19/6/2007). By mid-2009 this same school, under a different academic administrator, had attempted to introduce a revised teaching workload formula for academic staff to use (Case #101, general staff, Txt and GO, email 4/08/2009 and school meeting 5/08/2009). These attempts to quantify teaching workloads proved difficult for various reasons, and in both instances caused some disquiet amongst staff (e.g. Case #27, academic, Txt, response to workloads email, 5/07/2007; Case #101, general staff, Txt, response to school meeting discussions email 5/08/2009). Unfortunately, as previously mentioned, when staff at the school meeting of 2009 questioned where the data on teaching hours had come from the answer given was that it had come from eMed. Once again this incident indicated that the reputation of eMed was in danger of being discredited by being used for tasks outside its original intended purpose as a learning and teaching system (Case #1, Rx, post-incident 12/8/2009). A staff member’s level of employment (e.g. academic, general, conjoint, casual, affiliated) also seemed to affect a staff member’s use and perception of the Map, although much of this had to do with issues relating to access to the Map or knowledge about the Map, and these issues are discussed separately.

A number of course convenors and principal teachers noted that the Map administrators offered excellent **administrative support** in entering the Map data for them (this was also confirmed by data in the ‘document revision history’ field of the Map’s online forms). However, it was also noted that this task was meant to be done by the academics themselves for various reasons already described. What appeared to be missing were administrative **policies, procedures, guidelines and timelines** to remind academic staff when to revise their data in the Map. For example, between mid-2008 and mid-2009, the following administrative issues relating to using the Map were noted to cause various time-consuming and irritating problems with the Phase 2 DIG members, which led them to ask the Map administrators the same set of questions at the end of each teaching period or year when it was time to review their course (Case #1, #2, #3, #4, #7 and #57, GO and Txt, email examples included ‘SH3 course guide’ emails 1/7 to 3/7/2008; ‘Inviting teachers for LAFs’ emails 10/11 and 11/11/2008; ‘Map updating’ emails 11/11 and 12/11/2008; ‘Revert Map changes’ emails 16/11 and 17/11/2008; ‘SH3 Map archive’ emails 4/03/2009):

Not knowing:

- When they should or should not update their Map forms
- When to move or not move LAFs in the Map in relation to timetable changes
- When the course forms would be archived in the Map
- What needed doing or not doing before the course was archived
- When the Map data would be exported for the next course guide production
- What needed doing to the Map for the course guide production
- Which Map forms to update
- When or how best to invite principal teachers to revise their LAFs
- If invited principal teachers had Map access prior to inviting them
- If and when a principal teacher should be given ‘Teacher’ access to the Map (e.g. if the teacher only taught one or two UMP activities).
- What alternatives to use with these one-off principal teachers
- If other course convenors were inviting principal teachers at the same time as they were (i.e. risking invitation overload)
- Whether invitations to principal teachers had been issued
- When a Map or eMed version release was occurring to avoid inviting principal teachers at that time.

Hence, while these Phase 2 DIG members were prepared to update their Map forms themselves they did not know when or how best to proceed, which led them to waste their own time and that of the Map administrators, and to increase their workload and level of frustration with using the Map. Due to their centralised role in the UMP, the Map administrators were noted to be in an excellent position to develop and drive these Map policies, procedures, guidelines and timelines. For example, in late 2007 the chief Map administrator in consultation with the then Phase 2 convenor and the Associate Dean of Education sent a letter to the Phase 2 course convenors explaining how their 2007 courses would be archived at the end of the year, when and how course convenors needed to revise their Map forms, and when and how the Map administrators would invite principal teachers to review their forms (Case #7, general staff, Txt, letter 13/11/2007). This process was highly supported by the then Phase 2 convenor who said in an email “I would definitely favour it being driven from the OME. That's not meant to sound like a task being dumped [on the Map administrator]!” (Case #14, academic, Txt, email 13/11/2007). This process continued to be driven centrally by the Map administrators after the new Map Archive system was released in 2008 (Txt, Map v4.0 release document 8/09/2008).

This different type of Map support moved away from having Map administrators complete forms for course convenors, and instead offered support by driving the process for course convenors to complete their forms in collaboration with principal teachers. So while course convenors could focus on the numerous other tasks involved with managing and delivering a course, the Map administrators could drive the mapping process and therefore ensure its sustainability. Map administrators were noted to be excellent at coming up with clever and simple administrative solutions to some of the problems course convenors experienced with using the Map and with developing their course guides. Map administrators were noted to have a better understanding of the different needs of course convenors and principal teachers across the three Phases of the UMP. They were better skilled at sending email-merge invitations to principal teachers and could better gauge when not to send such invitations (e.g. due to clashes with IT version releases or fixes). Finally, Map administrators were noted to be in a good position to (Case #1, Rx, overview of events 2007-2009):

- Monitor the Map's data quality
- Maintain the Map's controlled vocabulary
- Maintain the Map Help site for staff and the eMed help website for students
- Report Map user problems (IT or administrative)
- Share simple solutions with users
- Propose system improvements
- Test new Map versions prior to release.

A number of problems were noted with staff members' **access to the Map system** which either prevented staff members from using the Map or allowed them to use it when they should have no longer been allowed to. Problems existed at the Faculty level and at the University's central services level. At the Faculty level, all staff members in the Faculty's staff database had 'Reader' access to the Map and higher levels of access such as course 'Designer' or 'Teacher' access were managed through the eMed Access Manager system. However, as noted in early 2009, the Map access data in eMed Access Manager was out-of-date and in general disarray so that staff members who had left the Faculty some years back were still found to have high level access to the Map, and conversely newer staff requiring a high level access had none (eMed group, GO, eMed meeting and minutes 5/05/2009).

Conjoint staff and clinical teachers were noted to have specific problems with accessing the Map (eMed group, GO, eMed meeting and minutes 9/12/2008). For example, after the clinical teacher's workshop in mid-2008 it was noted than many General Practice and Primary Care tutors either did not have a University staff number and password or were unaware that they had these and had failed to activate their password through the University's central IT services. As noted in an incident observed in late 2008, a conjoint clinical staff member had problems when trying to activate their password with central IT services because the particular central IT support staff could not access the University database that housed conjoint staff members' identification information (Case #46, clinical teacher, GO, incident 3/12/2008). Discussions about this incident with the relevant Faculty administrator in mid-2009 revealed that this may have been a one-off problem caused by the access available to IT service staff, but that it warranted further investigation if it occurred again since it inconvenienced conjoint staff (Case #53 and #1, GO, emails 29/5 and 1/6/2009).

There were also problems with knowing which University online access forms clinical teachers needed to complete to apply for a staff number since there were different forms for conjoint, contract, sessional and affiliated staff, and some clinical teachers were unsure of their level of employment which could range from a salaried position (e.g. academic, contract or sessional) to a non-salaried position (e.g. conjoint or affiliated). Other user-specific problems with accessing the Map were also noted, such as clinical teachers not knowing the difference between the 'Username' (i.e. staff number) and the 'Unipass' (i.e. password) and hence entering these in reverse order in the eMed login page; not knowing how to change their Unipass from the original alphanumeric password they had received (which was difficult to remember) to a personalised password; or having their Unipass expire which was a potential problem for those with affiliated staff access. It was these types of issues that were preventing clinical teachers in particular from using the Map (various clinical teachers and Case #39, #37, #31 and #1, GO, workshop 1/08/2009).

The **administration of the whole eMed system** was discussed at two eMed meetings in 2008 (eMed group, GO, eMed meeting and minutes 20/05/2008 and 11/11/2008). One proposal was to follow the original team-driven approach to be managed by an eMed administrator, and by administrative owners for each eMed tool who would be responsible for driving its development and testing. Another proposal was to have a process-driven approach whereby key users would identify the system requirements and improvements, and various administrators or academics would drive the development and testing of various tools. The process-driven approach was chosen because of difficulties in identifying an owner for each eMed tool (except for the Map whose owner was the Map administrator). It was noted that the eMed programmer in his capacity as the eMed project manager agreed to drive the testing and release of all new items in all eMed systems and that use of the eMed Issue Log system would continue to support this process (eMed group, GO, eMed meeting and minutes 11/11/2008).

Finally, in 2007 changes to the **University's central services** that supported education technology, IT and the Central Library were noted as having the potential to directly or indirectly affect use of the Map and its supporting systems. The centralisation of educational technologies and eLearning services such as the course management system WebCT Vista and the digital recording of lectures through Lectopia commenced in 2007. In 2008 the eLearning services previously provided by an educational technology centre were distributed between the University's IT Service Centre and a newly formed educational unit known at the time as Learning and Teaching @ UNSW. WebCT Vista was to be replaced with another commercial course management system known as Blackboard. This change had the potential to affect the use of the Map, which integrated with WebCT Vista to manage and archive the UMP content files. Partly for this reason, in late 2007 the eMed reference group decided to develop a content management and archiving function within the Map so as no longer to use WebCT Vista to manage or archive the UMP content files. These IT changes to the Map extended its uses as a learning and teaching system for staff and students.

The University's IT Change Program which commenced in 2007 also had the potential to affect University support for the Lotus Notes/Domino platform used to develop the eMed systems and this put into question the future of eMed and the Map. This issue was discussed by the eMed reference group in 2007 and it was decided to continue developing eMed in Lotus Domino, since it was Lotus Notes only that would no longer be supported centrally (eMed group, GO, eMed meeting and minutes 15/5/2007).

In late 2008 the Map and other eMed systems were moved from the Faculty's physical servers to a set of virtual servers hosted by the University's IT service centre as part of the University's consolidated infrastructure project. A day later some problems were noted with accessing the Map but these were soon resolved. However, in early 2009 some eMed tools could not be accessed due to some Central IT server problems which took some time to resolve (Cases #1 and #20, GO, emails 4/02/2009). In mid-2009 some IT changes were noted to have an effect on weekend Internet access services from some classroom computers within a school which had a direct effect on the presentation of the Map at a weekend workshop for clinical teachers (Case #1, #18 and #29, GO, emails 1/08 to 3/08/2009). Finally as part of the central IT changes, in mid-2008 staff numbers started to be changed from an “s” prefix to a “z” prefix and this change had the potential to affect the eMed log-in procedures and hence access to the Map.

This concludes the description of key events that exemplified the organisational factors affecting Map use. Also see Appendix G for a summary table of key organisational factors which enabled or hindered Map use.

Technical factors

Factors affecting Map use from the perspective of the information system included the following technology-specific themes:

- Map data and data structure
- Map IT features
- Other IT systems.

The main findings for each of these themes are described here and the key factors which enabled or hindered Map use from an IT perspective are summarised in table form in Appendix G.

Issues relating to the **Map data** included the **controlled vocabulary, data quality, data security and data limitations** and these were all noted to have an effect on how the Map was used. An audit of the Map data in early 2007 revealed inconsistencies and misinterpretations of the Map’s **controlled vocabulary** used to index courses and activities in Phase 2 of the UMP in particular (Case #1 and 14, GO, eMed meeting and minutes 19/06/2007). For example, the learning context in Phase 2 was officially known as the ‘clinical presentation’ but was being referred to as a ‘weekly theme’. This could potentially be confused with the UMP’s ‘domain themes’, which some Phase 2 course convenors had thought were terms only applicable to Phase 1 (Case #1, PO, meeting 6/02/2007).

Also, each Phase 2 course had adopted a slightly different interpretation of the meaning of the clinical activity types described in the Map glossary, and this meant there was limited standardisation of activity types across Phase 2 courses. There was also some misuse and overuse of terms in the existing ‘content topic’ field and ‘theme’ field of the Map. The breadth and depth of the controlled vocabulary provided in the Map was also an issue discussed at the time, since too complex or extensive a vocabulary was likely to discourage course convenors and principal teachers from indexing their activities themselves.

There had also been a request by one of the Phase convenors for a ‘discipline’ field to index UMP activities in the Map (eMed group, GO, eMed meeting and minutes 15/05/2007). These controlled vocabulary problems affected Map users particularly when performing Map searches. These issues were discussed by the eMed reference group and progressively resolved in 2007 (eMed group, GO, eMed meetings in 2007). The old content topics were replaced with new discipline-based topics. Technical changes to controlled vocabulary fields were included in Map version 3 released in late 2007 and users were able to suggest the addition of terms through the Map system itself. In 2008, following an observation that it was not possible to search for the UMP’s curriculum ‘elements’ component, indexing terms for these ‘elements’ were included in the content topics list. The continual monitoring and maintenance of the controlled vocabulary and the related Map glossary were noted to be an ongoing task best managed by the chief Map administrator.

The **quality of data** in the Map was also noted to affect its use, and most of these problems related to data that were either missing or out-dated or to Map forms that had not been created. These problems were most evident with clinical activity forms and with Phase 2 and Phase 3 courses. Other data quality problems included the use of unexplained abbreviations in free text fields, spelling mistakes, and incorrect staff member details such as their school affiliation which occurred because the Map’s data were not automatically refreshed when information in the Faculty’s staff database was updated.

Data security was also noted as a problem. By mid-2009 over 200 staff members had some level of Map editor privilege and these users were trusted not to edit forms that did not belong to them since the editing rights to Map forms were not user-specific, although this had not presented any problem. Principal teachers who only taught one or two UMP activities were not generally given editor privileges, and instead were asked to provide their learning activity updates to the Map administrator or course convenor by email or in a Word document. However, as previously referred to under the organisational factors section, problems were noted in early-2009 with the maintenance of the eMed Access Manager database which presented a potentially serious data security problem since some staff members who no longer worked in the Faculty still had high-level editor privileges to the Map (eMed group, GO, eMed meeting and minutes 5/05 and 2/06/2009). By mid-2009 the chief Map administrator, in consultation with the eMed reference group, had addressed this problem by reviewing and updating the records in eMed Access Manager for most eMed systems, and by developing a procedural manual for administrators on the use and maintenance of eMed Access Manager system (eMed group, GO, eMed meeting and minutes 4/08/2009). The content management fields in Map version 4 released in late 2008 allowed the attachment of teacher-only files. These files were protected by the need for a teacher to log in every time such a field was accessed. This feature made it more secure than the previously used WebCT Vista section for teachers (Txt, Map version 4.0, release notes 8/09/2009).

Some users were also affected by the **data limitations** of the Map. For example, use of the simple-text format as opposed to the rich-text format meant that Map data exported to create course guides required substantial re-formatting. Another data limitation was the lack of permission control on the content seen by students. Although this was not a limitation for the UMP because of its educational structure, it could present a problem if content ever needed to be progressively disclosed to students (e.g. as in a problem-based curriculum). The capacity of accessing the Map data through a 'screen-reader' application for visually impaired users was also noted as a potential limitation that had been discussed in 2003–2004 and that warranted further consideration.

Finally, in early 2009 some Phase 2 course convenors commented that while the Map could tell users what the students had covered in the UMP it could not tell users what the students had not covered (Case #24 and others, academics, GO, meeting 7/04/2009). While this comment could be interpreted as a limitation of the Map's data or functionality, it could also be interpreted as an issue of understanding the Map's overall data structure and purpose. In essence, the Map was an online database of curricular activities which provided a comprehensive search tool and set views for browsing information, but not much more. However, this comment was in itself interesting and a potential functionality that could meet this particular need warranted further investigation.

The **Map's IT features and functions** were also noted to affect how staff members used the Map. The slow-down in its development in 2006–2007 affected how staff members were able to use the Map. It also affected the readiness of Map advocates to offer training due to the Map's many unfinished features and functions and IT glitches. For example prior to the release of Map versions 3 and 4 (Txt, Map v3.0 and 4.0 release notes 27/11/2007 and 8/09/2009) use of the search tool was limited by the lack of reliable Boolean operators and this often affected a user's search results. The lack of a comprehensive export function also limited its use in data analysis. The importance of monitoring the needs of Map users and of refining the IT system accordingly, and in consultation with the eMed reference group, was noted as being essential.

Also important was the need to document any required fixes or new functions in the IT Issue Log and to follow through the development and testing of these with the IT programmers prior to their release to users. Use of the IT Issue Log system was an essential component in the success of this process (eMed group, GO, eMed meeting and minutes 11/11/2008 and 9/12/2008). Some Map users who were being inconvenienced by recurring IT glitches were reacting by saying that they “hated eMed”. For various IT-related reasons, the thoroughness with which the Map was tested prior to a version release did not always preclude IT glitches from occurring. For example, the integrated nature of the eMed system meant that changes in other parts of eMed unexpectedly affected the functioning of the Map (Cases #1 and #20, GO and Rx, critical incident 7/04/2009).

The Map was only one tool in a suite of **integrated eMed systems**. As such, the Map was integrated with eMed Timetable, Portfolio and Tracking, and could potentially integrate with new eMed systems such as eMed Assessment Item Bank, eMed Placements and eMed Metrics. The Map was also supported by other non-eMed tools such as WebCT Vista and later Blackboard 9, the Faculty’s staff database, the University’s Human Resources databases, and the Central Library systems. While this integration of systems was noted to be highly beneficial to avoid, for example, the duplication of data, it did present some problems. For example, in mid-2007 it was noted that adding a staff member’s name and contact details in the Map forms was automated through the Faculty’s database, but that if a staff member had not approved (through the Faculty database) that their full details be displayed on the Faculty’s website then there was a restriction on data displayed in the Map. Also, changes to data in the Faculty database such as to a teacher’s name or school affiliation were not automatically update in the Map.

The Map’s own data quality also affected how it could be used with other systems. For example, as noted in an eMed meeting in 2009, good data quality in the Map was important if it was to link with eMed Metrics (eMed group, GO, eMed meeting and minutes 7/04/2009 and 5/05/2009). Some data integration was automated and some was manual and this presented its own problems. IT glitches in any of its integrated systems could affect the use of the Map. Since most users saw eMed as ‘one system’ and not as a series of separate but integrated tools, for an eMed user experiencing a glitch in one eMed tool (e.g. Tracking) was equivalent to experiencing a glitch in all eMed tools. So while not having glitches particularly in the Map was seen as important to the Map designer and the Map administrators, it was less important to the average eMed user who expected no glitches in any of the eMed tools. As well, some staff members occasionally thought that the Map was faulty when in fact they were looking at the wrong eMed tool or at the wrong view or function within a tool.

Although the final major development of the Map was completed in September 2008 with the release of version 4.0, its development was ongoing since minor changes were still required and some major features had been proposed but not yet approved such as the development of data-visualisation and concept mapping functions. Because of the central position of the Map in the eMed system, it was noted by the IT programmers that any changes to its basic structure could potentially cause problems to other eMed tools, and that to prevent this would require the programmers to have a good understanding not only of each individual eMed tool but also of the whole eMed system.

This concludes the description of key events that exemplified the technical factors affecting Map use. Also see Appendix G for a summary table of key technical factors which enabled or hindered Map use.

Discussion

This section discusses the key findings from this qualitative study, including the process of sense making, the main findings and the development of three working hypotheses on Map use.

Process of Sense Making

The research framework in Appendix F emerged during the coding of observations and textual documentations in this study. The development of this research framework and its coding tree helped to:

- Consolidate the categories, themes and topics used to code and analyse the unstructured qualitative data collected over 2.5 years
- Better define the evaluation research questions
- Align the research questions with the evaluation methods in the subsequent studies
- Gauge when data saturation for this study had been reached

- Summarise and report the findings from this study.

While the educational, organisational and information systems domains identified at the beginning of this thesis were still valid, the researcher's own understanding of the relationship between these three domains changed dramatically during the analysis of the qualitative data in this study.

In 2007, at the start of this qualitative study, the researcher was aware that Map use was somehow dependent on issues relating to these three distinct domains, and that since each domain was seen to be as important as the other they all deserved to be explored. The relationship between domains was basically linear and each domain represented a discrete set of issues, as shown in Figure 5.1.

Figure 5.1: Map use perspective in 2007—domains seen as discrete sets of issues.

By December 2008, after conducting a preliminary analysis of the observations data in MS Word and developing a rudimentary coding tree in NVivo 8, the researcher began to see the three domains as categories that could give meaning to the topics and themes evolving from the data analysis. The relationship between domains became that of an intersection Venn diagram as shown in Figure 5.2. Success in the use of the Map was now thought to lie at the intersections of the three domains.

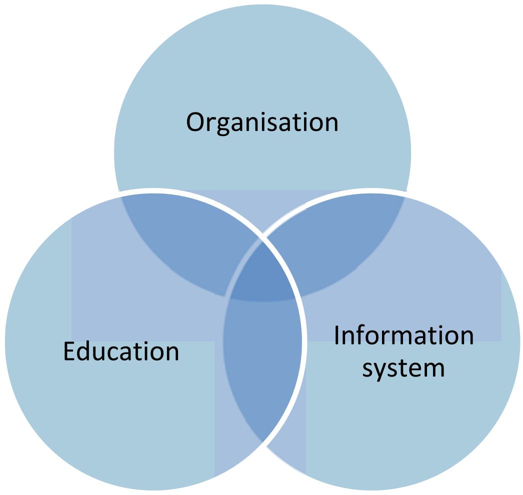

Figure 5.2: Map use perspective in 2008—domains seen as intersecting categories and issues.

By June 2009, three quarters into the qualitative data analysis phase, the researcher came to see the three domains as systems within systems, and their relationship had now changed to a nested Venn diagram, as shown in Figure 5.3. The potential success in the use of the Map now involved seeing the domains as interdependent systems which were affecting each other.

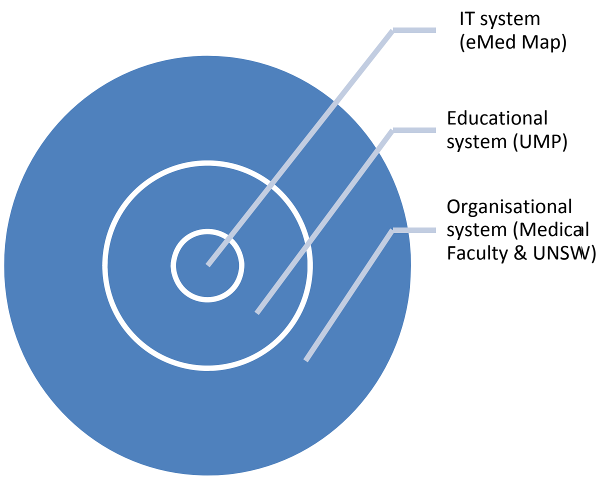

Figure 5.3: Map use perspective 2009—domains seen as nested systems and issues.

Furthering this new understanding of the relationship between the three domains as nested systems followed the concept that there were related ‘upstream’ nested systems (Figure 5.4) and ‘downstream’ nested systems (Figure 5.5) which were having an effect on staff members’ use of the Map. While the upstream systems (Figure 5.4) culminated in the effect of the university systems on the Map’s use, the downstream systems (Figure 5.5) culminated in the effect of the individual users including their workload, work flow and mental processing preferences, as well as their knowledge, skills and attitudes. Hence, this research would now need to further explore both the micro-issues and macro-issues which were affecting staff members' use of the Map.

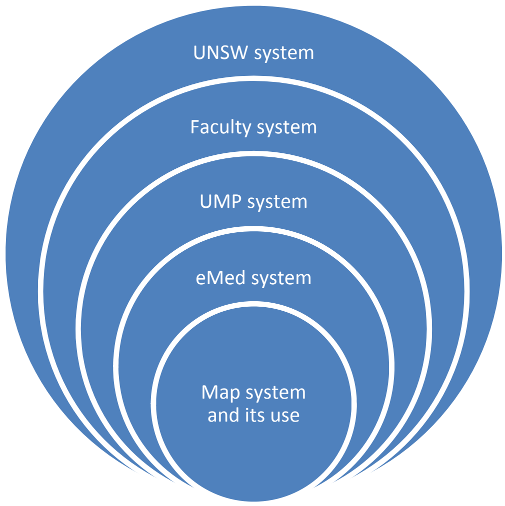

Figure 5.4: The 'upstream' nested systems affecting Map use.

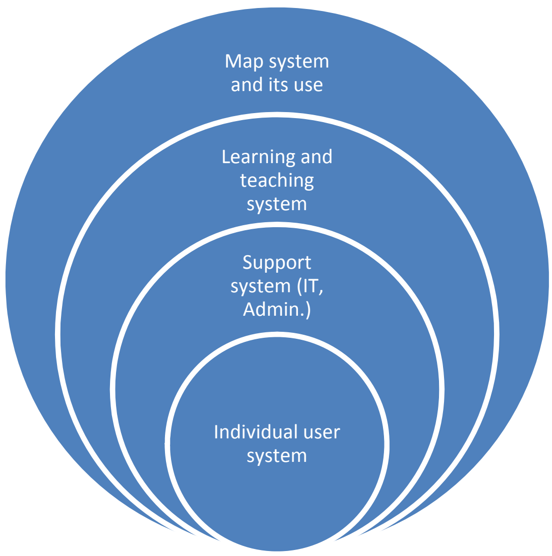

Figure 5.5: The 'downstream' nested systems affecting Map use.

Main Findings

During the Map design phase, and before this qualitative study began, the researcher had envisaged how she had intended the Map to be used in the UMP (see Appendix B). She also had some evidence of staff members' use of the Map from the eMed evaluation and analysis of web log reports in 2004 and 2006 (Watson et al., 2007), and from general observations made during her routine academic work between 2004 and 2006.

This qualitative study began by exploring whether staff members were using the Map or not. As the analysis of the qualitative data progressed, this question gave rise to these specific research questions:

- What were staff members using the Map for, either explicitly or implicitly? (Type of use)
- What factors relating to the users, the organisation or the IT system were enabling or hindering staff members from using the Map? (Factors affecting Map use)

The qualitative analysis identified 15 different factors that were affecting how staff members used the Map. Seven factors related to the individual user, five to the organisation and three to the IT system (see Table 5.5).

Table 5.5: Factors identified as affecting Map use (arranged by category).

Individual User	Organisation	IT system
Attitude	Communication	Data and data structure
Knowledge	Culture	IT features
Need	Management	Other IT systems
Effect	Administration	
Reward	Central services	
Perspective		
Advocacy		

These findings also revealed a number of key problems affecting how staff members used the Map and, as shown in Table 5.6, these were also associated with the individual user, the organisation and the IT system.

Table 5.6: Key problems observed to affect how staff members used the Map.

Key problems affecting Map use	Category of problem
Limited user knowledge and training	Individual user
Information duplication and reliance on paper	
Limited incentives to use the system	
Problems with the system meeting users' needs	
Workforce, workload and task allocation	Organisation
Limited Map policies, procedures, guidelines and timelines	
Limited communication and coordination	
Lag in IT development and maintenance and IT glitches	IT system
IT reputation of the eMed system	

Dividing specific factors and key problems into the individual user, organisational and IT categories aided in the analysis of data. However, these lists were an oversimplification of the issues involved since a distinct inter-relationship was observed between them, so that for example one problem often affected another and each problem often had more than one association to a category. Problems were observed to be complexly inter-related, so that considering them in isolation and resolving them one at a time could well cause further unforeseen problems. This observation was aided by the re-interpretation of domains as nested systems as described above, and by exploring GST, the systems thinking approach and the system dynamics methodology (see Chapter 3 for a description of these). Therefore, while this list of 15 factors is somewhat of an oversimplification of the Map use issues identified thus far, it still is a useful summary of findings from this qualitative study.

In general, these findings indicated that a major problem with the use of the Map by staff members between 2007 and 2009 appeared to be that there were many types of Map users (e.g. general teachers, principal teachers, course convenors, administrators and academic managers) and various Map support systems (support staff, websites, databases and IT systems) but few clear policies, procedures or guidelines or staff training on how to use the Map, limited advocacy regarding its use, and a limited understanding of how to use it from an IT perspective and even more so from an educational perspective. Hence, between 2007 and 2009 a staff member's use of the Map was often observed as being a somewhat reactive, inefficient, time-consuming and frustrating experience, and for some staff members it had become an extra imposition on their workload and time.

Hypotheses Building

Hypotheses on Map use emerged from the qualitative data through the grounded theorising approach described in Chapter 4. Deductive reasoning was used to generate further research questions and hypotheses on the relationships between categories, themes and topics of Map use previously identified through inductive reasoning. New questions emerged about the characteristics of Map users, as well as about their knowledge of and experiences with using the Map. These questions gave rise to the three working hypotheses shown in Table 5.7. As previously acknowledged, there could be an element of subjectivity in the findings from this qualitative study due to the researcher's academic roles involving the Map, as well as due to the inductive and interpretive nature of the research methods used. Therefore, to validate the findings from this study, these three working hypotheses were tested through the two quantitative studies using deductive reasoning.

Table 5.7: Three working hypotheses on Map use.

Hypothesis number and statement	Study used to test hypothesis
Hypothesis 1: Particular staff member characteristics (e.g. gender, age, staff type, school location, UMP roles) were associated with certain patterns of Map use (focus on user demographics)	Study 2: Web log and data linkage Study 3: Survey
Hypothesis 2: What staff members used the Map for was associated with certain factors affecting Map use (focus on types of Map use)	Study 3: Survey
Hypothesis 3: What staff members perceived as effects of the Map was associated with certain factors affecting Map use (focus on effects of Map use)	Study 3: Survey

Grounding of Findings in Theory

As noted in Chapter 3, there are many diverse educational, organisational and information systems theories and many of these could be used to explain these findings. GST was favoured because of its holistic approach. Hence, this theory along with the systems thinking approach and the qualitative system dynamics methodology had now clearly become a suitable theoretical and methodological framework on which to build the rest of this research.

Conclusion

All this activity culminated in the overall research design. This comprises a range of questions and hypotheses, executed by the key studies. The major inductive and interpretive phase of the Map's evaluation had now concluded and a more positivist and deductive approach was adopted with the ensuing two studies. However, as noted by Lee (1991), a further evolution of ideas could be expected due to the iterative nature of the discovery process when using both interpretive and positivist research approaches, as were used in this thesis.

Chapter 6 : Map Web Log Reports and Data Linkage Study

Introduction

This study covered the analysis of the eMed web log reports and their linkage to data on Faculty staff members and their involvement in the UMP. The study was quantitative, positivist and deductive in nature. It was descriptive and analytical and also partly confirmatory of the results from the other two studies. The data used in this study extended from January 2004 to December 2010. This longitudinal data was collected, processed and analysed between June 2010 and June 2011.

Quantitative data analysis was used to identify the following:

a) Patterns of collective Map use

b) Patterns of individual Map use

c) Characteristics of Map users and non-users.

The **key research question explored in Part** 1 of this study was: what were the general patterns of Map use? This question was answered by using the results from the analysis of the Map web logs. The **key research question in Part 2** of this study was: how many staff members involved in the UMP had used the Map and how many had not used it? This question was answered by linking the results from the Map web log analysis with data from the Faculty staff database and various UMP databases and data sources. This comprised the data linkage component of the study. The question was answered using descriptive statistical analysis in SPSS v20 and Excel 2007. In relation to **Hypothesis 1, the research question** was**:** was there a relationship between the patterns of Map use and certain demographic characteristics of Map users? This question was answered through a statistical analysis of the association between variables measuring Map use and the characteristics of Map users.

As illustrated in Figure 6.1, answers to these research questions were uncovered by iteratively linking the following three main data-sets and respective variables:

- Map use data and variables measuring Map use (session user, session, session duration and session event)
- Faculty staff data and staff demographics (age, gender, staff type and school location)

- UMP staff data and UMP roles (e.g. convenor, facilitator, eMed Timetable teacher, administrator etc.).

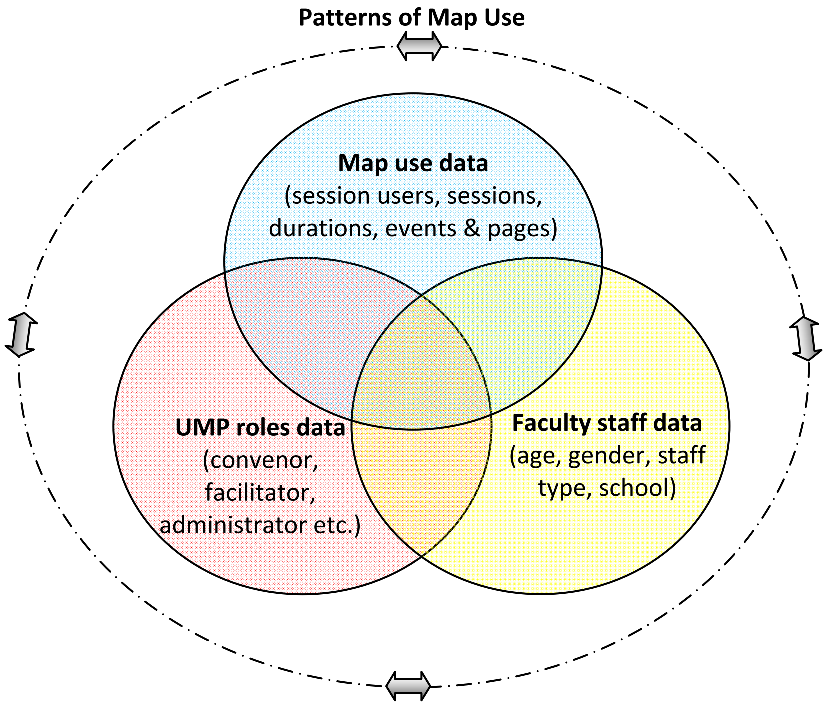

Figure 6.1: Patterns of Map use identified by iteratively linking variables from data-sets.

Methods and Procedures

This section describes the methods and procedures of this study. This includes a description of the population groups selected, the type of data collected and the data analysis procedures used.

Population and Data Items

Data used in this study were on the following Faculty population groups:

- Staff who accessed eMed Map and eMed Help
- Staff in the Faculty staff database
- Staff involved in the UMP.

The collected data extended from January 2004 to December 2010. Use of whole populations was chosen over using population samples to evaluate staff members' use of the Map because these populations changed over time since the UMP was a new medical program which was progressively introduced one year at a time from 2004 to 2009, the curriculum map was still being developed and refined during the same period, and the Faculty's staff member population constantly changed. Hence, it was difficult to select a representative sample of each population group to measure. As well, the availability of eMed web log reports from March 2004 to December 2010 made the proposition of evaluating the whole population of staff members who had accessed eMed Map more inviting since it would be possible to identify changes in patterns of Map use longitudinally, across the seven-year period.

The purpose of this quantitative data analysis was to identify the following:

a) The collective patterns of Map use by staff members within specified parameters (e.g. time of day, geographical location, operating systems used, Map sections used).

b) The number of staff members in the Faculty and the number involved in the UMP between 2004 and 2010, including their UMP role(s)

c) The number and characteristics of Map users and non-users (e.g. age, gender, staff type, school location) and their roles in the UMP (e.g. convenor, facilitator, administrator)

d) The patterns of Map use by individual UMP staff members (number and average duration of sessions, number of session events) and the demographic characteristics of these UMP Map users (age, gender, staff type, school location and UMP roles).

The aim of this analysis was to quantify staff members' use of the Map and to explore the demographics and UMP roles of those staff members who had used the Map as well as those who had not. A similar quantitative analysis was conducted on the use of the eMed Help site, which contained information for staff members on how to use the Map from both an educational and IT perspective.

Context

The eMed Map system is a fully password-protected online system available to all staff members of the Faculty of Medicine and to affiliated UMP teachers (while it is also available to all UMP students, they were not included in this evaluation study for reasons previously discussed). To log into the Map, staff members have to first log into the online system by entering their activated University staff number (Username) and password (UniPass) in the eMed log-in page. The Map access levels for staff are: Reader, Teacher, Designer or Administrator. All staff members whose ID number and details are included in the Faculty of

Medicine's staff database automatically have 'Reader' access to the Map, regardless of their involvement in the UMP.

The Faculty staff database, which was developed in Lotus Domino 7, contains information on staff members who are full-time, part-time, conjoint, adjunct or visiting staff, as well as select staff members from one particular school in the Faculty of Science who teach extensively in the UMP. However, the database does not generally contain information on casual or affiliated staff members such as casual UMP tutors or clinical teachers in Primary Care or community placements. Casual and affiliated staff members who have an activated University staff number and password can be given access to the Map on request through the eMed Access Manager system, which is also used to give select Map users higher levels of access (e.g. as 'Teacher' or 'Designer'). Therefore, staff members who do not have an activated University staff number and password (or who do not know their password or staff number) cannot access the Map even if they teach in the UMP.

Data Collection

Data on staff members' access to the Map were collected from the Lotus Domino 7 eMed access web log reports captured between January 2004 and December 2010. General data on staff members of the Faculty of Medicine such as their position, school affiliation, gender and age were collected from the Faculty's staff databases in Lotus Domino 7 (public and private versions). Data on staff members' roles in the UMP were collected from eMed Map, eMed Timetable, eMed Access Manager and eMed Clinical Placements databases, as well as from electronic copies of the UMP course guides and phase guides, the Faculty's governance webpage and the Rural Clinical School's website and database. While some of the data analysed were available for continuous periods of time (e.g. web log reports), other data were only available for specific points in time (e.g. Faculty staff data). See Appendix H for detailed information on all the data collected in this study from each of these sources.

The Lotus Domino 7 eMed access web log files were analysed using the web log analyser Sawmill Professional version 8.1.5 (Sawmill 8 for short). Results from Sawmill 8 were exported to MS Excel 2007 for further analysis and data linkage. Data from various Faculty and eMed databases were also exported into Excel, and data in select documents and websites were copied into Excel. All data in Excel were extensively checked, cleaned and standardised in preparation for the data linkage process (e.g. duplicate entries were deleted, hidden spaces removed, any variations in names or ID numbers across databases were standardised and the like). This was essential to ensure the accuracy of the data linkage component of this study.

eMed Access Web Log Files and Sawmill Analysis

The raw eMed access web log files were automatically captured by the Lotus Domino eMed server on a daily basis and routinely saved onto CD or DVD every few months by the MCSU. A total of 7,042 eMed web log files containing a total of 159Gb of data were captured and saved between 20 January 2004 and 31 December 2010 (due to an oversight in the saving routine, web logs for May 2008 and April 2009 were missing from the data-set). All data were saved onto an external hard drive and analysed by the researcher using Sawmill 8 (see Appendix I and Appendix J for further details).

Raw eMed access web log files contained large amounts of detailed and varied web log traffic information on all users who had logged onto the eMed website between January 2004 and December 2010. Data on authenticated eMed user (visitor) included the following:

- Authenticated user ID number (staff or student number/username)
- Type of user (staff or student)
- Hostname/client IP
- Date and time of logging in and logging out
- eMed directories/tools visited (e.g. Map, Timetable, Portfolio, Help etc.)
- Pages viewed
- File types viewed
- Session information (session pages, entry pages, exit pages and session users)
- Geographical location of access (countries, regions and cities)
- Technical information (screen dimensions, screen depth, web browsers, operating systems, referrers and server responses).

Sawmill 8 is a customisable, GUI-based web log analysis tool (see Appendix I for details). Various Sawmill fields and filters were used in this study to either exclude or include specific data contained in the Lotus Domino eMed access web log files (see Appendix J for details). Sawmill analysis of eMed Map and eMed Help web traffic excluded the following data:

- eMed directories other than eMed Map or eMed Help
- Students

- Staff members who had opted-out of this study
- Staff member from the MCSU (IT programmers and technicians)
- Dummy accounts used for testing eMed
- Non-authenticated eMed users
- eMed Help page writers
- eMed Help pages for tools other than eMed Map.

Sawmill can count web log traffic in several ways. Each way is counted independently of the others and each has its own advantages in analysing the web traffic (see Appendix I for details). The main web log traffic measurements reported in this study were based on session information and included:

- Session users
- Sessions
- Session events
- Session duration
- Session pages.

Excel 2007 Data Analysis and Linkage

Results of the Sawmill analysis of the raw eMed access web log files were exported to Excel 2007. These results provided data on the collective use of the Map by all session users, and on the individual use of the Map by each session user from January 2004 to December 2010. Data from the Sawmill analysis were collated into the following three major Excel files:

a) A file with data on the collective use of the Map by all session users as a group (original filename: OverallMapUse.xlsx, and reference filename: Overall Map use).

b) A file with data on the individual use of the Map by individual session users, as well as data on individual Faculty staff members from various sources. The combination of these two major data-sets formed the data linkage component of this study (original filename: MapUserDec2010-2004+Staff+Tbl.xlsx, and reference filename: Individual Map user).

c) A file with data on the use of eMed Help by individual session users, as well as some staff member data (original filename: eMedHelpUser+Staff_2004-2010.xlsx, and reference filename: eMed Help user).

Data in each Excel file were saved at varying levels of detail on separate Excel worksheets. All data were extensively cleaned and then merged, condensed, classified and linked in various ways, and finally analysed at various levels of granularity and from different perspectives. The Excel function 'VLookup' with absolute values (function F4) was extensively used to link data from one worksheet to another, and pivot tables and graphs were extensively used to explore data from various perspectives. Each Excel file contained numerous worksheets, and data were finally compiled into a small number of key worksheets for analysis.

The 'Overall Map use' file only contained data from the Sawmill analysis of eMed access web log files. It had 13 key worksheets containing combined data on the following web log parameters on Map use: years, months, days of week, hours of day, countries, regions, file type, web browsers, operating systems, referrers, server responses, session users and individual sessions.

The 'eMed Help user' file contained data from the Sawmill analysis of the eMed access web logs on individual session users (authenticated users) and on session pages accessed from January 2004 to December 2010, as well as data from the Lotus Notes Designer system on the unique alphanumeric key, title, section and system of each eMed Help webpage available.

The 'Individual Map user' file contained three key worksheets with combined data on Map use from the Sawmill analysis of the eMed access web logs, and data on Faculty staff members from various Faculty and UMP databases and sources. This file was used in the data linkage component of this study to explore the number and characteristics of staff members who had either used the Map or not used the Map between January 2004 and December 2010. Table 6.1 outlines the type of data in this file and the source of these data from January 2004 to December 2010 (see Appendix H for further details on these data sources).

Table 6.1: Type and source of data on Map users and staff members in the 'Individual Map user' file.

Data type	Data source
Individual session users	Sawmill analysis of Lotus Domino eMed access web logs
Individual sessions	Sawmill analysis of Lotus Domino eMed access web logs
Staff ID number, name and surname	Sawmill analysis of Lotus Domino eMed access web logs Faculty staff database eMed Timetable eMed Map and Map Archive eMed Access Manager
Role in the UMP (convenor, principal teacher, campus teacher, clinical teacher etc.)	eMed Timetable eMed Access Manager eMed Placements UMP Course Guides and Program Guides Faculty of Medicine's "Governance" webpage Rural Clinical School website and database Mini-survey on UMP roles of staff*
Faculty affiliation (School, Department etc.)	Faculty staff database (public version)
Staff type (academic, general, conjoint, external etc.)	Faculty staff database (public version)
Staff position (lecturer, professor, administrator, researcher etc.)	Faculty staff database (public version)
Gender	Faculty staff database (public version)
Age	Faculty staff database (private version)
Currency of position (start/end dates, start of current position)	Faculty staff database (private version)

*This mini-survey was released on 13 May 2009 along with a Faculty-wide email announcement to staff about this eMed Map study.

Statistical Methods

In Part 1 of this study, the patterns of Map use were analysed using the collective number of session users for each year from 2004 to 2010, and for all seven years in total. In Part 2A and Part 3, Map use was analysed using the individual number of session users for all seven years in total. In Part 2B Map use was analysed for each year and for all seven years in total. The two main Sawmill variables used to measure Map use were the 'session user' and 'session' variables.

Table 6.2 outlines the variables analysed in Part 2 and Part 3, which comprised the data linkage component of the study. The 'session' and 'session range' variables were used as the main dependent variables to test the null hypothesis (H_0) that Map use was independent of any staff characteristics, with the alternative Hypothesis 1 (H_1) being that Map use was associated with one or more staff characteristics. The 'session duration', 'session event' and 'years of use' variables were also used to test Hypothesis 1 but to a lesser extent.

Table 6.2: Variables analysed in the study's data linkage component.

Description of variable	Type of variables and measurement scale	Name of variables
Characteristics of staff members	Independent variables Measurement scales were nominal, except for the age range which was ordinal, and the number of UMP roles which was interval	General demographics: Gender Age range Faculty demographics: Staff type School location UMP demographics: UMP role
Map use measurements	Dependent variables Measurement scales were interval, except for the session range which was ordinal	Main variables of Map use: Session user Session Session range Secondary variables: Session duration (decimal minutes) Session events Years of use

Because the distribution of counts in the 'session' variable was not normally distributed, it was transformed into the categorical 'session range' variable in SPSS by dividing the total count of sessions into six groups with approximately 16% of cases in each group, as shown in Table 6.3.

Table 6.3: Number of cases in each category of the session range variable.

Session range	Frequency and percentage of cases
1 to 2	102 (20%)
3 to 5	90 (18%)
6 to 9	68 (13%)
10 to 17	82 (16%)
18 to 45	81 (16%)
46 to 3372	84 (17%)

The frequency analysis of session users in Part 1 (collective patterns of Map use with file 'Overall map use'), in Part 2A (individual patterns of Map use with file 'Individual Map user' linked to data on staff characteristics) and in Part 3 (individual pattern of Map Help use linked to data on staff characteristics) was conducted in Excel 2007. The chi-square tests between the Map use status and staff characteristics variables in Part 2A and Part 3 were conducted in SPSS v20 by using the total count of session users derived from the Excel analysis (i.e. single cases were analysed in Excel and the total counts of these cases were analysed in SPSS).

In Part 2B, the frequency analysis, chi-square tests for independence and median tests on Map use by individual staff members (with file 'Individual Map user') were conducted in SPSS v20 (i.e. single cases and total counts were both analysed in SPSS). The Sawmill variables used to measure Map use in Part 2B were: session user, session, session range, session duration, session events and years of use (see Table 6.2 above). The association between certain staff demographic variables was also analysed in SPSS v20 using the chi-square test and single cases of Faculty staff members as opposed to total counts.

The Excel frequency analysis included counts and percentages. The SPSS frequency analysis included counts and percentages, as well as measures of central tendency (mean, median and mode), dispersion (standard deviation, minimum and maximum values, and standard error), distribution (skewness with standard error), percentile counts and outliers to assess the distribution of counts in each variable. Since the Map use variables were asymmetrically distributed (positive skew), the following non-parametric statistical tests were used:

- Pearson's chi-square test for independence for hypothesis testing (2-sided): used in the cross-tabulation analysis in Part 2A to measure the significance of the association between Map use and staff characteristics, to test Hypothesis 1; and similarly in Part 3 in relation to Map Help use. In Part 2B, it was used to measure the significance of the association between the Map 'session range' counts and staff characteristics to continue testing Hypothesis 1. Statistically significant results were followed by a cross-tabulation examination of cell frequencies and, when expected cell counts were greater than five, by examination of the cell's adjusted standardised residual (AR) value to identify those cells contributing to the significant overall chi-square value using an absolute value of greater than 2 as the significant value (i.e. $\alpha <= 0.05$). The chi-square test was also used to analyse the association between the Map 'session range' counts and either the school location or staff type variable, while controlling for levels of the other staff variable (i.e. using a layered cross-tabulation analysis). Throughout this study, the Pearson's chi-square exact test was used in place of the asymptotic test since some cross-tabulations had more than 20% of cells with expected counts of less than 5. Since the exact p-value for large cross-tabulations could not always be computed due to limited computer memory, the Monte Carlo method was used to calculate the estimated exact p-value (2-sided) based on 10,000 sample tables with a starting seed set at 2,000,000, and a 99% confidence interval (CI) for the exact p-value (for details on the SPSS exact tests see Mehta & Patel (2010)).
- Cramer's V: used in the cross-tabulation analysis to measure the effect size or the strength of association between variables (rather than the significance). The Cramer's V result was evaluated using the following criteria, where the degrees of freedom (df) is the smaller of either (R-1) or (C-1) (Gravetter & Wallnau, 2004; Pallant, 2011):

    - df = 1 (two categories): small = 0.01, medium = 0.30, large = 0.50
    - df = 2 (three categories): small = 0.07, medium = 0.21, large = 0.35
    - df = 3 (four categories): small = 0.06, medium = 0.17, large = 0.29.
- Median test for k independent samples: used in Part 2B to measure whether or not there was a significant difference in the Map 'session' counts and staff characteristics, to test Hypothesis 1. If the result was statistically significant, a pair-wise median-test was used on pairs of categories in each demographic variable. This test was also used in Part 2B with the Map use variables on 'session duration', 'session events' and 'years of use', but to a lesser extent.

All statistical tests in this study used a significance level of 5% ($\alpha <= 0.05$). In general, the median test on Map session counts was used to establish overall differences in Map use by different categories of staff members, while the Pearson's chi-square test on session range counts was used to assess in more depth the differing patterns of Map use across select categories of staff members. These two tests were considered the most appropriate non-parametric tests for this study since its focus was to look at the differences in Map use in relation to single staff characteristics using one independent variable at a time. Since this exploratory study did not intend to look at the variance of Map use in relation to a set of staff characteristics (more than one independent variable at a time), or to compare the predictive ability of a number of different staff characteristics on Map use, it was decided that in this study there was no need to use regression analysis (e.g. Poisson regression or negative binomial regression) or structural equation modelling (Pallant, 2011).

Results

This section is divided into the following three major parts. As shown in Figure 6.2, each part reports the results on various patterns of Map use and characteristics of Map users:

- Part 1: Collective patterns of Map use
- Part 2: Individual patterns of Map use and data linkage
- Part 3: Patterns of Map Help use.

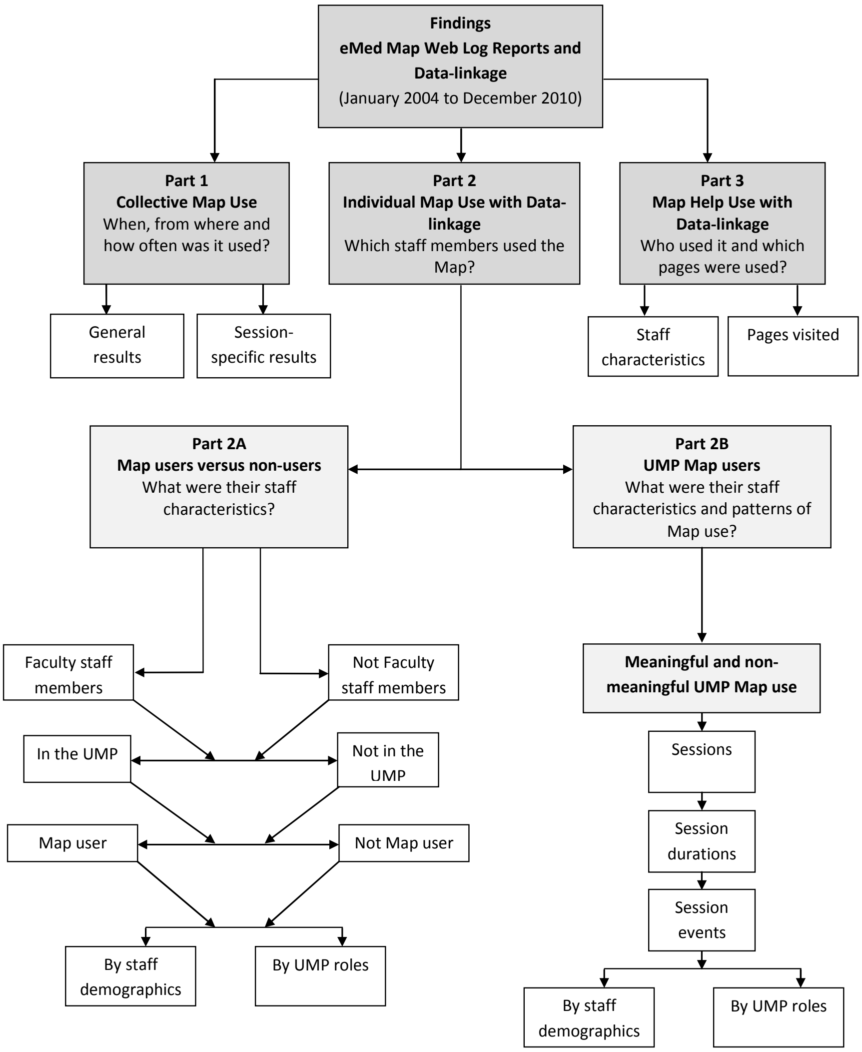

Figure 6.2: Outline of the presentation of results from the web log and data linkage study.

Part 1: Collective Patterns of Map Use

These results are on the collective patterns of Map use by all staff members from January 2004 to December 2010. The **specific research questions** in this section were: (a) When, from where and how often had staff members used the Map? (b) Which sections of the Map had they used? (c) Had there been any IT issues or problem in accessing the Map (e.g. server or document errors)? Data used to answer these questions came from Sawmill reports and only related to the 'Map use data' component of Figure 6.1 prior to its linkage to the other two data sets. This section has been divided into general results and session-specific results, as shown in Figure 6.3.

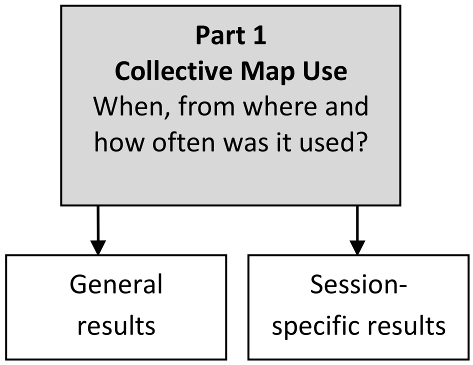

Figure 6.3: Outline of the presentation of results from the collective patterns of Map use.

The count of session users in Sawmill reports represent unique users only within the time frame specified in the report (e.g. one week, one month or one year). Therefore, session user counts in this section which have been summed across the seven years are not of unique users. Even so, these summated counts are useful to illustrate the general patterns of Map use from 2004 to 2010. Since these results include all Map session users, counts are somewhat higher than those in Part 2B which excluded sessions users not involved in the UMP and sessions of very short duration.

General Collective Patterns

The Sawmill measurements of Map use reported in this section are of the 'session' and 'session user' variables (see Appendix I for definitions). The general collective patterns of Map use in relation to the time and location of its use between January 2004 and December 2010 were as follows:

- There was a steady increase in the number of unique session users from 2004 to 2010, and a noticeable increase in the number of sessions in 2009 and 2010 (note that since web log files for May 2008 and April 2009 were missing from the data-set, the total counts for 2008 and 2009 were likely to have been higher) (see Figure 6.4). This trend coincided with the increase in the number of staff members involved in the UMP as consecutive years of the medicine program were implemented (this pattern is explored further in Part 2B).
- Map use for each month of the year did not vary substantially. The largest number of session users and sessions occurred in March with a small peak in June, which coincided with preparations for the start of the first and second sessions of the academic year at

UNSW. The quietest months were January and December which reflected the Australian summer holiday period. (See Figure 6.5).

- The busiest days of the week were Monday and Tuesday, with a small decline in session users and sessions as the week progressed toward Friday and a larger decline on Saturday and Sunday, matching the regular pattern for a working week. (See Figure 6.6).
- Map use for each hour of the day generally followed the regular hours of a working day (9:00 hours to 17:00 hours) although hours of use extended from about 7:00 hours to 23:00 hours. The busiest hours of the day were mid-morning and mid-afternoon with a slight decline between 13:00 and 14:00 hours, coinciding with the lunch break. (See Figure 6.7).
- Access to the Map occurred mostly from within Australia, with access from overseas increasing over the seven years so that by 2010 a total of 87 sessions took place in other countries. Access from within Australia occurred from most States and Territories, but mostly from within the State of New South Wales coinciding with the location of the central campus of the Faculty of Medicine at UNSW.

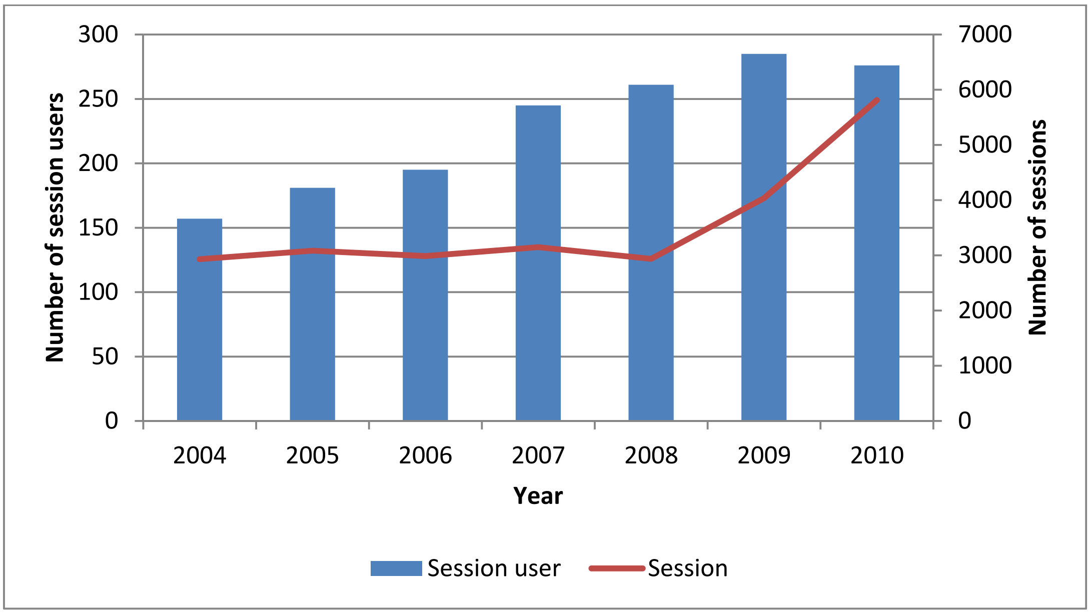

Figure 6.4: Number of Map sessions and unique session users for each year[2].

[2] The total counts for 2008 and 2009 in Figure 6.4 may have been higher since web log files for May 2008 and April 2009 were missing from the data-set.

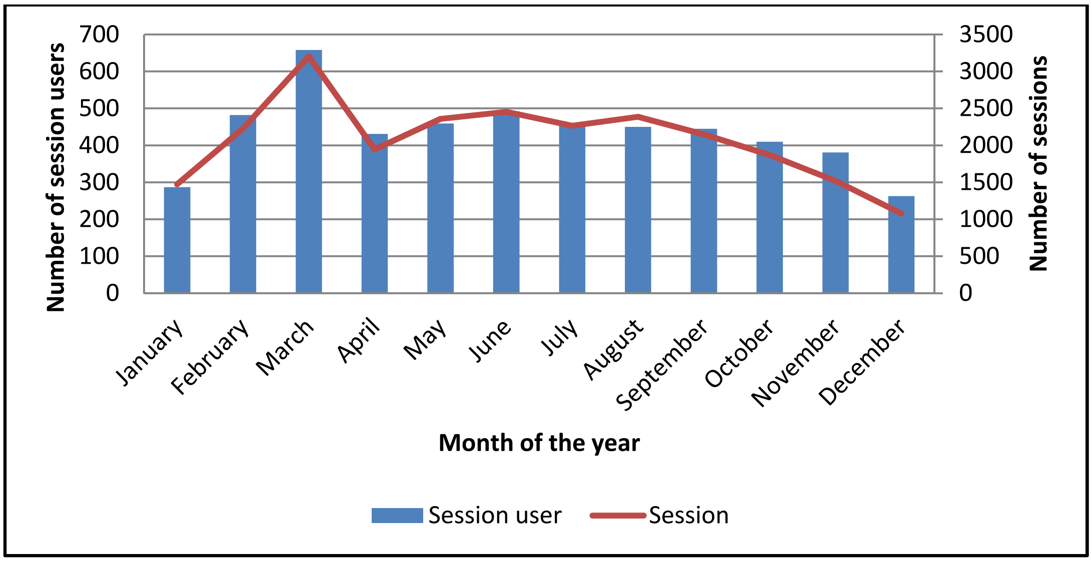

Figure 6.5: Number of Map sessions and non-unique session users by months of the year.[3]

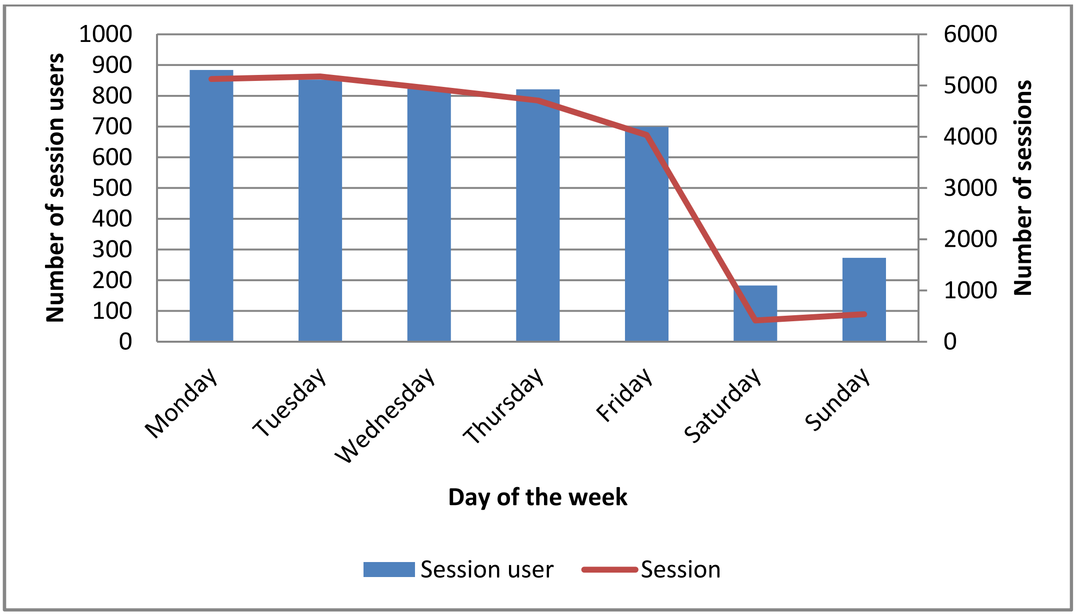

Figure 6.6: Number of Map sessions and non-unique session users by days of the week.

[3] The number of session users in Figures 6.5, 6.6 and 6.7 are not of unique users since these numbers were aggregated for all seven years from January 2004 to December 2010.

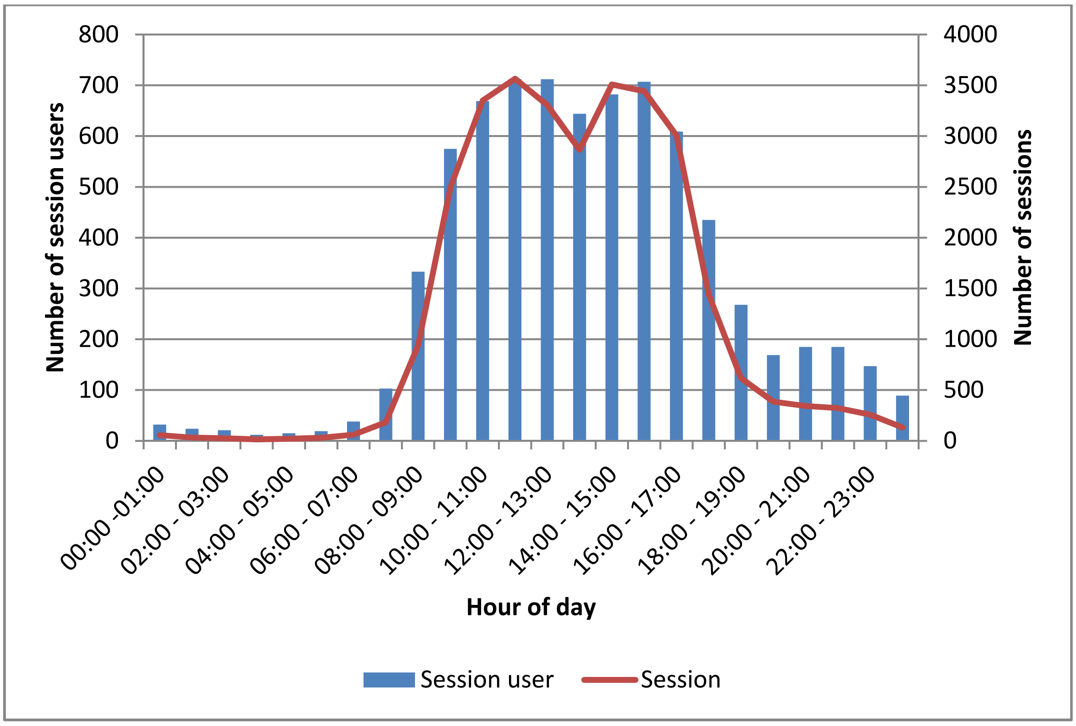

Figure 6.7: Number of Map sessions and non-unique session users by hour of the day.

The general collective patterns of Map use in relation to the IT systems and Map sections used were as follows:

- The most common Map referring website was the eMed website itself via its various sub-servers and directories, and the second most common group were the corporate learning management systems used along with the Map to manage the online content of the UMP—namely WebCT (2004 to 2005), WebCT Vista (2006 to 2008/9) and Blackboard (2009 to 2010). The increased use of eMed Tracking as a referrer from 2007 onward was likely due to the provision of hyperlinks between the Map and Tracking systems.
- Following the release of the Map's content management system in September 2008, the file types accessed the most frequently were the PDF and MP3/4 files, with numbers increasing substantially between 2009 and 2010. The PDFs were used for handouts, lecture notes and readings, and the MP3/4 files were used for audio recordings of lectures, tutorials and other learning activities captured in the Map.
- The use of MS Excel files to export the Map's Search results (a feature released in November 2007) was relatively low.
- The browsers most commonly used to access the Map were Internet Explorer, Firefox and Safari (in decreasing order of use) and the operating systems most commonly used were

Windows (with Windows XP being the most common) and Apple/Macintosh. These coincided with the browsers and operating systems supported by the eMed system.

- The number of users experiencing document-related or server errors was generally low, indicating that Map users did not experience many IT-related problems and that the Map was a stable system.

Session-Specific Collective Patterns

The Sawmill measurements reported in this section are of the Map 'session', 'session user' and 'session pages' variables (see Appendix I for definitions). The session-specific collective patterns of Map use were as follows:

- Between 52.0% and 60.0% of Map users (depending on the year) performed between 1 to 4 sessions in total per year (this pattern is explored further in Part 2B).
- The number of one-time session users was the largest count in each year, representing between 22.0% and 32.0% of the total number of session users depending on the year (this pattern is explored further in Part 2B).
- The number of sessions accessing the Map forms steadily increased over the years. This may have been due to an increase in (a) the number of forms created as the UMP was being progressively implemented between 2004 and 2009, and (b) the availability of content files (e.g. lecture notes and audio files) attached to Map forms from September 2008 onward.
- The specific Map view accessed the most was the LAF view, with its rise in use from 2008 onward indicating that staff members were accessing these forms more often. Access to AAF, COF and LCF views were substantially lower, and generally remained stable across the seven years.
- The number of sessions accessing the Map Search tool increased over the years.
- Use of the Search Export function was generally low, although it was only available to those with 'Designer' or 'Administrator' access to the Map.

Part 2: Individual Patterns of Map Use and Data Linkage Results

This section reports the results of the data linkage component of the study. Result were used to test Hypothesis 1, which proposed that staff members' Map use status was associated with their gender, age, Faculty position, school affiliation and/or UMP involvement. To test this hypothesis, web log data from Sawmill reports pertaining to individual Map users were linked to the following two major data sets:

(a) Faculty staff data (related to staff demographics such as age, gender, staff type and school location)

(b) UMP staff data (related to the UMP roles held by staff).

The UMP data was collected from various sources including the Map, eMed Timetable, eMed Access Manager and eMed Placements databases, Faculty and School websites, UMP documentation, and results of a staff survey on UMP roles conducted in May 2009 with a return rate of 46 surveys (for further details on the data used in this study see Appendix H).

Part 2A looks at all staff members in the Faculty staff database or the UMP data who had either used or not used the Map. The r**esearch questions** were: (a) How many staff members involved in the UMP either used or did not use the Map between 2004 and 2010? (b) Were there any significant differences between the characteristics of staff and Map use status? To answer these questions, Map users and non-users were compared based on their staff demographics and UMP involvement. Map use was measured using the count of session users from Sawmill reports.

Part 2B only looks at individual UMP staff members who had used the Map. The main **research question** explored in this section was: Amongst the UMP Map users, were there any significant differences between the characteristics of staff and patterns of Map use based on the number of sessions, duration of sessions or number of session events performed? Map use was measured using the count of session users, sessions, session durations and session events from Sawmill reports. Excel 2007 and SPSS V20 were used for data analysis in both sections. Figure 6.8 provides an outline of results covered in each section and Appendix I provides a definition of the Sawmill measurements used.

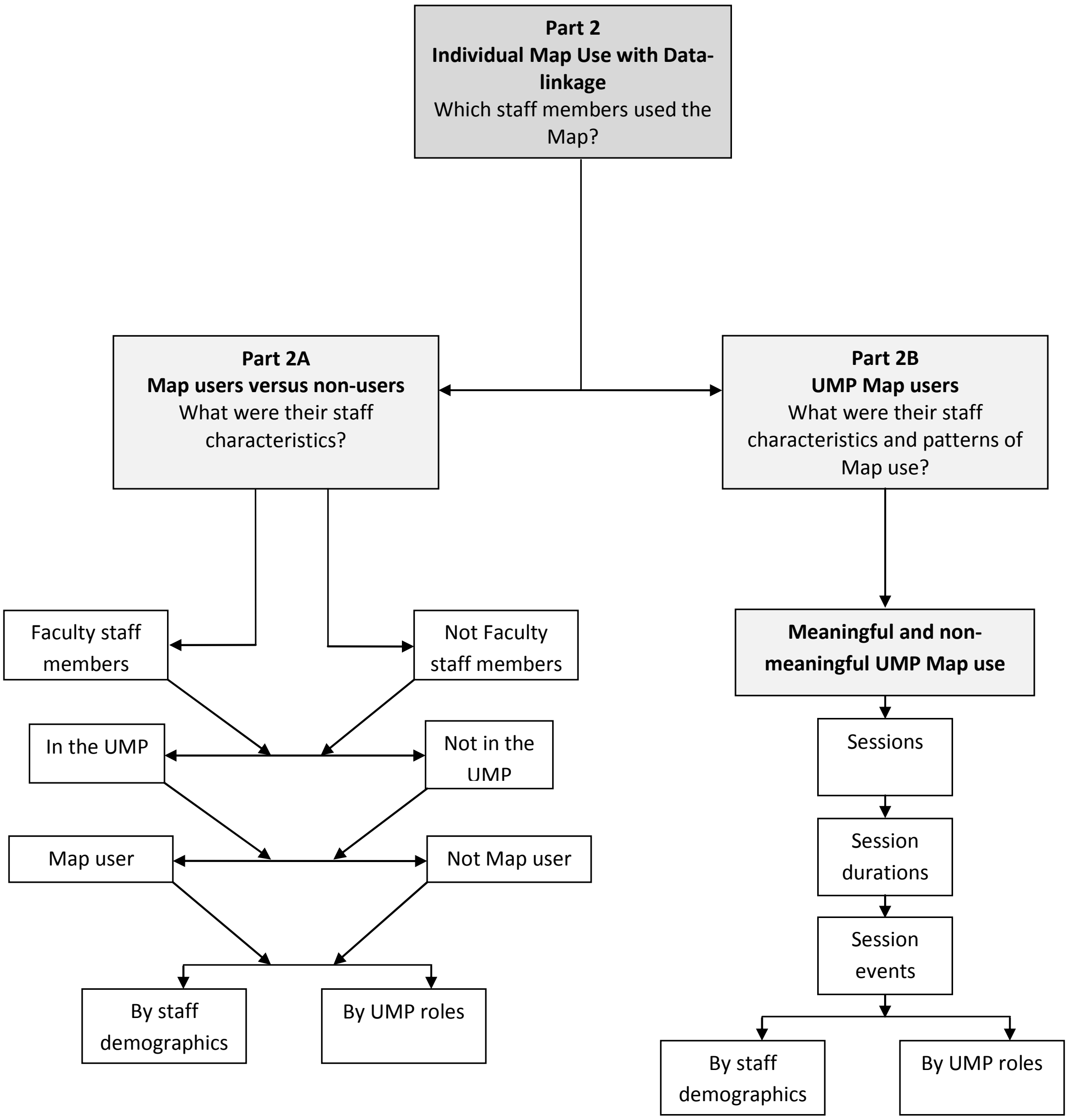

Figure 6.8: Outline of Part 2 results on individual patterns of Map use with data linkage.

Faculty Staff and their UMP Involvement

From 2004 to 2010 there were approximately 5196 staff members in the Faculty of Medicine staff database. Since the staff population changed over time and since the staff data used in this study was not continuous, this number may not be exact but is a very good approximation which is able to serve as an acceptable denominator. For further details on the Faculty staff data collected in this study see Appendix H.

Not all staff members in the Faculty's staff database were involved in the UMP and not all teachers or administrators in the UMP were included in the Faculty staff database. In general this database did not contain data on casual or affiliated staff members. All those in this database had 'Reader' access to the Map regardless of their UMP involvement. Since the population of Faculty staff varied over time, the population of those with access to the Map also varied.

The number of staff members involved in the UMP progressively increased from the start of Phase 1 in 2004 to the implementation of all three Phases by 2009. Table 6.4 shows the type and number of staff members in the Faculty staff database who were involved in the UMP between January 2004 and December 2010. Due to the non-continuous nature of available data on Faculty staff, these staff counts are for all seven years in total and not for each year. Hence, while total counts of Map users from Sawmill reports were for each of the seven years and were exact, total counts of Faculty staff were only for certain points in time during the seven years and hence were good approximations of actual counts instead of exact counts (see Appendix H for details).

Table 6.4: Number and percentage of staff in Faculty staff database between January 2004 and December 2010 categorised by staff type.

Staff type	Number and percentage of staff in Faculty staff database	Number and percentage of UMP staff in Faculty staff database
Academic	907 (17.5%)	377 (29.9%)
Adjunct	14 (0.3%)	3 (0.2%)
Casual	46 (0.9%)	30 (2.4%)
Conjoint	2428 (46.7%)	655 (51.9%)
External	67 (1.3%)	7 (0.5%)
External from Science school	94 (1.8%)	36 (2.8%)
General	1394 (26.8%)	137 (10.9%)
Visiting	234 (4.5%)	18 (1.4%)
Not Available	12 (0.2%)	0 (0.0%)
Total	**5196 (100%)**	**1263 (100%)**

Part 2A: Analysis of Map Users and Non-Users

This first half of the data linkage analysis looked at all staff members who had either used or not used the Map between 2004 and 2010. Results were used to test Hypothesis 1, which proposed that there was an association between certain staff characteristics and the Map use status. **Research questions** answered in this section were: (a) How many staff in the Faculty database had used or not used the Map? (b) How many staff involved in the UMP had used or not used Map? (c) Amongst UMP staff, were there any differences between Map use status and staff characteristics? Questions were answered by linking information from a number of databases and comparing counts of Map users or non-users to certain staff characteristics (Figure 6.9). The Pearson's chi-square test was used to test the null hypothesis that there was no association between Map use status and staff characteristics.

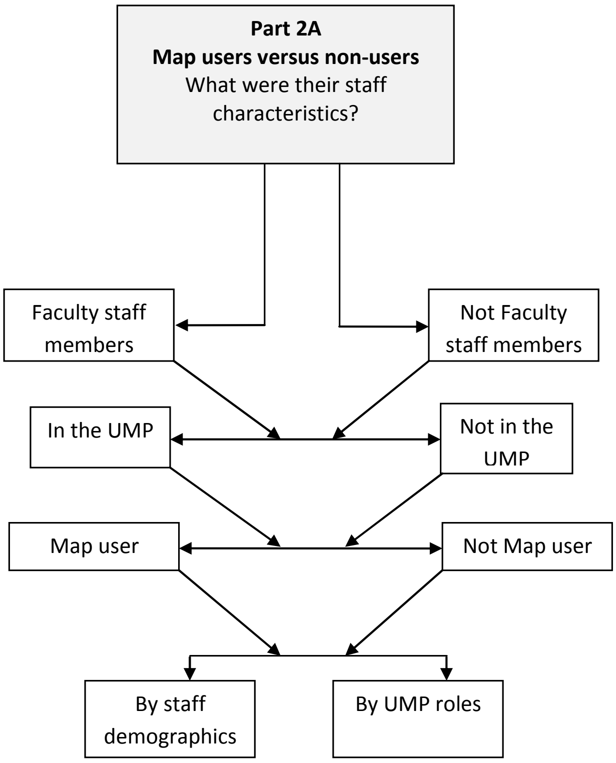

Figure 6.9: Outline of Part 2A results on Map users and non-users with data linkage.

Overview of population groups

Figure 6.10 provides an overview of total counts in the three population groups—namely Map users, Faculty staff and UMP staff. It shows the exact number of staff members who used the Map between January 2004 and December 2010, and the approximate number of Faculty and UMP staff during the same time period. Results showed the following:

- Faculty staff who used the Map totalled 12.2% (632 of 5196)
- Faculty staff involved in the UMP totalled 24.3% (1263 of 5196)
- Faculty staff involved in the UMP who used the Map totalled 46.0% (581 of 1263)
- UMP staff who used the Map totalled 47.2% (610 of 1292), and UMP staff who did not use the Map totalled 52.8% (682 of 1292)
- Not all those involved in the UMP (1292) were in the Faculty staff database (e.g. 581 of the 610 UMP Map users were in the Faculty staff database and 29 were not); casual or affiliated teachers were generally not included in this database
- Not all those who used the Map (672) were in the Faculty staff database (e.g. 40 of the 672 Map users were not in the Faculty staff database (672 - 632 = 40) and some of these were likely to have been casual or affiliated staff members)

- Fifty one Map users in the Faculty staff database were not involved in the UMP (632 - 581 = 51), which represented 7.6% of Map users (51 of 672).

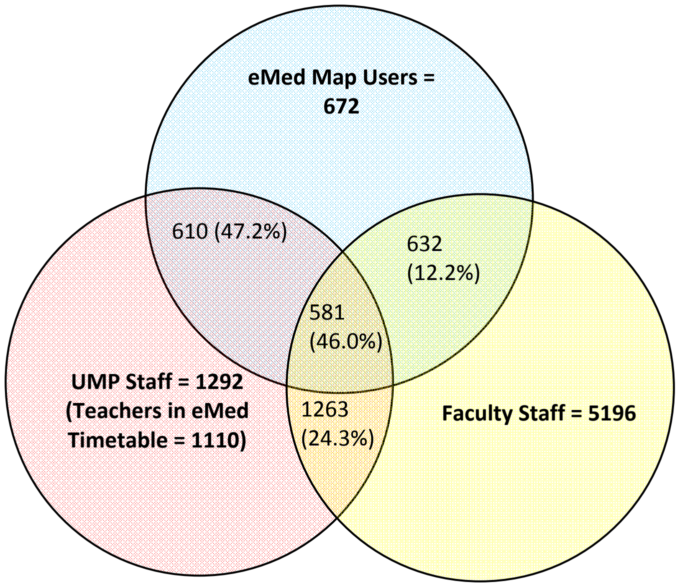

Figure 6.10: Total number of staff between January 2004 and December 2010 for each data-set.

Map users and non-users

Following is a summary of the results for UMP staff members who either used or did not use the Map according to their staff demographics and UMP roles (Appendix K shows these results in detail). Table 6.5 shows that while most UMP staff (52.8%) did not use the Map, more general staff (77.7%) than teaching staff (43.5%) used it, and this result was statistically significant.

Table 6.5: UMP general and teaching staff who used or did not use the Map.

Number of UMP teaching and general staff*	Map users			Map non-users in Faculty staff database
	In Faculty staff database	Not in Faculty database	Total	
Teaching: 1153	475	27	502 (43.5%)	651 (56.5%)
General: 139	106	2	108 (77.7%)	31 (22.3%)
Total: 1292	**581 (44.9%)**	**29 (2.2%)**	**610 (47.2%)**	**682 (52.8%)**

*Data from Faculty staff database. The count of teaching staff excludes general staff who taught.

The Pearson's chi-square test for independence and cross-tabulations between the demographics of UMP staff and their Map use status showed the following statistically significant results (see Appendix L Tables 1 to 7 for details):

- Gender: more females and fewer males were Map users ($p < 0.001$)
- Age: more staff in the 50-59 age group and fewer in the 20-29 age group were Map users ($p = 0.001$)
- Staff type: more academic staff and fewer conjoint staff were Map users ($p < 0.001$)
- School location: more campus teaching staff and fewer rural teaching staff were Map users ($p < 0.001$); more campus general staff and fewer rural general staff were Map users ($p = 0.002$); and more campus school staff and fewer metropolitan clinical school staff were Map users ($p < 0.001$)
- Teaching versus general staff: more general staff and fewer teaching staff were Map users ($p < 0.001$).

Table 6.6 summarises the number of UMP roles held by staff members who either used or did not use the Map, based on data from various sources including eMed Timetable. While there were 1292 staff members involved in the UMP (Table 6.5), there were 2491 UMP roles held by these staff members (Table 6.6), which on average represents about two roles per staff member. These results showed that that the majority of UMP roles were held by Map non-users (57.2%). Results for each role (see Table 5 in Appendix K) showed that the majority of Phase 1 facilitators (91.5%), group members (83.8%), administrators (83.7%) and convenors (81.6%) had used the Map, while about half the Principal teachers (52.8%), about one third of eMed Timetable teachers (35.1%) and a few Primary Care clinical teachers (5.1%) had used it. The number of staff with a UMP role of eMed Timetable teacher (1110) may have under-represented the true number of teachers from clinical schools since these schools did not tend to use eMed Timetable to schedule their teaching activities between 2004 and 2010. The percentage of UMP roles held by staff members without an ID number was 33.0%. This included 79.6% (374 of 470) of those with a Primary Care teacher role, 33.7% (374 of 1110) of those with an eMed Timetable teacher role, and 14.5% (60 of 414) of those with a Principal Teacher role. These staff members would not have been able to access the Map by themselves since an ID staff number was required to log into the eMed system. See Appendix K for further details on results for Map users and non-users.

Table 6.6: UMP roles held by staff members who used or did not use the Map.

Number of UMP roles held by staff	**Number of roles held by Map users**			**Number of role held by Map non-users**	
	In Faculty database	Not in Faculty database	**Total**	**In Faculty database**	Without ID#
2491*	1032 (41.4%)	34 (1.4%)	**1066 (42.8%)**	**1425 (57.2%)**	822 (33.0%)

*Data from various sources including eMed Timetable database. Count of clinical school teachers in eMed Timetable may under-represent the true count.

Part 2B: Analysis of Individual UMP Map Users

This second half of the data linkage analysis looked only at UMP staff who had used the Map (see Figure 6.11). Results were used to test Hypothesis 1, which proposed that there was an association between patterns of Map use and staff characteristics. The **research questions** were: (a) Were there any significant differences between the staff characteristics of UMP Map users and their patterns of Map use? (b) Were there any significant changes in their patterns of Map use over the 7-year period? To answer these questions, Map use was first analysed for all seven years in total, and then for each calendar year from 2004 to 2010. The Map use measurements reported in this section were session user, sessions, session durations and session events (see Appendix I for definitions). SPSS was used for the statistical analysis which included a frequency analysis, the means test and the Pearson's chi-square test (see this study's methods section for details). Statistically significant p-values in tables are asterisked.

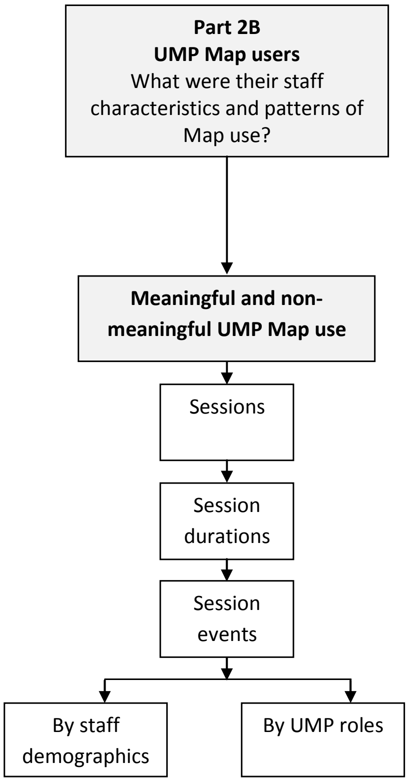

Figure 6.11: Outline of Part 2B results on UMP Map users with data linkage.

Overview of Map use measurements

Table 6.7 shows the frequency analysis of the three main variables measuring Map use, namely session, session duration and session events. The large standard deviation for each of these variables indicated that scores were not normally distributed but instead had a positive skew (scores clustered to the left at the lower values). Median scores showed that the number of sessions performed remained stable at about 4 sessions per user per year, with the session duration decreasing from 38 minutes in 2004 to 19 minutes in 2010. The median score for session events (i.e. pages viewed during a session) decreased proportionally to the decrease in session duration over the years. The percentile value for the number of sessions also decreased over the years, except for a slight increase in the 95th percentile value between 2009 and 2010.

The prevalence of 1 or 0 as the mode for the number of sessions and the duration of sessions across the seven years was investigated. Results showed that the total duration of some sessions was of less than 1 minute in seven years, and these were considered to be non-meaningful sessions. The cut-off point for 'meaningful session duration' was set at 1 minute or more per seven years (or per calendar year) and the data was filtered accordingly. See Appendix M for details of this analysis.

Table 6.7: Frequency analysis of Map use measurements for all cases per calendar year.

Year and number of session users	Measurement of Map use	Total count	Max. per user	Min. per user	Mean	Median	Mode	Std. deviation	Skewness	Map User percentiles			
										25	**50**	**75**	**95**
2004 Session users: 157	Sessions	2931	552	1	19	4	1	56	7	2	4	12	75
	Session duration (min)	44800	13001	0	285	38	1a	1205	8	10	38	115	975
	Session events	192737	61470	3	1228	163	7	5435	9	58	163	583	3000
2005 Session users: 181	Sessions	3083	430	1	17	4	1	52	6	1	4	11	58
	Session duration (min)	47123	9034	0	260	27	0	1079	6	7	27	94	974
	Session events	187641	37868	1	1037	139	7a	4185	7	40	139	374	3302
2006 Session users: 195	Sessions	2987	716	1	15	3	1	64	9	1	3	11	41
	Session duration (min)	46906	21065	0	241	11	0	1634	11	3	11	73	731
	Session events	132984	36413	1	682	81	8a	3324	9	26	81	292	2387
2007 Session users: 245	Sessions	3148	581	1	13	3	1	54	10	1	3	8	34
	Session duration (min)	41405	11554	0	169	15	0	1001	10	1	15	50	329
	Session events	145221	35212	1	593	83	17	2982	9	22	83	265	1385
2008 Session users: 257	Sessions	2936	516	1	11	4	1	42	10	1	4	8	38
	Session duration (min)	38633	12389	0	150	7	0	1090	11	1	7	38	273
	Session events	136143	49199	1	530	40	4	3892	11	11	40	135	788
2009 Session users:285	Sessions	4035	776	1	14	3	1	60	10	1	3	9	48
	Session duration (min)	50535	21833	0	177	9	0	1445	13	1	9	47	424
	Session events	133926	55700	1	470	39	4	3659	13	10	39	139	1066
2010 Session users: 274	Sessions	5817	987	1	21	4	1	88	9	1	4	11	64
	Session duration (min)	64183	21283	0	234	19	0	1625	11	2	19	66	543
	Session events	148334	43748	1	541	64	8	3416	11	14	64	200	1232

a. Multiple modes existed, and the smallest value is shown.

Figure 6.12 shows the number of cases in the three major datasets and in the sub-groups of UMP Map users based on their total session duration. The 103 cases of UMP Map users with total sessions of less than 1 minute in seven years represented 16.9% of all UMP Map users (103 of 610) and 8.0% of all UMP staff (103 of 1292). The 507 cases with total sessions of 1 minute or more in seven years represented 83.1% of all UMP Map users (507 of 610) and 39.2% of all UMP staff (507 of 1292). Amongst these 507 cases, there were 77 Map users who performed over 50 sessions in seven years, and these were considered the top UMP Map users. Results for each of these three sub-groups of UMP Map users follow.

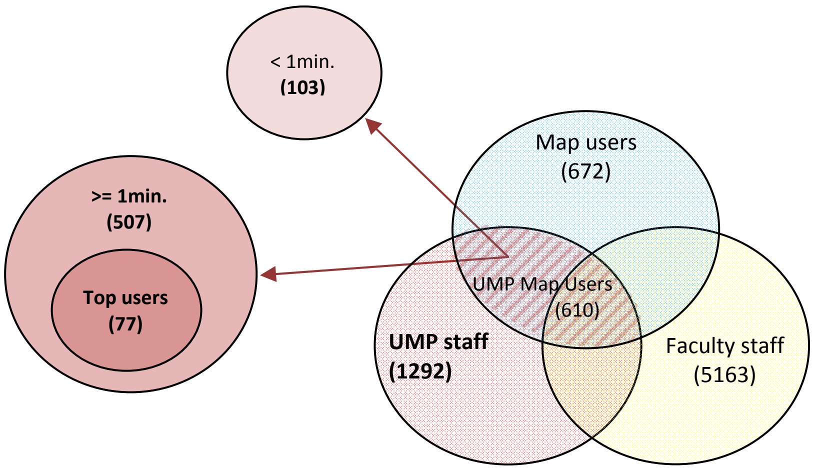

Figure 6.12: Cases in each data-set including the UMP Map user group and its three sub-groups based on total session durations over seven years.

Non-meaningful versus meaningful Map use

The following is a summary of results for those Map users who performed meaningful sessions and those who performed non-meaningful sessions. Results are presented in full in Appendix M, and statistically significant cross-tabulations are shown in Tables 8 and 9 of Appendix L.

Of the 672 Map users, 81.5% (548 users) performed meaningful session durations, and 18.5% (124 users) performed non-meaningful session durations. The percentage of users performing non-meaningful session durations increased over the seven years from 6.4% (10 of 157) in 2004 to a peak of 15.1% (43 of 285) in 2009, with a decline to 8.4% (23 of 274) in 2010 (see Table 2 in Appendix M for details).

Of the 610 UMP Map user, 83.1% (507 users) performed meaningful session durations and 16.9% (103 users) performed non-meaningful session durations. The Pearson's chi-square test and cross-tabulations between the demographics of UMP staff and their session durations showed the following statistically significant results (see Tables 8 and 9 of Appendix L):

- Gender: more females performed meaningful sessions than males (p = 0.049)
- School location: more campus staff performed meaningful sessions than metropolitan clinical schools staff. (p = 0.028).

Results also showed that all UMP roles had non-meaningful Map users including two convenors (3.2% or 2 of 62), and that the role of eMed Timetable Teacher had the largest percentage of non-meaningful Map users (13.3% or 52 of 390). This was followed by the role of Principal Teacher (8.8% or 19 of 215) and P1 Facilitator (8.7% or 18 of 206) (see Table 5 in Appendix M for details).

Meaningful Map use for all seven years

These results are of the 507 UMP Map users who had used the Map for 1 minute or more in seven years, and included the top 77 users. The **main research** question was: Were there any differences between the staff characteristics of these UMP Map users and their patterns of Map use over seven years? To answer this question, the characteristics of these 507 cases were compared with their levels of Map use measured by the number of sessions, duration of sessions and number of session events. Statistical analysis included counts and percentages, the median test and the Pearson's chi-square test (see this study's methods section for details).

Staff demographics

Table 6.8 shows the count and percentage of UMP Map users grouped by staff characteristics. Results of the median test showed no significant difference between the total number of sessions performed in seven years and the user's gender (median = 9.00, X^2= 3.36, df = 2, p = 0.186) or age (median = 9.00, X^2= 3.48, df = 6, p = 0.747). However, there was a significant difference in median scores for the user's staff type (median = 9.00, X^2= 59.70, df = 5, p < 0.001) and school location (median = 9.00, X^2= 28.40, df = 4, p < 0.001).

Table 6.8: UMP Map users with meaningful session durations grouped by staff demographics.

Staff characteristic	Category	Frequency and percentage of Map users (*n* = 507)
Gender	Female	274 (54.0%)
	Male	218 (43.0%)
	NA	15 (3.0%)
Age range (on 31/12/2010)	20-29	10 (2.0%)
	30-39	68 (13.4%)
	40-49	126 (24.8%)
	50-59	140 (27.6%)
	60-69	57 (11.3%)
	70+	13 (2.6%)
	NA	93 (18.3%)
Staff type	Academic	233 (50.0%)
	Conjoint*	114 (22.5%)
	Casual	30 (5.9%)
	General	92 (18.1%)
	External#	25 (4.9%)
	Visiting	13 (2.6%)
School location	Campus	244 (48.1%)
	Metropolitan Clinical	166 (32.7%)
	Rural Clinical	61 (12.0%)
	Not in Faculty	23 (4.6%)
	Information not available	13 (2.6%)

*Conjoint includes adjunct staff.
#External includes Faculty of Science school staff.

A pair-wise comparison of medians for the staff type categories showed that academic and general staff used the Map more often than conjoint, casual or external staff, and these differences were statistically significant (Table 6.9).

Table 6.9: Pair-wise median test results on Map sessions and staff type variables (overall median = 9.00; X^2= 59.70; df = 5; *p* < 0.001).

Count (*n*)	Median	Staff type	Academic	Conjoint	Casual	General	External	Visiting
233	15.00	Academic		.000*	.000*		.035*	
114	4.00	Conjoint						
92	13.00	General		.000*	.000*			
30	4.50	Casual						
25	8.00	External						
13	7.00	Visiting						

The Pearson's chi-square test for independence was used to further explore the patterns of Map use by the three main staff type categories (i.e. academic, conjoint and general staff), using the total session range as the dependent variable of Map use. Results showed a significant association between these three staff types and the total session range (χ^2 (10, *n* = 439) = 58.25, *p* < 0.001, 99% CI [0.000, 0.000], *Cramer's V* = 0.258), and the cross-tabulation showed that there were more conjoint staff than expected in the 1-2 session range (37.7% or 43 of 114, AR= 5.7), more academic staff in the 46+ range (23.2% or 54 of 233, AR= 2.6), and more general staff than expected in the 10-17 range (23.9% or 22 of 92, AR = 2.3) (see Figure 6.13, and Appendix L Table 10).

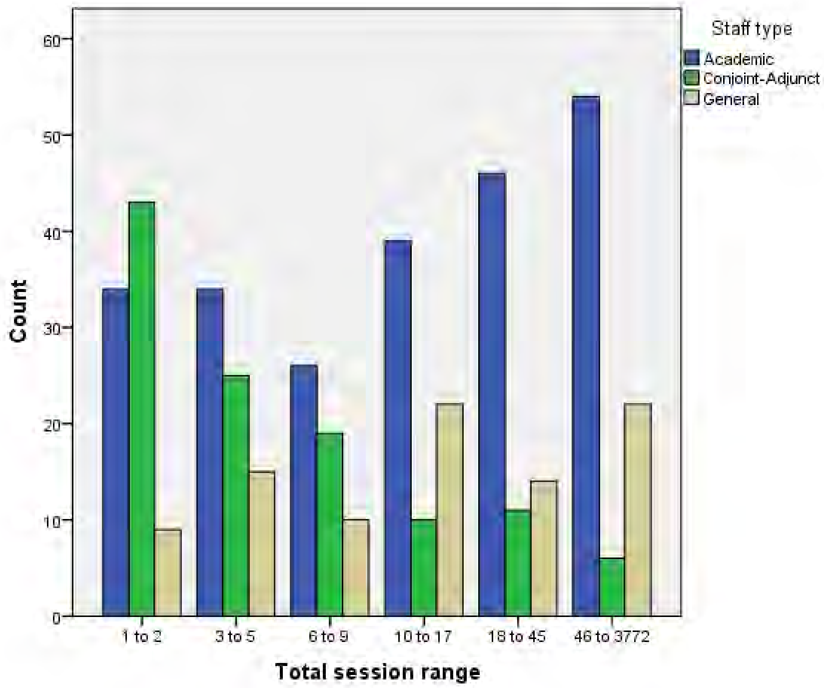

Figure 6.13: Total session range counts of UMP Map users by the three main staff types.

A pair-wise comparison of median scores for the school location variable showed that staff from campus and rural schools used the Map significantly more often than staff from metropolitan clinical schools, non-Faculty schools or unknown schools (Table 6.10).

Table 6.10: Pair-wise median test results of Map sessions and school location (overall median = 9.00; chi-square = 28.40; df = 4; *p* < 0.001).

Count (*n*)	**Median**	**School location**	Campus	Clinical	Rural	Non-Fac.	NA
244	13.00	Campus		.000*			.000*
166	5.00	Clinical					
61	18.00	Rural		.003*		.039*	.000*
23	10.00	Non-Faculty					
13	5.00	Unknown					

The chi-square test showed a significant association between the total session range and the campus, clinical and rural school locations (χ^2 (10, *n* = 471) = 38.91, *p* < 0.001, 99% CI [0.000, 0.000], *Cramer's V* = 0.203), and the cross-tabulation showed that there were significantly more metropolitan clinical school staff than expected in the 1-2 session range (30.1% or 50 of

166, AR= 4.2), and more campus school staff (23.2% or 54 of 233, AR= 2.6) and rural school staff (27.9% or 17 of 61, AR = 2.3) than expected in the 46+ range (see Figure 6.14, and Appendix L Table 11).

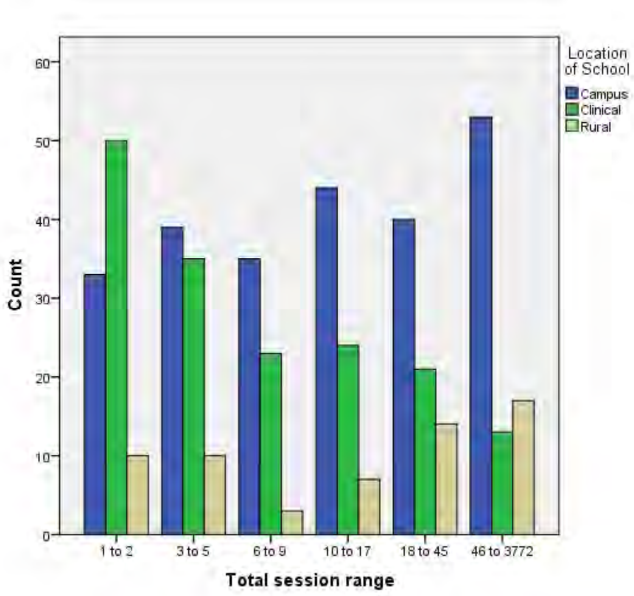

Figure 6.14: Total session range counts of UMP Map users by three main school locations.

Results of the chi-square test using a layered cross-tabulation between total session range and main staff types (academic, conjoint and general) while controlling for the main school locations (campus, metropolitan clinical and rural) showed a statistically significant association for all three school locations. Significant chi-square and cross-tabulation results were as follows:

- Campus school results (χ^2 (10, *n* = 215) = 30.64, *p* = 0.001, 99% CI [0.000, 0.001], *Cramer's V* = 0.267) showed more conjoint staff than expected in the 1-2 range (35.1% or 13 of 37, AR = 4.4), and more academic staff in the 46+ range (28.8% or 39 of 135, AR = 2.1) (see Figure 6.15, and Appendix L Table 12).
- Metropolitan clinical school results (χ^2 (10, *n* = 161) = 24.06, *p* = 0.007, 99% CI [0.005, 0.009], *Cramer's V* = 0.273) showed more conjoint staff than expected in the 1-2 range (41.5% or 27 of 65, AR = 2.8) and more general staff in the 10-17 range (29.0% or 9 of 31, AR = 2.6) (see Figure 6.15, and Appendix L Table 13).
- Rural school results were significant although the upper CI level was 0.052 (χ^2 (10, *n* = 61) = 18.12, *p* = 0.047, 99% CI [0.041, 0.052], *Cramer's V* = 0.385), and showed more conjoint staff than expected in the 3-5 range (45.5% or 5 of 11) and more general staff in the 46+ range (50.0% or 9 of 18) (see Figure 6.15, and Appendix L Table 14). AR values were not included in these results since more than 20% of cells had expected counts of less than 5.

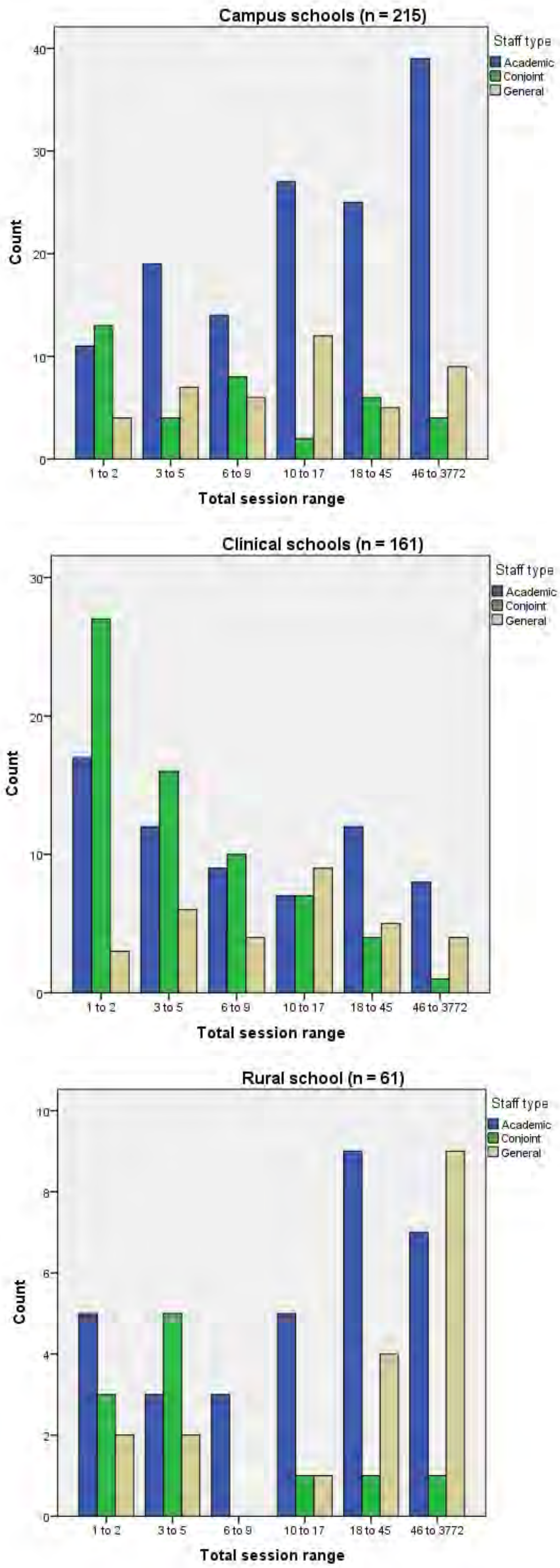

Figure 6.15: Total session range counts of UMP Map users by the main staff types while controlling for the main school locations.

Results of the chi-square test using a layered cross-tabulation between the total session range and main school locations while controlling for main staff types (academic, conjoint and general) were not significant for general staff (χ^2 (10, *n* = 92) = 13.95, *p* = 0.179, 99% CI [0.169, 0.188], *Cramer's V* = 0.275) or for conjoint staff (χ^2 (10, *n* = 113) = 15.54, *p* = 0.104, 99% CI [0.096, 0.112], *Cramer's V* = 0.262). However chi-square results were statistically significant for academic staff (χ^2 (10, *n* = 232) = 20.68, *p* = 0.023, 99% CI [0.019, 0.026], *Cramer's V* = 0.211), and the cross-tabulation showed there were more academic staff from clinical schools than expected in the 1-2 range (26.1% or 17 of 65, AR = 3.2), and more academic staff from campus schools in the 46+ range (28.9% or 39 of 135, AR = 2.4) (see Figure 6.16, and Appendix L Table 15). These results indicate that academic staff from campus schools used the Map more often than academic staff from clinical schools.

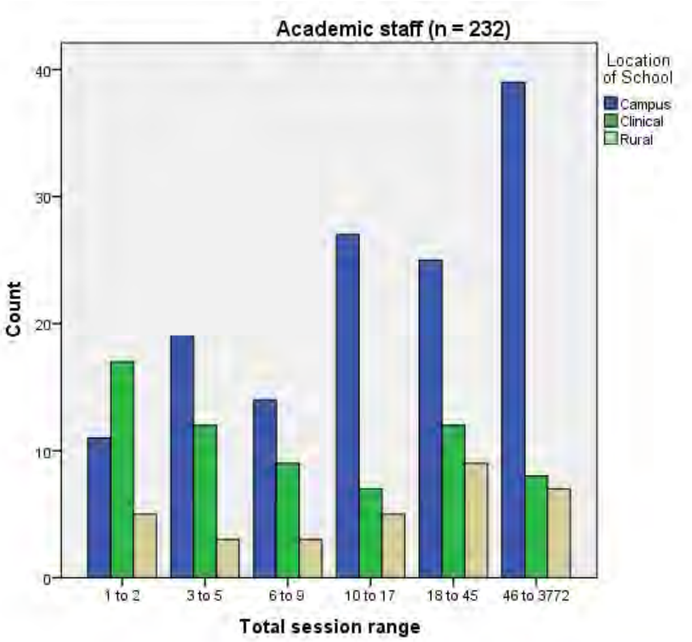

Figure 6.16: Total session range counts of UMP Map users by the main school locations while controlling for the main staff types.

UMP roles

Table 6.11 shows the number of Map users per UMP role. While some staff members had only one UMP role, others had an average of two to three roles as reflected in the total count of UMP roles. Results show that 66.6% of the 507 UMP Map users were Timetable teachers, 38.6% were Principal teachers, 37.1% were P1 Facilitators and 4.3% were Primary Care clinical teachers.

Table 6.11: UMP Map users by their UMP roles.

UMP Role	Count and percentage of UMP Map users per role (*n* = 507)
Convenor	60 (11.8%)
Committee/Group member	109 (21.5%)
Administrator	38 (7.5%)
Principal teacher	196 (38.6%)
Phase 1 Facilitator	188 (37.1%)
eMed Timetable teacher	338 (66.6%)
Primary Care clinical teacher	22 (4.3%)
Total number of UMP roles	**1172**

Since staff members could have more than one UMP role, cases were not mutually exclusive between UMP roles. Hence, a chi-square test could not be performed for the variable on UMP roles as a whole (i.e. across the categories of UMP roles). Instead, a Pearson's chi-square exact test was performed using a layered cross-tabulation for each UMP role individually using the total session range of Map use and the main school locations (campus, clinical or rural) or main staff types (academic, conjoint or general).

Results of the chi-square tests between the main school location and total session range of Map use while controlling for each UMP role (layered cross-tabulation) showed no significant association for the UMP role of Convenor, Committee/Group member, Administrator, P1 Facilitator, eMed Timetable teacher or Primary Care clinical teacher. However, there was a significant association for the role of Principal teacher (χ^2 (10, *n* = 180) = 29.03, *p* = 001, 99% CI [0.00, 0.01], *Cramer's V* = 0.284) and the cross-tabulation showed that there were more principal teachers from campus schools than expected in the 46+ session range (43.7% or 45 of 103) and more principal teachers from metropolitan clinical schools in the 1-2 range (25.0% or 19 of 76) (see Figure 6.17, and Appendix L Table 16). The chi-square result was still significant after excluding the one case of a principal teacher from the rural school (χ^2 (5, *n* = 179) = 22.39, *p* < 0.001, 99% CI [0.00, 0.01], *Cramer's V* = 0.354) (adjusted residual values were not included since more than 20% of expected cell counts were less than 5).

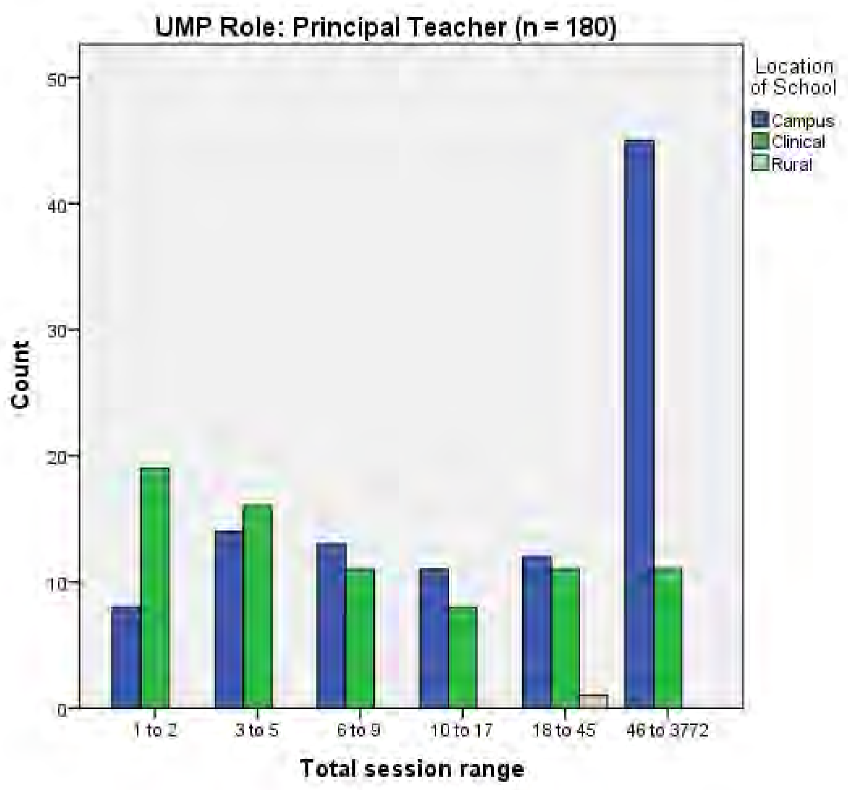

Figure 6.17: Total session range counts of Map users who were UMP Principal Teachers by the main school locations.

Results of the chi-square test between the main staff types (academic, conjoint and general) and total session range of Map use while controlling for each UMP role (layered cross-tabulation) showed no significant association for the UMP role of Administrator, P1 Facilitator or Primary Care clinical teacher. However, there was a statistically significant association for the UMP roles of Convenor, Committee/Group member, Principal teacher and eMed Timetable teacher. These significant chi-square and cross-tabulation results were as follows (adjusted residual values were not included in these results since more than 20% of expected cell counts were often less than 5):

- Convenor: the chi-square result was statistically significant (χ^2 (10, *n* = 60) = 67.98, *p* = .002, 99% CI [0.001, 0.001], *Cramer's V* = 0.753) only when the one case of a general staff member with a convenor role was included, but it was not significant when this case was excluded (χ^2 (4, *n* = 59) = 7.85, *p* = .084, 99% CI [0.077, 0.091], *Cramer's V* = 0.365) indicating that the significant association was due to this one case.
- Committee/Group member: the result (χ^2 (10, *n* = 104) = 24.02, *p* = .012, 99% CI [0.009, 0.015], *Cramer's V* = 0.271) showed significantly more conjoint staff than expected in the

6-9 range (33.3% or 5 of 15), and more academic staff in the 46+ range (53.2% or 41 of 77) (see Figure 6.18, and Appendix L Table 17).

- Principal teacher: the result (χ^2 (10, *n* = 175) = 25.63, *p* = .004, 99% CI [0.002, 0.005], *Cramer's V* = 0.271) showed significantly more conjoint staff in the 1-2 range (29.5% or 13 of 44) and significantly more academic staff in the 46+ range (38.2% or 47 of 123) (see Figure 6.19, and Appendix L Table 18).
- eMed Timetable teacher: the result (χ^2 (10, *n* = 280) = 41.48, *p* < *.001*, 99% CI [0.000, 0.000], *Cramer's V* = 0.272) showed significantly more conjoint staff in the 1-2 range (32.4% or 23 of 71) and 6-9 range (23.9% or 17 of 71), and significantly more academic staff in the 46+ range (25.4% or 48 of 189) (see Figure 6.20, and Appendix L Table 19).

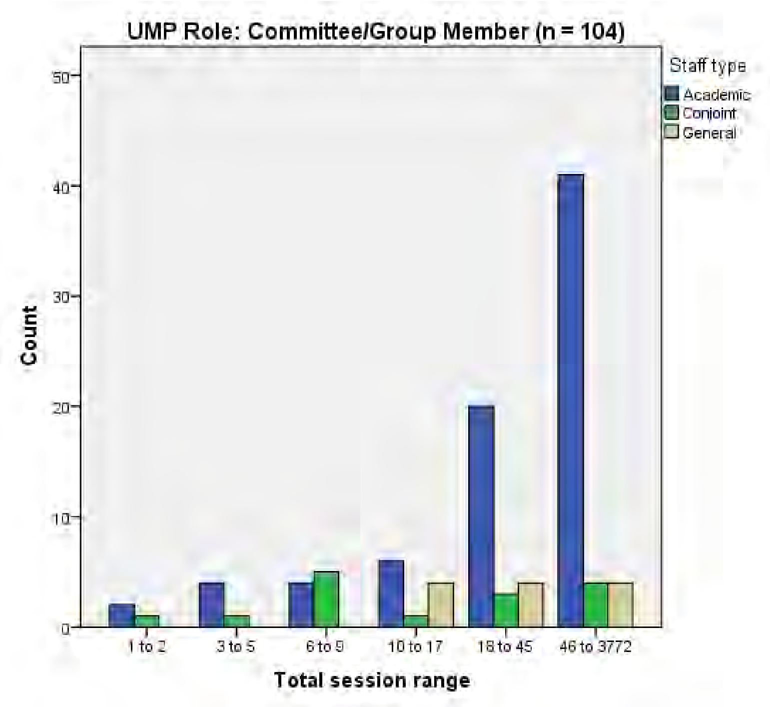

Figure 6.18: Total session range counts of Map users who were Group members by the main staff types.

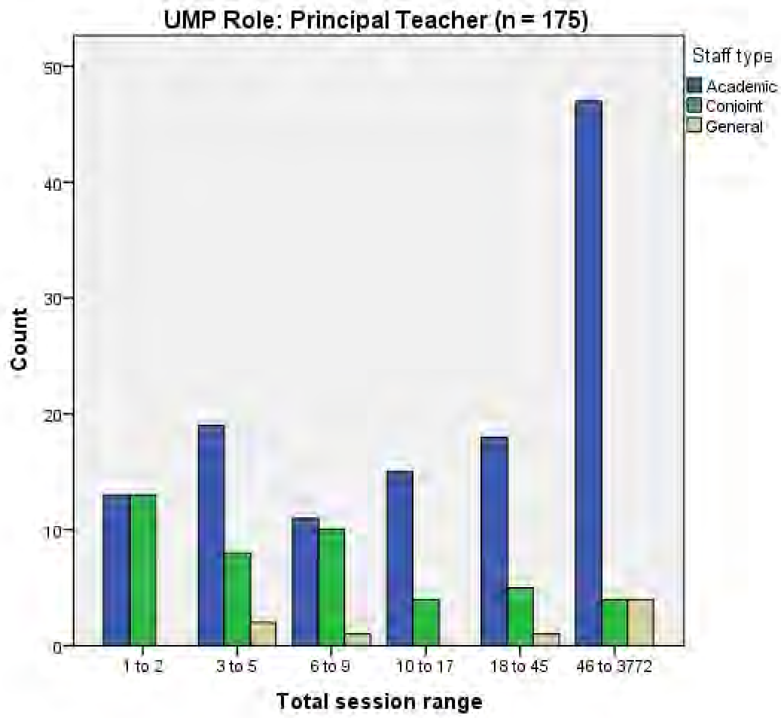

Figure 6.19: Total session range counts of Map users who were Principal Teachers by the main staff types.

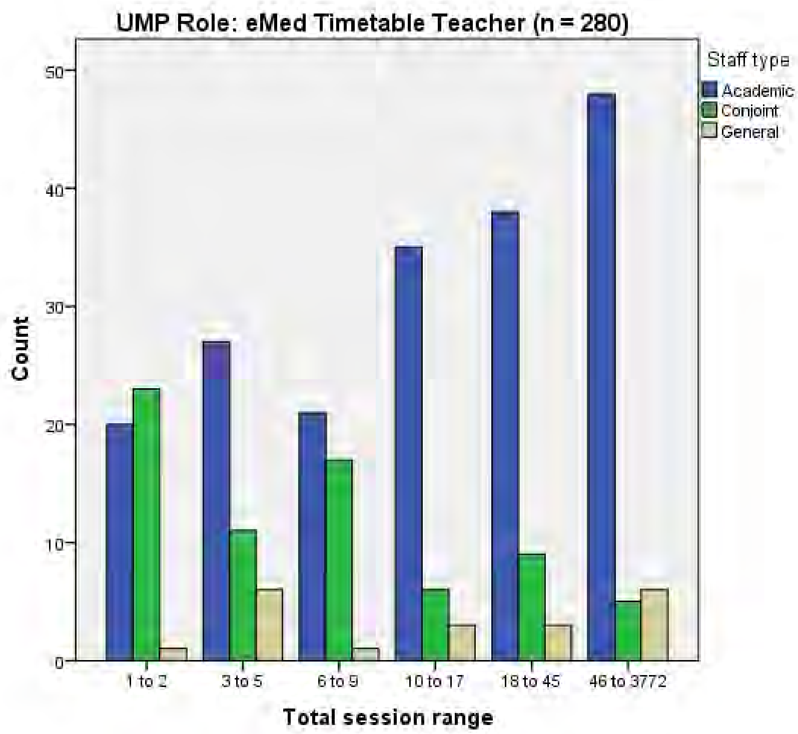

Figure 6.20: Total session range counts of Map users who were eMed Timetable teachers by the main staff types.

UMP Map users were also categorised according to the total number of UMP roles they held over seven years, as shown in Table 6.12. These results showed that most Map users (59.5%) held between 1 to 2 roles. Results of the median test showed a statistically significant difference between the total number of sessions performed in seven years and the total number of UMP roles held my a Map user (median = 9.00, X^2= 57.57, df = 6, $p < 0.001$). A pair-wise comparison of median scores for the total number of UMP roles showed that staff with four to six roles used the Map significantly more often than staff with one to three roles (Table 6.13).

Table 6.12: UMP Map users by their total number of UMP roles in seven years.

Total number of UMP roles per case	Count and percentage of UMP Map users (*n* = 507)
1 role	174 (34.3%)
2 roles	128 (25.2%)
3 roles	108 (21.3%)
4 roles	48 (9.5%)
5 roles	38 (7.5%)
6 roles	10 (2.0%)
7 roles	1 (0.2%)
Total number of UMP roles per case	**507 (100.0%)**

Table 6.13: Pair-wise median test results of Map sessions and total number of UMP roles (overall median = 9.00; chi-square = 57.57; df = 6; *p* < 0.001).

Count (*n*=507)	Median	Number of UMP roles	1	2	3	4	5	6	7
174	5.00	1		.002*	.002*	.000*	.000*	.001*	
128	8.50	2				.005*	.000*	.000*	
108	9.00	3				.004*	.000*	.000*	
48	23.50	4					.009*		
38	64.00	5							
10	49.00	6							
1	(30#)	7							

#Total count for the one case.

The Pearson's chi-square test result between total number of UMP roles and total session range counts was statistically significant (χ^2 (30, *n* = 507) = 176.06, $p < 0.001$, 99% CI [0.000, 0.000], *Cramer's V* = 0.264), and the cross-tabulation showed that there were significantly more UMP Map users with one role in the 1-2 range (32.2% or 56 of 174), significantly more with five roles in the 46+ range (68.4% or 26 of 38), and significantly more with 6 roles in either the 18-45 or 46+ range (50.0% or 5 of 10 in each). The adjusted residual values were not included since more than 20% of cells had expected counts of less than 5 (see Figure 6.21 and Appendix L Table 20). All these results supported Hypothesis 1.

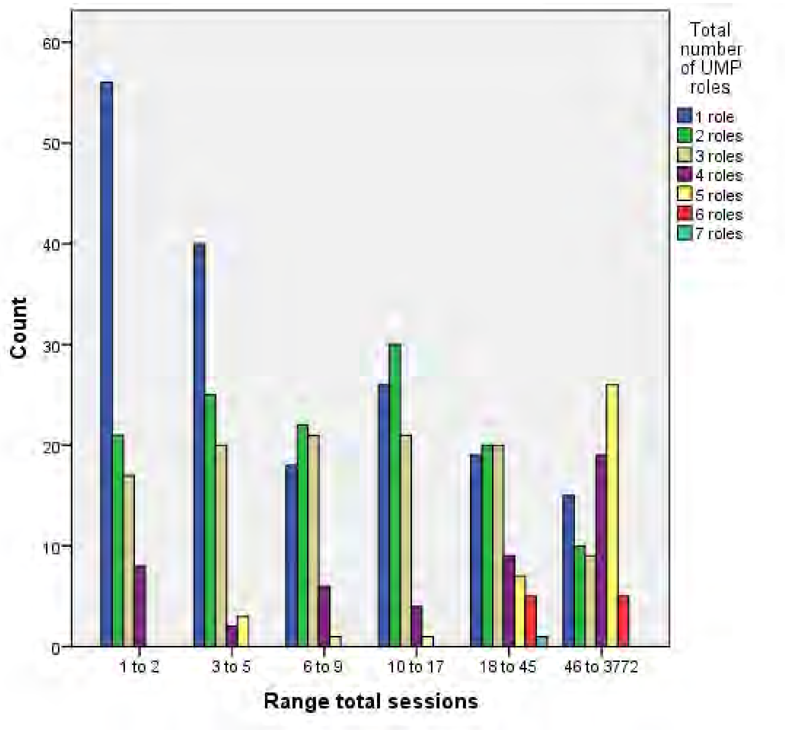

Figure 6.21: Total session range counts of Map users by the total number of UMP roles.

Total years of Map use

Table 6.14 shows the total number of years during which individual staff members used the Map. These results show that just over one third of cases (36.3%) used the Map for one year, and very few cases (8.3%) used it for each of the seven years. Differences between total years of Map use and characteristics of Map users were explored for the staff type and school location variables only (gender and age were considered less important in this case). The median test showed a significant difference in median scores for the user's staff type (median = 2.00, X^2= 32.65, df = 5, p < 0.001) and school location (median = 2.00, X^2= 13.06, df = 4, p = 0.011). The Pearson's chi-square test was used in place of the pair-wise comparison of median scores since it better illustrated patterns of Map use in this case.

Table 6.14: UMP Map users by the total years of Map use.

Total years of Map use	Count and percentage of UMP Map users (n = 507)
1 year	184 (36.3%)
2 years	99 (19.5%)
3 years	80 (15.8%)
4 years	52 (10.3%)
5 years	33 (6.5%)
6 years	17 (3.3%)
7 years	42 (8.3%)
Total	**507 (100.0%)**

The Pearson's chi-square test between the staff type and total years of Map use variables was statistically significant (χ^2 (30, n = 507) = 60.28, p = 0.001, 99% CI [0.000, 0.002], *Cramer's V* = 0.154), and the cross-tabulation showed there were more conjoint staff in the 1-year group (51.7% or 59 of 114), and more casual staff in the 2-year group (40.0% or 12 of 30). Adjusted residual values were not included since more than 20% of cells had expected counts of less than 5 (see Figure 6.22, and Appendix L Table 21).

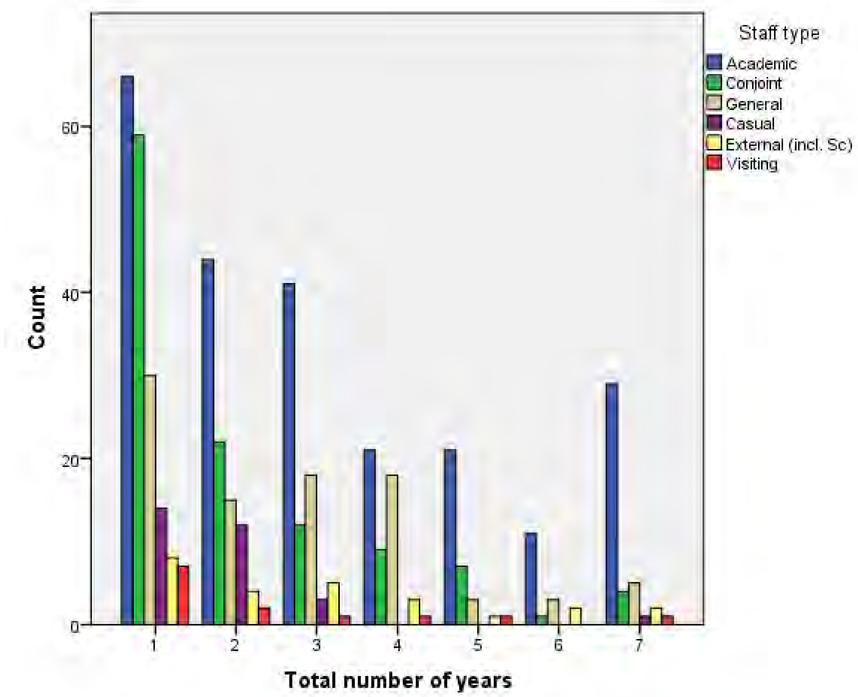

Figure 6.22: Total years of Map use by UMP staff by their staff type.

The chi-square test between school location and total years of Map use was statistically significant (χ^2 (24, n = 507) = 39.16, p = 0.027, 99% CI [0.023, 0.031], *Cramer's V* = 0.139), and the cross-tabulation showed there were more clinical school staff (42.8% or 71 of 166) and staff from unknown schools (84.6% or 11 of 13) in the 1-year group. Adjusted residual values were not included since more than 20% of cells had expected counts of less than 5 (see Figure 6.23, and Appendix L Table 22).

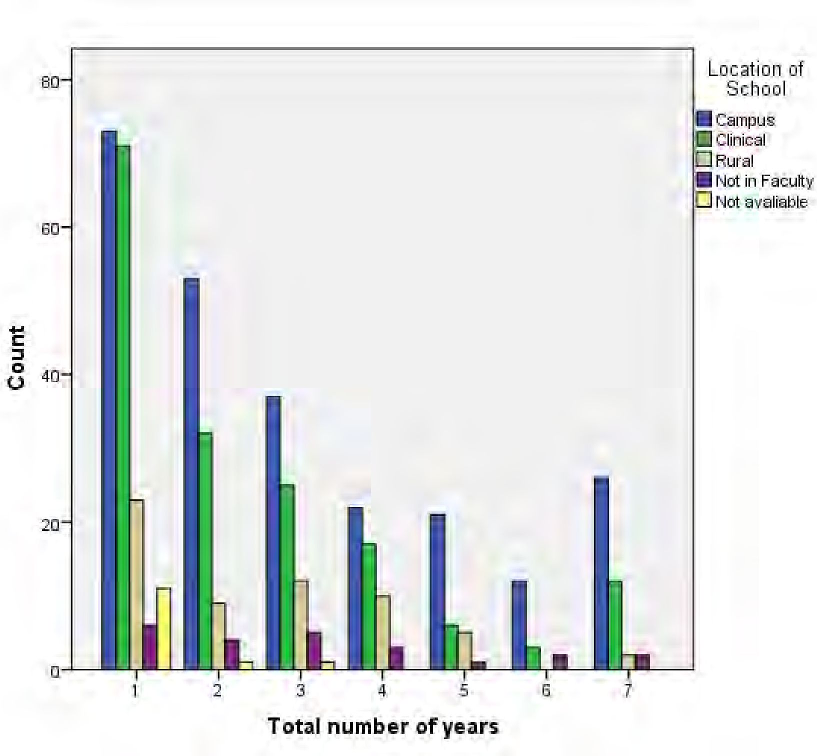

Figure 6.23: Total years of Map use by UMP staff by their school location.

This concludes the analysis of Map use for all seven years in total. These results supported the hypothesis that certain staff demographic characteristics were related to the number of sessions, duration of sessions and number of events performed by individual users, and their total number of years of Map use. The next section looks at the pattern of Map use for each of the seven calendar years.

Meaningful Map use for each calendar year

This section looks at the patterns of Map use by the 507 UMP Map users for each calendar year from January 2004 to December 2010. The main **research question** was: Were there any differences between the patterns of Map use in each year and the characteristics of Map users? The Map use variables used to answer this question were session user, session, session duration and session events, and the statistical analysis included median scores and the median test results from the SPSS hypothesis test summaries. Table 6.15 shows that amongst the 507 UMP Map users there were some cases of non-meaningful session durations in each calendar year, and that the number of these cases increased from 5.0% (7 of 139) in 2004 up to a maximum of 20.6% (46 of 223) in 2008 and then down to 14.5% (35 of 241) in 2010. These non-meaningful cases were excluded from each year's data prior to its analysis.

Table 6.15: UMP Map users with total session durations of less than 1 minute or of 1 minute or more per calendar year.

Year	Total UMP Map users (*n* = 507)	Non-meaningful UMP Map users (less than 1 minute/year)	Meaningful UMP Map users (1 minute or more/year)
2004	139	7	132
2005	165	8	157
2006	174	16	158
2007	216	22	194
2008	223	46	177
2009	233	32	201
2010	241	35	206

Staff demographics and UMP roles

Table 6.16 presents the median scores of Map use measurements for the 507 meaningful UMP Map users and for each UMP role, as well as the p-values of significant median test results for each of the four staff demographics variables. Results for these meaningful UMP Map users (Table 6.16 and Figure 6.24) show that: (a) the total number of session users rose from 132 users in 2004 to 206 users in 2010, (b) the median score for total sessions remained stable at about 5 with a slight increase to 7 in 2010, (c) the median score for session durations decreased from 47 minutes in 2004 to 18 minutes in 2008 and then increased to 33 minutes in 2010 and (d) the median score for session events decreased from 212 in 2004 to 72 in 2008 and then increased to 104 in 2010.

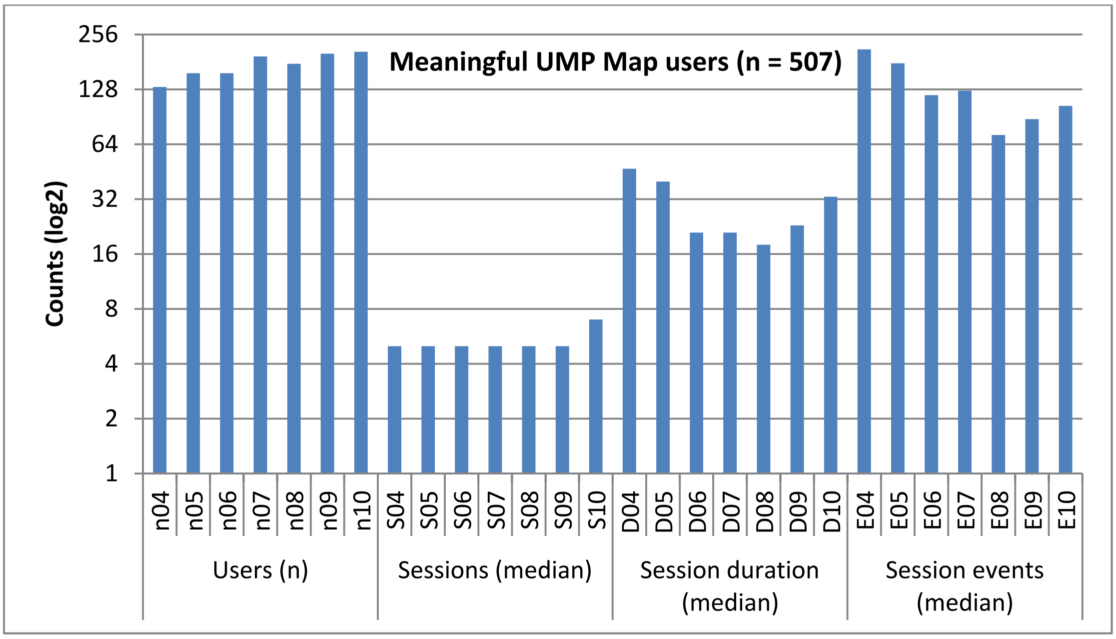

Figure 6.24: Total number of meaningful UMP Map users, and median scores for the total number of sessions, session durations (min.) and events performed each year from 2004 to 2010.[4]

[4] The counts in Figure 6.24 only include Map users with total session durations of 1 minute or more in a year. The y-axis is set to log2 to accommodate the variation in total counts.

Table 6.16: Number of UMP cases; median scores for total number of sessions, session durations in minutes and session events per calendar year; and statistically significant p-values of median test results between Map use and staff demographics variables.

UMP Map users	Map use measurements for each year (from January 2004 to December 2010)* [5]																											
	2004 (*n* = 132)				2005 (*n* = 157)				2006 (*n* = 158)				2007 (*n* = 194)				2008 (*n* = 177)				2009 (*n* = 201)				2010 (*n* = 206)			
	n	**S**	**D**	**E**	***n***	**S**	**D**	**E**	***n***	**S**	**D**	**E**	***n***	**S**	**D**	**E**	***n***	**S**	**D**	**E**	***n***	**S**	**D**	**E**	***n***	**S**	**D**	**E**
UMP staff: counts and median scores																												
All staff	132	5	47	212	157	5	40	178	157	5	21	119	194	5	21	126	177	5	18	72	201	5	23	88	206	7	33	104
UMP roles: counts and median scores																												
Convenor	35	12	148	628	37	17	120	431	36	14	101	399	39	11	57	307	33	10	39	203	38	10	49	144	34	11	59	141
Group member	55	12	142	628	60	11	97	319	62	11	84	338	69	8	31	215	66	7	25	104	71	10	38	139	70	11	47	142
Administrator	10	24	149	758	13	10	68	218	14	10	42	210	16	5	29	247	21	14	49	241	19	13	29	149	24	10	35	130
Principal teacher	77	7	73	345	92	6	60	240	92	8	53	182	103	6	26	174	82	6	29	93	96	6	28	105	88	8	35	100
P1 Facilitator	64	10	71	430	89	9	62	245	90	8	41	142	100	6	31	151	91	7	21	70	91	8	23	103	89	9	35	103
PC clinical teacher	4	5	22	119	5	1	5	33	5	2	8	29	4	1	5	69	5	2	2	20	12	3	15	37	9	2	12	35
Timetable teacher	113	6	57	253	138	6	43	184	130	6	29	134	137	5	18	131	121	5	18	65	131	5	21	77	129	7	30	93
Median test results (from SPSS hypothesis-test summaries): statistically significant results of Map use measurements by staff demographics (*p* <= 0.05)																												
Gender														.004		.011				.012			.013	.039				
Age											.010																	
Staff type								.006			.008				.020			.015				.000				.000	.033	.022
School location						.049				.018					.019			.040				.008	.000	.011		.011	.006	.004

* Counts only include users with total session durations of 1 minute or more per year. Cases with total session durations of less than 1 min per year were excluded prior to the analysis of each year.

[5] Code: (*n*) cases; (S) sessions; (D) session duration in minutes; (E) session events.

Results for UMP roles (Table 6.16) showed that the total number of sessions, durations and events were not proportional to the number of users in each UMP role, but instead varied according to the role. This pattern is better seen in Figure 6.25, using 2010 as the model year.

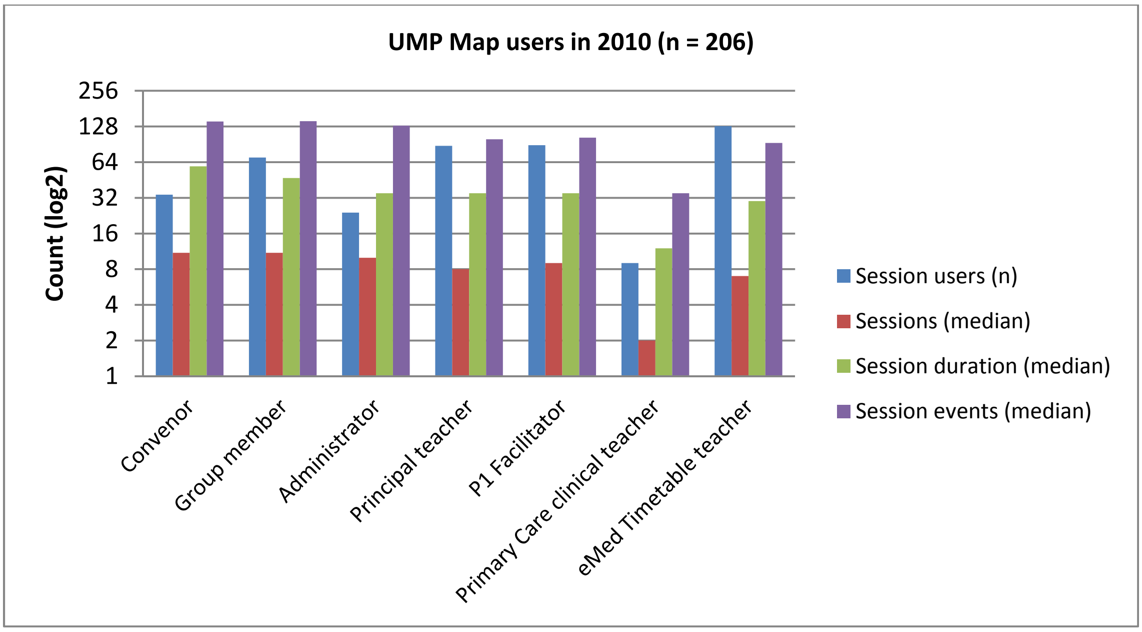

Figure 6.25: Total number of UMP Map users for each UMP role, and median scores for total number of sessions, session durations and session events performed in 2010 only. [6]

Table 6.16 also shows the significant p-values from median test results (from the SPSS hypothesis-test summaries) for each staff demographics variable. These results show that in some years the median score for a specific Map use variable (e.g. session or session duration) was significantly different for a specific staff characteristic (e.g. gender or staff type), while in other years there was no significant difference. The largest number of significant results are related to school location (10 significant results) and to staff type (8 significant results), and there were more significant results in 2009-2010.

[6] The counts in Figure 6.25 only include Map users with total session durations of 1 minute or more in a year. The y-axis is set to log2 to accommodate the variation in total counts.

Top UMP Map users

The examination of outlier cases at the top-end of UMP Map users identified seven staff members who had performed over 500 sessions in seven years, followed by another 31 staff members who had performed between 101 and 500 sessions, and by a third group of 39 staff members who had performed between 51 to 100 sessions. Collectively, these 77 top UMP Map users represented 15.2% of the 507 UMP Map users. Table 6.17 shows the staff characteristics of these 77 Map users (all of them were in the Faculty staff database). Results of the median tests on total session counts, and of the Pearson's chi-square tests on total session range counts from 2004 to 2010 showed no statistically significant associations between Map use and staff demographics.

Table 6.17: Count and percentage of the top UMP Map users grouped by staff demographics.

Staff demographics	Category	Count and percentage of top UMP Map users (*n* = 77)
Gender	Female	52 (67.5%)
	Male	25 (32.5%)
Age range (on 31/12/2010)	20-29	1 (1.3%)
	30-39	8 (10.4%)
	40-49	26 (33.7%)
	50-59	26 (33.7%)
	60-69	9 (11.7%)
	70+	3 (3.9%)
	NA	4 (5.3%)
Staff Type	Academic	50 (64.9%)
	Conjoint/Adjunct	5 (6.5%)
	Casual	0 (0.0%)
	General	20 (26.0%)
	External (incl. Science school)	1 (1.3%)
	Visiting	1 (1.3%)
School Location	Campus	47 (61.0%)
	Metropolitan Clinical	12 (15.6%)
	Rural Clinical	17 (22.1%)
	Not in Faculty	1 (1.3%)

Table 6.18 shows the count and percentage of these top Map users in relation to their UMP roles. Results show that the majority of these top Map users were eMed Timetable teachers, P1 Facilitators, Principal Teachers and/or Committee/Group members, about one third were convenors, about one fifth were administrators and none were Primary Care clinical teachers.

Table 6.18: Top UMP Map users by their UMP roles.

UMP Role	Count and percentage of top Map users per roles (*n* = 77)
Convenor	29 (37.7%)
Committee/Group member	46 (59.7%)
Administrator	15 (19.5%)
Principal teacher	52 (67.5%)
P1 Facilitator	46 (59.7%)
eMed Timetable teacher	56 (72.7%)
Primary Care clinical teachers	0 (0.0%)
Total number of UMP roles	**244**

At the very top-end of the 77 UMP Map users, there were six outlier cases who each had performed over 800 sessions in seven years. Because these six cases had specific UMP roles related to the Map itself, they were analysed separately. Table 6.19 shows the median scores for the Map use variables over seven years for the remaining 71 users in total, and according to their UMP roles. These results show that the median scores between UMP roles were relatively similar, with convenors having the highest median scores for each variable and administrators the lowest median scores.

Table 6.19: Median scores for the total number of sessions, session durations and session events by the top 71 Map users.

Top UMP Map users (excluding top six)	Number of Map users (*n* = 71)*	Total sessions	Total session duration (min.)	Total session events
UMP staff: median scores				
Top users	71	92	776	2692
UMP roles: median scores				
Convenor	28	114	910	3686
Group member	42	96	827	3070
Administrator	10	79	496	1966
Principal teacher	50	91	783	2959
P1 Facilitator	45	83	709	2854
Timetable teacher	53	90	776	2854

*Counts exclude the top six users.

Table 6.20 shows the results for the top ten Map users. These users included, in descending order, the UMP's Learning Resources Manager (LRM) and chief Map administrator since 2004 (top Map user); three Assistant LRM and Map administrators who had each spent about 2 to 3 years in the position with one replacing the other; the eMed Timetable administrator; the Map designer (the researcher); two academic staff members closely involved with the educational development and management of the UMP and with learning and teaching; a general staff member from the rural school; and the senior academic administrator responsible for overseeing the UMP and the eMed system. All but one of the top ten users were staff members of the Medical Education and Student Office (MESO) either in a full-time or fractional position. Both the chief Map administrator and the Map designer had been closely involved in the development of the IT system, and had therefore accessed the Map as part of the IT testing procedures, which would account for a number of their Map sessions particularly in the earlier years. Many of the chief Map administrator's sessions would have been performed in the capacity of LRM which involved tasks such as regularly updating the Map forms and uploading attachments, in collaboration with the Assistant LMR and Map administrators. The chief Map administrator was also a principal teacher and a group member, so some of this person's sessions would have related to these roles which at times had included performing Map search exports for senior academic administrators. The Timetable administrator, who was also a group member, would have mostly accessed the Map to link with the eMed Timetable system since both IT systems were integrated. One Assistant LRM/Map administrator had also been a Timetable teacher. Many of the researcher's own sessions as the Map designer would have been related to designing, testing and researching the system, although she had also used the Map in her capacity as UMP principal teacher, committee/group member, P1 facilitator and course convenor/co-convenor.

Table 6.20: Total number of sessions, session durations and session events by each of the top 10 UMP Map users between January 2004 and December 2010.

Ranking	Staff Type	Main UMP Role	Total sessions	Total session duration (min)	Total session events
1	General	LRM & chief Map administrator	3772	70500	215986
2	General	Assistant LRM & Map admin.	2150	54987	136522
3	Academic	Map designer	1490	38970	99338
4	General	Assistant LRM & Map admin.	1454	25952	93738
5	General	Assistant LRM & Map admin.	923	20889	71388
6	General	Timetable administrator	845	7258	37101
7	Academic	Phase convenor	612	7133	19243
8	Academic	Element & Course convenor	493	5133	15716
9	General	Administrator (RCS)	335	2805	7251
10	Academic	Program Coordinator	329	3941	14706

Figure 6.26 shows the individual patterns of Map use by those who performed over 100 sessions in seven years (38 cases). This pattern indicates that, as the total number of sessions performed by a user increased, there was a tendency for the average duration of each session to increase, although it is also evident from these results that the top 10 Map users in particular had the largest total duration of sessions.

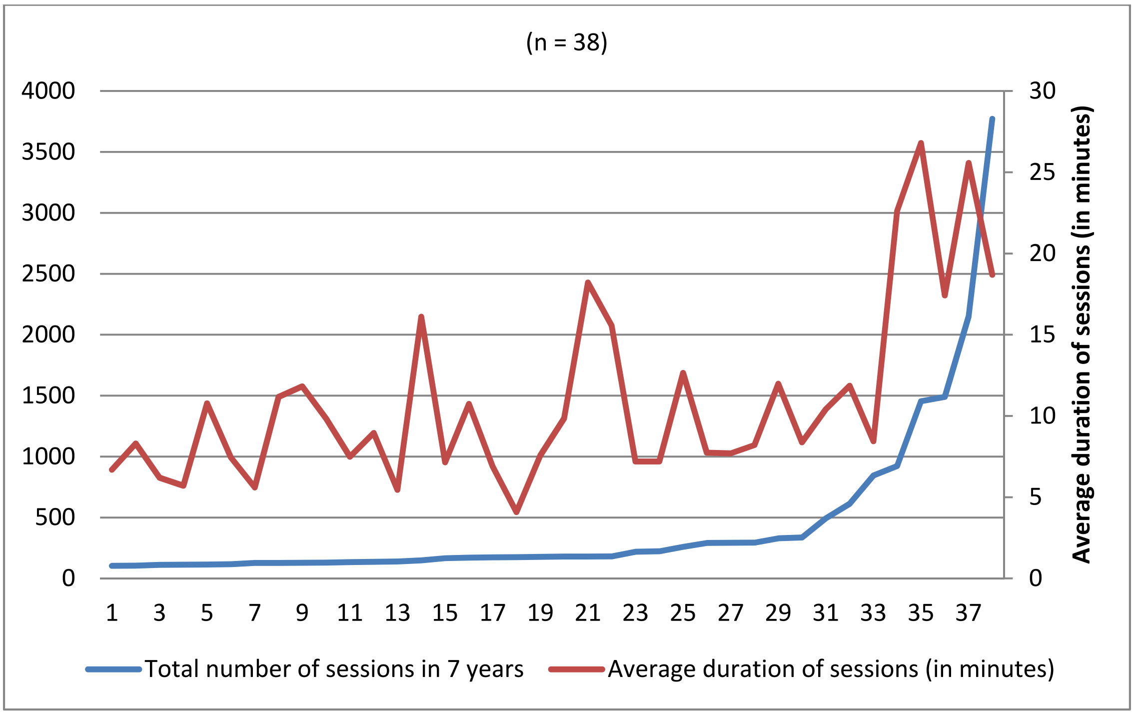

Figure 6.26: Total number of sessions and average duration of each session (min.) for each Map user who performed over 100 sessions in seven years. [7]

Comparative summary of UMP Map users

Table 6.21 summarises the median scores for the total number of Map sessions, session durations and session events performed by different groups of UMP Map users. These results clearly show the difference in median scores between these groups, indicating the presence of sub-groups within the UMP Map user population.

Table 6.21: Median scores for the total number of Map sessions, session durations and session events by groups of UMP Map users between January 2004 and December 2010.

Map user groups	Number of Map users	Median scores for 7 years in total		
		Total sessions	Total session durations (min.)	Total session events
All UMP Map users	610	6	30	121
UMP Map users with session duration >= 1 min	507	9	46	198
Top UMP users (51+ sessions)	77	99	863	2966
Top UMP users excluding the top six users (51+ sessions)	71	92	776	2692
Top 10 UMP users (329+ sessions)	10	884	14073	54244
Top six UMP users (845+ sessions)	6	1472	32461	96538

[7] Cases in Figure 6.26 are identified by their ID number (x-axis), and arranged in ascending order by the total number of sessions performed.

Table 6.22 summarises the percentage increase in Map users in 2010 compared with 2004 before and after the removal of select cases (i.e. 103 cases with total session durations of less than 1 minute in seven years, 59 cases not involved in the UMP and three cases with unidentified names). These results show that the rise in Map use in 2010 compared with 2004 after the exclusion of cases with short session durations was still considerable at 56.1% (74 of 132), but more moderate than the 75.8% increase (119 of 157) noted before the exclusion of any cases.

Table 6.22: Number of Map users in 2004 and 2010 before and after excluding cases*.

Map user group based on session duration	Number of Map users in 2004	Number of Map users in 2010	Difference and percentage increase in Map users between 2004 and 2010
All Map users (all session durations)	157	276	119 (75.8%)
UMP Map user >= 1 min. for all 7 years in total*	147	251	104 (70.7%)
UMP Map user >= 1 min. for a single year in total*	132	206	74 (56.1%)

*The cases excluded were: (a) cases with session durations of less than 1 minute, (b) Map users not involved in the UMP, and (c) Map users with unidentified names.

Association between Demographic Variables

Many of the results in Part 2 of this study supported the hypothesis that certain staff characteristics were associated with different patterns of Map use. To better understand these results, the Pearson's chi-square test for independence was used to explore the association between each of the four staff demographic variables (i.e. gender, age, staff type and school location) within the following three population groups: (a) the 610 UMP Map users, (b) the 1263 UMP staff and (c) the 5196 staff in the Faculty database. This statistical analysis explored whether there were any significant associations between the four staff demographics variables, and if the associations were similar in each of the three population groups. These results, which are presented in full in Appendix N, showed that significant associations did exist between the demographic variables in each population group, and that associations were similar for each of the three population groups. In summary, results for the UMP Map user population group (n = 610) showed the following significant associations (for details see Appendix N):

- Gender and staff type: more general staff were female and more conjoint staff were male ($p < 0.001$).

- Gender and school location: campus schools had more females and clinical schools had more males ($p = 0.044$).
- Age and gender: more staff in the 20-49 age groups were female and more staff in the 60-70+ age groups were male ($p < 0.001$).
- Age and staff type: more staff in the 20-29 age group were general staff and fewer were conjoint staff ($p < 0.001$).
- Staff type and school location: campus schools had more academic staff and clinical schools had more conjoint staff ($p < 0.001$).
- Age and UMP roles: there were more UMP Principal Teachers in the 50-59 age group ($p < 0.001$) and fewer eMed Timetable Teachers in the 20-39 age groups ($p = 0.036$).
- Gender and UMP roles: there were more females in the role of UMP Administrator ($p = 0.003$) and more males in the role of Principal Teacher ($p < 0.001$) and eMed Timetable Teacher ($p < 0.001$).
- Staff type and UMP roles: there were more academic staff in the roles of UMP Convenor ($p < 0.001$), Committee/Group member ($p < 0.001$), Principal Teacher ($p < 0.001$), P1 Facilitator ($p < 0.001$) and eMed Timetable Teacher ($p < 0.001$). There were more general staff in the role of UMP Administrator ($p < 0.001$). There were more conjoint staff in the role of UMP Primary Care clinical teacher ($p < 0.001$).
- School location and UMP roles: here were more campus staff in the role of Committee/Group member ($p < 0.001$), P1 Facilitator ($p < 0.001$) and eMed Timetable Teacher ($p < 0.001$). There were fewer rural staff in the UMP role of Convenor ($p = 0.020$) or Principal Teacher ($p < 0.001$).

Part 3: Map Help Use Results

This section reports the results of the use of the Map Help site by staff members between January 2004 and December 2010. The **research questions** in this section were: (a) How many staff members had accessed the eMed Map Help site? (b) How long were their sessions? (c) What were the characteristics of users? (d) Which pages had they accessed? To answer these questions, results from the Sawmill reports on the use of the Map Help website were linked to data from the Faculty and UMP datasets (Figure 6.27).

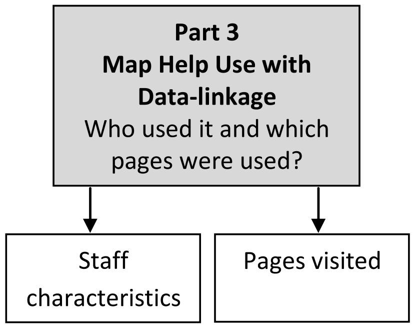

Figure 6.27: Outline of Part 3 results on the use of Map Help.

Results

The eMed Help website contained educational and IT information on how to use the Map, as well as information on other eMed tools. The Map information had been available to staff members from January 2004 onward, and had been expanded and updated over the years. A total of 45 staff members (unique session users) accessed the Map help site between January 2004 and December 2010 (the four staff members who had authored the eMed Help pages were excluded from this count). Of these 45 staff members, 36 used the site only once in seven years, seven used the site two times, one used it three times, and one used it four times in seven years. All but one of the 45 staff members had also used the Map, and 43 were involved in the UMP. Since some Map help pages were brief, the cut-off point for a meaningful session duration was set at 0.5 minutes or more in seven years (instead of the 1.0 minute cut-off point used for the analysis of Map use).

Of the 43 UMP staff members who had accessed the site, 19 (44.2%) used it for less than 0.5 minutes in seven years, and 24 (55.8%) used it for 0.5 minutes or more. The Pearson's chi-square test showed no significant association between the total duration of sessions and the age, gender, staff type, school location or currency of appointment of staff members. The 19 staff that accessed the site for less than 0.5 minutes were excluded from further analysis. The remaining 24 users represented 3.9% of the 610 UMP staff members who had used the Map over the same period. Table 6.23 shows that the majority of these 24 Map Help users were academic staff (54.2% or 13 of 24), from campus schools (62.5% or 15 of 24) and aged between 40 and 59 years (70.8% or 17 of 24), and that the number of males to females was about equal. Table 6.24 shows that those with a role of eMed Timetable teacher, Principal teacher and/or Phase 1 facilitator used the site more so than those with other UMP roles.

Table 6.23: UMP staff members who used the Map Help site for 0.5 minutes or more from January 2004 to December 2010.

Characteristic	Category	Count and percentage of UMP staff who used Map Help (*n*=24)
Staff Type	Academic	13 (54.2%)
	Casual	1 (4.1%)
	Conjoint/Adjunct	7 (29.2%)
	External (incl. Science school)	0 (0.0%)
	General	3 (12.5%)
	Visiting	0 (0.0%)
School Location	Campus	15 (62.5%)
	Metropolitan Clinical	7 (29.2%)
	Rural Clinical	2 (8.3%)
	Not in Faculty	0 (0.0%)
	NA	0 (0.0%)
Gender	Female	12 (50.0%)
	Male	11 (45.8%)
	NA	1 (4.2%)
Age range (on 31/12/2010)	20-29	0 (0.0%)
	30-39	3 (12.5%)
	40-49	6 (25%)
	50-59	11 (45.8%)
	60-69	0 (0.0%)
	70-89	1 (4.2%)
	NA	3 (12.5%)
Currency of appointment (on 31/12/2010)	Active	20 (83.4%)
	Terminated	2 (8.3%)
	NA	2 (8.3%)

Table 6.24: Roles of UMP staff who used Map Help for 0.5 minutes or more between January 2004 and December 2010.

UMP Role held by staff	Number and percentage of UMP roles held by Map Help users (*n* = 24)*
Convenor	7 (29.2%)
Group member	7 (29.2%)
Administrator	2 (8.3%)
Principal teacher	13 (54.2%)
Phase 1 Facilitator	14 (58.3%)
eMed Timetable teacher	18 (75.0%)
Primary Care clinical teacher	0 (0.0%)
Rural Clinical school teacher	2 (8.3%)
Metropolitan Clinical school teacher	7 (29.2%)
Total number of roles	**70**

*Counts based on data from various sources including eMed Timetable.

There were 96 eMed Help pages in total and 47 of these were on eMed Map. Table 6.25 shows a list of the Map Help sections and page titles. Of the 249 Map help session page visits which took place from 2004 to 2010, 137 (55.0%) page visits were of less than 0.5 minutes duration and the remaining 112 (45.0%) page visits were of 0.5 minutes or more. Of these 112 pages, the User Instruction page for principal teachers was the most visited page with 15 sessions lasting about 19 minutes in total (about 1.3 minutes/session). The next two most visited pages were the User Instruction page for all staff (9 sessions lasting about 1.2 minutes/session) and the page for facilitators/tutors (9 sessions lasting about 0.6 minutes per session). The Glossary section had the most sessions overall (48), and the pages most visited in the Glossary were the Thesaurus page (6 sessions at 2.9 min/session), Content Topic page (6 sessions at 2.0 min/session) and Theme page (7 sessions at 1.7 min/session). The Search Engine page on how to use exports (for Designers) had the second longest average session duration at 2.6 minutes/session (for 3 sessions in total). On average, other pages were visited between 1 to 5 times for 1 minute or less/session. This concludes the results on the use of the Map help site. The next section discusses the results of this study.

Table 6.25: eMed Map Help sections and page titles.

Map Help Section	Page Title	Map Help Section	Page Title
Map Overview	Overview of Map Access to Map	User-Function Matrix	Map Matrix
Glossary	Map Glossary Controlled Vocabulary Map Forms Phase, Course & Cycle Learning Context Learning Activity Assessment Activity Graduate Capability Domain Theme Content Stream Content Topic Element Thesaurus	FAQs	Map support Acronyms Why fill forms? A "model" form? Aims, concepts & capabilities (LAF) References & keywords (LAF) Instructions for students (LAF)* Codes Attachments* Exam components (AAF) Entering data Recovering forms* Map archives* Titles & abbreviations* Log in & out
Search Engine	Simple & Advanced Options Using Exports (Designer)	Troubleshooting	Troubleshooting Tips
User Instructions	For All Staff Type of Users* Student Facilitator/Tutor Principal Teacher Convenor Administrator	Version releases	Map v1.1* Map v1.2* Map v1.3* Map v2.0* Map v2.1 Map v3.0* Map v4.0*

*Pages that were not accessed by staff members.

Discussion

Results from this study provide concrete, quantitative evidence on how many staff members involved in the UMP had or had not used the Map between 2004 and 2010, as well as evidence regarding the patterns of collective Map use including the sections of the Map that had been used or not used, the number of Map users and non-users, and the patterns of use and characteristics of individual UMP staff members. Many of the results from this study supported Hypothesis 1 which proposed that certain staff member characteristics were associated with Map use.

Overall, this study showed that between January 2004 and December 2010, approximately 1292 staff members were involved in the UMP and that the majority of these (785 or 60.8%) either did not use the Map (682 or 52.8%) or only used it for non-meaningful session durations (103 or 8.0%). In essence, these results indicate that a system that had been labour intensive and time consuming to design, develop and maintain, was widely available for use but diffusion amongst UMP staff was not what was hoped for by planners and advocates of the Map. What follows is a detailed discussion of these results, and of the collective and individual patterns of Map use.

Collective Patterns of Map Use

General patterns of collective Map use followed the regular patterns of staff members' working day, week, month and academic year, which often extended beyond the Monday to Friday from 9 a.m. to 5.p.m. pattern. Access was mostly from within the State of New South Wales in Australia where the Faculty was located, although access from interstate and overseas had steadily increased over the years. These results reflect the benefits of having an online curriculum map which can be accessed from any place and at any time, which is one of the advantages often referred to in the literature. The most common referring websites were eMed and WebCT Vista/Blackboard which showed that users were navigating from the UMP's course-management systems to the Map, as was originally envisaged when the Map was designed.

The increased use of PDF and MP3 file attachments indicated that staff members were making good use of this function which was added to Map v4. Use of the Excel file to export Search results was relatively low and, although this function was only available to Map users with Designer access (i.e. course, phase or element convenors or designers) or Administrator access, its low use could indicate that few convenors were performing in-depth curricular analyses. Most users were accessing the Map through browsers and operating systems supported by eMed, and the number of server or document errors was low indicating that in general the Map was a readily accessible and stable IT system.

The session-specific patterns of collective Map use showed that in general Map use was infrequent, with over half the users only performing 1 to 4 sessions per year, with about one quarter of users performing only one session (one-time users). The number of sessions accessing Map views and forms steadily increased over the years, which tends to indicate that users were navigating more within the Map. The LAF view was accessed the most often, while access to AAF, LCF and COF views was substantially lower and generally did not increase over the seven years. This result was partly predictable since LAFs contain information about individual learning activities, which are the main component of the curriculum. The increased use of LAF views from 2008 onward coincided with the release in Map v4 of the file attachment function, which tends to indicate that staff members were accessing these attachments (e.g. lecture notes and audio files, class readings etc.).

Individual Patterns of Map Use

Many of the results provided supportive evidence in favour of Hypothesis 1 which proposed that certain staff characteristics were associated with Map use. The characteristics explored included two general demographic variables (gender and age), two staff demographic variables (staff type and school location) and one UMP-specific variable (UMP roles). The hypothesis was that one or more of these variables could be associated particularly with using the Map or more generally with using an IT system. Since the Faculty staff population was not static, the currency of appointment variable was also explored to establish if staff members who had left the Faculty had used the Map significantly more or less than those who were still in the Faculty, and these results showed that there was no significant difference in usage.

Map Users versus Non-Users

Comparison of the characteristics of UMP staff members who used the Map with those who did not use it showed that significantly more UMP academic staff and general staff used the Map and significantly fewer UMP conjoint staff used it.

In relation to the school location, there were significantly more UMP teaching staff and general staff from campus schools who used the Map and significantly fewer from the rural school, which may indicate that rural school staff were not as aware of the Map as campus school staff or did not see the need to use it. There were significantly more UMP general staff who were Map users and significantly fewer teaching staff, a result that may indicate that the Map was being used more as an administrative tool (e.g. to timetable activities, to upload or download teaching materials) and less as a learning and teaching tool (e.g. to assist in developing an integrated curriculum, or to assist in learning and teaching). Another possible explanation is that general staff were accessing the Map on behalf of teaching staff, particularly clinical teaching staff, who may have requested general staff to find curriculum information on their behalf.

That significantly more female than male UMP staff used the Map was an unexpected result since the researcher had assumed that either there would be no difference between genders or that males may have had more affinity with using an IT system. While this result could indicate an actual gender difference in the use of the Map, such as a greater degree of diligence by female staff in reviewing or updating the Map, this result is more likely related to the association noted between gender and staff type in that significantly more UMP general staff were female and more conjoint staff were male; and also to the association between gender and school location in that there were significantly more UMP female staff in campus schools and significantly more UMP male staff in clinical schools. Hence, since more campus school staff and general staff had used the Map, indirectly more female staff had also used it.

Also unexpected was the result that significantly fewer UMP staff in the 20-29 age group used the Map and significantly more staff in the 50-59 age group used it since the researcher had assumed that younger staff members would have had a greater affinity with using an online IT system. It is likely that this result was related to the association noted between age and staff type since significantly fewer UMP staff in the 20-29 age group were academic staff; and also to the association between age and school location since significantly more UMP staff in the 20 to 39 age groups were from metropolitan clinical schools and significantly more UMP staff in the 50-59 age group were from campus schools. Another possible explanation is that more staff in the 50-59 age group were UMP Principal Teachers which was a role that required the completion of LAFs (this significant association was confirmed for the 610 UMP Map users but not for the 1263 UMP staff in the Faculty database, as noted in Appendix N). Hence, since more academic staff, campus school staff and Principal teachers had used the Map and were in the older age groups, indirectly fewer younger staff had used the Map.

While it was promising to see that over 80% of Phase 1 facilitators, group members, administrators and convenors had used the Map, it was less promising to note that about 18% of UMP convenors (14 of 76 convenors) had not used it since the convenors' role involved ensuring the development and implementation of an integrated and spiral curriculum. Since not having a staff ID number precluded teachers from using the Map, it was interesting to discover that 33.0% of UMP roles were held by staff members who did not appear to have an ID number. Most of these (79.6%) were staff members with a Primary Care teacher role, although many (33.7%) were staff members with an eMed Timetable teacher role or a Principal Teacher role (14.5%). These individuals were likely to be either casual or affiliated staff members since they were not included in the Faculty staff database.

Map Use Measurements

The median values of Map use for all individual Map users regardless of session duration for each of the seven years showed that session counts remained stable at about 4 sessions per user per year, but session duration decreased from 38 minutes in 2004 to 19 minutes in 2010. One possible explanation for the decrease in session duration is that in earlier years, course convenors and principal teachers had created and completed new activity forms (i.e. LAFs and AAFs) while in later years they had only needed to review and revise the content of these forms. As well, the median for session events (i.e. pages viewed during a session) decreased in line with the decrease in session duration over the years. This result seems to indicate that the decrease in session duration was not because of users viewing pages faster than before (e.g. due to an increased familiarity with the Map) but because they were generally viewing fewer pages. The percentile value for the number of sessions also decreased over the years, except for a slight increase in the 95th percentile value between 2009 and 2010, which seems to indicate that the top Map users performed a few more sessions in 2010.

Meaningful versus Non-Meaningful Map Use

That almost 17% of UMP Map users used the Map for less than 1 minute in seven years (non-meaningful session durations) tends to indicate that many staff members either accessed the Map by mistake, did not know what it was for or how to use it, or saw no need to use it after a very short visit. While there was no statistically significant difference between those who used the Map for less than 1 minute or for 1 minute or more in seven years and their staff type or age, there were significantly more males and metropolitan clinical school staff performing non-meaningful session durations. Since there were also significantly more males in clinical schools and more males who were conjoint staff, the reason for having more males performing non-meaningful Map sessions was likely related to their school location and staff type more so than to their gender per se. These results could indicate that these clinical school staff and conjoint staff had accessed the Map unintentionally maybe while trying to access another eMed tool such as Tracking or Teamwork. An alternative interpretation is that they had accessed the Map intentionally but had found it too confusing or not useful and, therefore, had quickly exited although for a Map user to reach this conclusion in less than 1 minute seems less likely. Overall, these results tend to indicate a need for better training of clinical school staff and conjoint staff involved in the UMP on how to use the Map from an educational perspective and an IT perspective.

Results also showed that all UMP roles had about 3% to 13% of non-meaningful Map users, with eMed Timetable teachers, Principal teachers and P1 Facilitators having the largest percentage at about 9% to 13%. This could indicate that Map users with these particular UMP roles also needed more training.

That the number of overall Map users who performed non-meaningful sessions in one year rose from 6.4% in 2004 to a maximum of about 15.1% in 2009 could have been due to an increased use of the eMed system in general, which could have led to more eMed users accessing the Map unintentionally, or been due to short visits performed during Map training sessions. Alternatively, it could have been due to one-off visits following the 2009 staff email announcement about this Map study—this interpretation is supported by the decline in non-meaningful sessions to 8.4% in 2010.

Meaningful Map Use by UMP Staff

Of the 507 UMP Map users with session durations of 1 minute or more (meaningful sessions), it was clearly evident from the cross-tabulation results that academic and general staff used the Map more often than conjoint, casual or external staff; and that campus and rural schools used it more often than metropolitan clinical schools or non-Faculty schools. Results from layered cross-tabulations allowed for a more in-depth analysis of Map use between demographic variables. This analysis showed that academic staff from campus schools used the Map more often that conjoint staff from these same schools; and that general staff from metropolitan or rural clinical schools used the Map more often than conjoint staff from these same schools.

These results provided further evidence in favour of Hypothesis 1, and showed that use of the Map was not evenly distributed across staff types or school locations, with the common pattern being that conjoint and clinical school staff used the Map the less often. Once again, these results confirmed that clinical school teaching staff were not using the Map to the same extent as campus school teaching staff or general staff.

Those with roles of convenor, principal teacher or committee/group member were considered as needing to use the Map the most since these roles were directly involved with developing and implementing integrated learning and assessment activities. However, results showed that conjoint staff who were committee/group members, principal teachers or eMed Timetable teachers used the Map less often than academic or general staff, and that Principal teachers from metropolitan clinical schools used the Map less than those from campus schools. Once again, these results supported Hypothesis 1.

The number of UMP roles held by staff was also associated with the amount of Map use, since those with one role used it less often than those with five to six roles, which tends to indicate that those with many roles had more of a need to use it. The total number of years of use also showed that more conjoint staff and clinical school staff had used the Map for only one of the seven years, which could be due to these staff members not being as involved in the curriculum until Phase 3, which is the most clinical of the three phases of the UMP and which only commenced in 2008.

This quantitative study did not provide the reasons for these different patterns of Map use amongst staff members. However, these differences could have been due to a lack of understanding by conjoint staff and clinical school staff in particular on how to use the Map, a lack of training, or a lack of perceived or actual need to use the Map by these staff.

Use per Calendar Year

While it was promising to see that more UMP staff were accessing the Map each year they did not appear to be increasing their overall use of the Map as indicated by the duration of sessions and number of session events, which tended to decrease up until 2009-2010 when there was a slight increase in each. These patterns of use may reflect different stages in the development and review of the curriculum from year to year, or be due to one-off events such as staff training sessions whereby user numbers increased temporarily but overall use was not sustained over time.

As well, patterns of use based on UMP roles were not always proportional to the number of users in each role. For example, while the number of course convenors, committee/group members and administrators who visited the Map each year was moderate compared to other UMP roles, the number of sessions and events they performed was higher, indicating that staff with certain UMP roles were using the Map more frequently than others.

School location and staff type, more so than gender or age, were the two variables that were significantly associated with different patterns of Map use from year to year. School location in particular was significantly associated with the number of sessions performed from 2005 onward. This result lends support to the idea that staff training may need to be based around school locations such as clinical schools, as well as around staff types such as conjoint staff. In some years, gender had a significant association to Map use on its own. Knowing that these demographic patterns exist and can change from year to year is an important finding, particularly if results from only one year are to be interpreted in any future studies. These changing patterns may be due to changes in the population of Map users and/or in how or for what purpose the Map was used in particular years (e.g. major curricular reviews). These yearly results also support Hypothesis 1.

Top Map Users

Amongst the top 77 UMP Map users, the majority were academic staff (64.9%), about one quarter were general staff (26.0%) and very few were conjoint staff (6.5%). The majority were from campus schools (61.0%) and less than one quarter were from metropolitan or rural clinical schools (15.6% and 22.1% respectively). These results indicated once again that clinical schools and conjoint staff had used the Map less frequently. However, the cross-tabulation results for these top users did not support Hypothesis 1 since there was no significant association between their Map use and their staff demographics. Hence, the significant demographic associations noted amongst the 507 UMP Map users were no longer present once staff members were performing over 51 sessions in seven years (or about 7 sessions per year). This interesting result could mean that once a UMP staff member starts using the Map every couple of months, the demographic differences in Map use may no longer exist.

Median scores for Map use variables based on the UMP roles of these top Map users were also relatively similar. Convenors had the highest scores and administrators the lowest, which could indicate that the top users were using the Map as an educational tool more so than an administrative tool. Nine of the top ten users were staff members of MESO and one was a general staff member from the Rural Clinical School. These results show that there was a heavy concentration of top Map users in MESO, which was predictable since this Office was responsible for overseeing the UMP.

The top Map user was the chief Map Administrator and Learning Resources Manager (LRM) for the UMP, and next in line were the three LRM assistants. These results indicate the importance of having one person responsible for managing and maintaining a curriculum map and related learning resources, as well as having staff to support this process. That six of the 10 top Map users were general staff was also telling and reflects the importance of having administrative staff to manage such a system. It was promising to see that the Associate Dean of Education since 2006 was amongst the top ten Map users. The Associate Dean was a conjoint staff member of a clinical school, the UMP program coordinator, and the eMed system's business owner.

The top 10 users had not only the largest total number of sessions but also the largest total session durations and session events, which indicates that they were spending a substantial amount of time using the Map and viewing many pages during visits. As the total number of sessions performed by these users increased there was also a tendency for the average duration of each session to increase.

The identification of these top 10 and top 77 Map users is in itself important since these staff members could be encouraged to become Map champions who promote the use of the Map amongst their colleagues, and help them learn how to use the Map and exploit its educational potentials, as suggested in the curriculum mapping literature. Overall, these results show that there were distinct Map user population groups and that each of these groups may have specific uses of the Map as well as specific training needs. This information can help senior UMP managers and administrators decide which groups need training, and what type of training they need.

Map Help Use

Results on the use of the Map Help site revealed that, during the seven years, only 24 UMP staff members used the site for meaningful session durations, which represented 3.9% of the 610 UMP staff members who had used the Map (the four authors of the help site were excluded). The majority of these 24 UMP staff members were academic staff from campus schools who were aged between 40 and 59 years, which was similar to the demographics of the most frequent UMP Map users. The help site was used the most by those with UMP roles of eMed Timetable teacher, P1 facilitator or Principal teacher and the least by administrators, which could indicate that users were seeking help on the educational aspects of the Map more so than its IT or administrative aspects. The most visited Map Help pages were the User Instruction pages for principal teachers, for all staff and for facilitators/tutors. The most visited Help section was the Glossary, in particular the thesaurus, content topics and theme pages.

The Map help site had been provided as a self-help site for staff members to learn how to use the Map from an educational and IT perspective, and had been revised and kept up-to-date over the years. Overall, these results showed that the Map Help site had barely been used. Some possible reasons for this could be that staff members did not know the help site existed, did not find it useful or easy to use, or chose to use trial and error instead of seeking help through this website.

Conclusion

Results from this study provided concrete, quantitative evidence of how many staff members involved in the UMP had used the Map and how many had not, as well as information about various collective and individual patterns of Map use, and about the characteristics of Map users and non-users. These results also provided supportive evidence in favour of Hypothesis 1 which proposed that certain staff member characteristics were associated with Map use. The key findings from this study indicate the following:

- Less than half the UMP staff (39.2%) had used the Map for meaningful session durations and very few (3.9%) had accessed the Map Help site for meaningful session durations.
- While more UMP staff accessed the Map each year (from 132 meaningful UMP users in 2004 to 206 users in 2010) their general Map use did not increase as indicated by the duration of sessions and number of session events. This pattern may reflect different stages in the development and review of the curriculum from year to year, or be due to one-off events such as staff training whereby user numbers increased temporarily but overall use was not sustained over time.
- Over the seven years in total, meaningful UMP Map users had a median score of 9 sessions in seven years; however, the top 77 UMP Map users had used it much more frequently and for much longer session durations indicating that patterns of use varied between sub-groups of UMP Map users.

- Conjoint staff and clinical school staff either did not use the Map, used it for non-meaningful session durations or used it only infrequently, which may indicate that these staff members either did not know about the Map, did not know how to use it or did not see the need to use it.
- More UMP general staff (77.7%) than teaching staff (43.5%) used the Map, which may indicate that the Map was being used more for administrative reasons than learning and teaching reasons.
- About one third of UMP teachers in eMed Timetable could not access the Map by using their own staff ID number because they did not appear to have one.
- About 15% of UMP Map users performed over 51 meaningful sessions over seven years.
- There was a small rise in the number of non-meaningful sessions over the seven years.
- Nine of the top ten users were from MESO; the top user was the general staff member in charge of the Map and the UMP learning resources; and the Associate Dean of Education since 2006 was amongst the top ten users.
- The Map form that was accessed the most was the LAF; the attachments accessed the most were the PDF and MP3 files; and the Excel file for exporting Search results was rarely accessed.
- Staff members accessed the Map at all times of the day and from various geographical locations in Australia and overseas, although it was mostly accessed during working hours and within the Australian State of NSW where the UNSW Medical Faculty is located.
- Most users were accessing the Map through eMed-supported browsers and operating systems, and the IT system seemed stable since there were few system errors recorded in the access web logs.

These quantitative results support some of the findings from the qualitative study such as the type of UMP staff members who were or were not using the Map, the Map sections that were being used, the frequency of use, and problems with staff ID numbers. In order to triangulate these results further, and strengthen, corroborate or disconfirm these findings and interpretations, these results are further explored through the Map survey study which is covered in the next chapter.

Chapter 7 : Map Survey Study

Introduction

This study was based on an anonymous, self-reporting Map survey of staff members involved in the UMP. The study was quantitative, positivist and deductive in nature. It aimed to elicit staff perspectives and attitudes on the Map. This survey was used to explore the following **research questions**:

a) Which staff members were or were not using the Map?

b) What did staff members used the Map for?

c) What were their perceptions of the Map?

d) What personal, technical and organisational factors were being experienced by Map users?

e) Was the original purpose of the Map being achieved?

f) Could the three hypotheses which had emerged from the qualitative study be confirmed?

g) Could some of the results from the other two studies be verified or explained?

This study was designed to triangulate with the other research results from earlier chapters. First the methods and procedures are described.

Methods and Procedures

This survey study explored the behaviours, perceptions and attitudes of Map users and non-users, and aimed to verify the factors of Map use identified in the observations and textual documentation study. The development of this survey instrument was in line with the exploratory assessment step of the construct development methodology of Lewis et al. (2005). The study included a preliminary assessment of the measurement properties of certain items. Work to refine the survey was conducted, but testing its psychometric properties was not deemed necessary.

Development of Survey Instrument

Most survey items were closed-ended questions or statements and three items were open-ended questions. Statement-based items were developed to cover the various Map-related issues identified in the qualitative study and in the relevant literature. Attempts were made to keep the number of items to an effective size without compromising the number of factors explored and, hence, the usefulness of the data gathered through the survey. The development of items was based on the following sources:

- The qualitative findings on the types of Map use and the fifteen factors affecting Map use (see Chapter 5).
- The SUV systematic evaluation model by Jokela et al. (Jokela et al., 2008) (see Chapter 3 for details).
- The evaluation of curriculum mapping in Canadian and UK medical schools conducted by Willett (2008) (see Chapter 2 for details).
- The IS-Impact Measurement Model by Gable et al. (Gable, Sedera, & Chan, 2008).

Items in Sections 5 to 7 of the survey were classified according to the following: (a) the main factor covered in each statement (derived from the factors of Map use identified in the qualitative study), (b) the categories and levels of the SUV evaluation model, and (c) the statement being either favourable (positive) or unfavourable (negative) to Map use.

Appendix O contains a copy of the final online version of the survey instrument. Appendix P contains a version of the survey which shows the relation of items to particular research questions, types of Map use, factors affecting its use, and categories from the SUV model and the IS-impact measurement model.

Survey Testing and Implementation Procedures

A paper-based version of the survey was developed in MS Word 2007 and reviewed by three academic staff members with expertise in survey measurement. The feedback received was then used to revise the survey items and scales, and to re-classify or delete some items. An online version of the survey was then developed in the application KeySurvey version 6.9 and piloted. While the original plan was to pilot the survey with six to nine staff members (one for each UMP role listed in the survey) the plan was changed to avoid over-burdening the potentially small pool of regular Map users. Instead, in a purposeful piloting process, three key staff members involved in the administration and use of the Map and in the UMP were invited to pilot the survey. These staff members were asked to review all aspects of the survey, including its format, content, clarity, terminology, ease and speed of completion, and online delivery. Two of the three staff members responded and piloted the online survey, and their feedback was used to revise some of the items and survey instructions.

The final online version of the Map survey (see Appendix O) contained dichotomous questions (yes/no), multiple-response questions, statement-based questions with a response scale, and open-ended questions. The frequency response scale had four categories (often, sometimes, rarely, never) and the agreement response scale had six categories (strongly agree, agree, neutral, disagree, strongly disagree, don't know). The 'don't know' category was intended for respondents who had never considered the issue in question or had never used a particular function of the Map, while the 'neutral' category was for respondents who were neutral or undecided about an issue.

The types of data collected included nominal data (gender, school affiliation, staff type, yes/no answers and the like), ordinal and interval data (response scales, age range) and textual data from open-ended questions. Some of the response scale categories were merged during the analysis process to meet the requirements of certain statistical tests.

The number of items to be completed by a respondent depended on the person's level of Map use and role in the UMP. Hence, the logical pathways function of the KeySurvey v6.9 application was used to direct respondents to different survey items depending on the answers they provided.

The survey was released to all staff members of the Faculty of Medicine and select staff members from the Faculty of Science through a Faculty-wide email broadcast. The online survey was opened on 12 October 2009 and closed on 23 November 2009. A reminder email was sent on 10 November 2009. All those who completed the survey had the opportunity to enter a lucky draw to win one of three prizes. See Appendix O for a copy of the final online survey instrument.

Research Questions and Hypotheses

The survey was used to explore a number of research questions related to who was using the Map and who was not, what the Map was being used for, what knowledge and opinions users had of the Map, and what factors affected its use. This survey was also used to explore the three hypotheses derived from the qualitative study. Hypothesis 1 proposed that certain demographic characteristics of staff members were associated with their use of the Map and their perceptions of and experiences with using it. The demographic variables explored were:

- Gender
- Age range
- Staff type (academic, general, conjoint, casual/sessional/affiliated, or other)
- School location (campus school, clinical school, or research centre/institute)
- UMP roles (campus based teacher, clinical school based teacher, general practice or primary care teacher, convenor/co-convenor, curriculum design, overview or evaluation group or committee member, administrator and/or other)
- UMP phase involvement (Phase 1, 2 and/or 3).

Hypothesis 1 was tested by measuring the answers to individual survey items against the demographic characteristics of staff. This hypothesis proposed that one or more of a respondent's demographic characteristics influenced the person's types of Map use, perceived effects of Map use, or actual experiences with using it. Since the respondent's Map use and experiences could be either positive or negative the hypothesis was two-sided. The null hypothesis was that there was no association between staff demographics and item responses. In general, the **research question** was: were there any significant associations between the demographic characteristics of respondents (in particular their staff type and school location) and their responses to individual survey items?

Hypothesis 2 proposed that what staff members used the Map for was associated with the factors affecting their use of the Map. This hypothesis was tested by measuring respondents' summated scores for items in Section 3 of the survey which related to the types of Map use, against their summated scores for items in Section 5 to 7 of the survey which relate to the personal, technical and organisational factors affecting Map use. This hypothesis was also two-sided, and the null hypothesis was that there was no association between the two sets of variables. The **research question** was: were there any significant associations between the actual types of Map use and the personal, technical or organisational factors affecting Map use?

Hypothesis 3 proposed that what staff members perceived as being effects of the Map was associated with the factors affecting their use of the Map. This hypothesis was tested by measuring respondents' summated scores for items in Section 4 of the survey which related to their opinion on the effects of the Map against their summated scores for items in Section 5 to

7 of the survey which relate to the personal, technical and organisational factors affecting Map use. This hypothesis was also two-sided, and the null hypothesis was that there was no association between the two sets of variables. The **research question** was: were there any significant associations between the perceived effects of the Map and the personal, technical or organisational factors affecting Map use?

Data Collection and Analysis Procedures

At the end of the survey period, all data were exported from KeySurvey to an Excel file, and then into an SPSS file for statistical analysis. The type of data collected included nominal data (gender, school affiliation, staff type, yes/no answers and the like), ordinal and interval data (response scales, age range) and textual data from open-ended questions. Many of the variables had more than two categories or levels (e.g. response scales had four to five levels).

All item responses were analysed as single items to establish the total count and percentage of responses for each item. As well, items in Sections 3 to 7 were analysed using a summative scale for sets of items so as to assign each respondent (case) with a single score that represented the person's overall use of the Map, and his/her perceptions of or experiences with using the Map.

This study used the following statistical analyses:

- Frequency analysis of single responses: used to establish overall counts and percentages of responses in relation to various demographic characteristics of respondents.
- Frequency analysis of summated scores for sets of responses: used to establish counts and percentages as well as measures of central tendency and dispersion for sets of responses (groups of survey items).
- Fisher's Exact Test of association for hypothesis testing (2-sided): used in the cross-tabulation analysis to measure the significance of the association between the response to a survey item and the demographic characteristics of respondents, to test Hypothesis 1. Also used to measure the association between a respondent's summated scores for different groups of survey items, to test Hypothesis 2 and Hypothesis 3.
- *Cramer's V*: used in the cross-tabulation analysis to measure the effect size or strength of the association between variables (rather than the significance). The *Cramer's V* result was evaluated using the following criteria, where the degrees of freedom (df) is the smaller of either (R-1) or (C-1) (Gravetter & Wallnau, 2004; Pallant, 2011):

    - df = 1 (two categories): small l= 0.01, medium = 0.30, large = 0.50
    - df = 2 (three categories): small = 0.07, medium = 0.21, large = 0.35
    - df = 3 (four categories): small = 0.06, medium = 0.17, large = 0.29.
- Item reliability analysis using Cronbach's coefficient alpha: used to explore the internal consistency of items grouped under the personal, technical and organisational factors affecting Map use.
- One-way between group analysis of variance (ANOVA) with post-hoc test: used to explore the difference in the summated scores for using the 'don't know' and 'neutral' responses in the survey. The Tukey test was used for post-hoc comparisons, and eta squared was used to calculate the effect size (Pallant, 2011).
- Content analysis: used to explore the qualitative responses from open-ended questions.

The statistical analysis was conducted in SPSS v20, and the content analysis in Excel 2007. The cross-tabulation analysis used the Fisher's Exact Test (FET) of association instead of the Pearson's chi-square test of independence because the survey's dataset was small and the expected cell frequencies in cross-tabulations were often less than 5 (Elliott & Woodward, 2007). In general, this study reports the FET exact p-value. However, due to limited computational power with large cross-tabulations the FET estimated exact p-value was occasionally reported using the Monte Carlo method based on 10,000 sample tables with a starting seed set at 2,000,000, and a 99% confidence interval (CI) (Mehta & Patel, 2010). Statistically significant results were followed by an examination of cell frequencies in cross-tabulations. In general, the response variable was in columns (C) and the explanatory variable in rows (R), and the rows total was reported. Statistically significant cell counts and percentages are included in the Results section of this chapter and the respective cross-tabulations are included in Appendix Q. Statistical tests in this study used a significance level of 5% ($\alpha \leq 0.05$).

Summative Scaling Procedure

A summative scale was developed for items in Sections 3 to 7 of the survey. Sections 3 items related to the types of Map use, and Section 4 items to the effects of Map use, and all statements in these two sections were favourable to Map use. Items in Sections 5, 6 and 7 assessed the factors affecting Map use from a personal, technical and organisational level respectively, and these statements were either favourable or unfavourable to Map use.

As shown in Table 7.1, each response category for an item was given a numeric weight. Then, each respondent's original answers were converted to this numeric weight. A respondent's total score for sets of items was then computed using the SPSS "Transform" function, and then the total scores for each set of items were grouped into ranges. Therefore, a respondent's score was the algebraic sum of the person's responses to sets of items. High scores represented an overall positive use or experience of the Map, while low scores represented an overall negative use or experience. This method was based on the summative scaling procedure described by Fink and Kosecoff (1985) and by Trochim (2006).

Table 7.1: Numeric weighting and range of total scores used in summative scales for survey Sections 3 to 7.

Numeric weight of response categories for items in the section of the survey	Range and classification of total scores
Section 3: Types of Map use	
Often or sometimes = +1 Rarely or never = 0	Nil score, if total = 0 Low score, if total = 1 to 5 Medium score, if total = 6 to 10 High score, if total = 11 and above
Section 4: Effects of Map use	
Agree or strongly agree = +1 Neutral or don't know = 0 Disagree or strongly disagree = -1	Negative score, if total <= -1 Neutral score, if total = 0 Positive score, if total >= +1
Sections 5, 6 and 7: Personal, technical and organisational factors affecting Map use	
Agree or strongly agree with favourable statement = +1 Disagree or strongly disagree with unfavourable statement = +1 Neutral or don't know = 0 Agree or strongly agree with unfavourable statement = -1 Disagree or strongly disagree with favourable statement = -1	Negative score, if total <= -1 Neutral score, if total = 0 Positive score, if total >= +1

Measurement Properties of Instrument

Evaluation of the measurement properties of the survey items was conducted within the limits of the available data and the statistical requirements of each test. To explore the reliability of items in Sections 5, 6 and 7, the internal consistency of items grouped under the personal, technical and organisational domains was measured using Cronbach's coefficient alpha in SPSS. It was decided that it was unnecessary to conduct an exploratory factor analysis of these items because the required case-to-item ratio of at least 5 to 1 (or a bare minimum of 3 to 1) could not be met since the number of Map user cases was small and the number of items for each domain was relatively large.

Results

These results are organised according to the survey's general structure as follows:

- Section 1: response rate, demographics and Map use
- Section 2: use of Map features and functions
- Section 3: types of Map use
- Section 4: effects of Map use on the curriculum and the Faculty
- Section 5: personal, technical and organisational factors affecting Map use
- Section 6: comparison of scores on the types, effects and experiences of Map use
- Section 7: overall perceptions of the Map
- Section 8: final comments.

Section 1 covers the results of all survey respondents, while Sections 2 to 8 cover the results of respondents who had used the Map within 12 months of the survey's release date. Section 1 includes the testing of Hypothesis 1 in relation to respondents' gender, age, staff type, school location, UMP involvement and Internet use. Sections 2 to 5 and Section 7 include the testing of Hypothesis 1 in relation to respondents' staff type and school location only. Section 6 includes the testing of Hypotheses 2 and 3. Section 8 covers the qualitative analysis of the survey's two final open-ended questions. Statistically significant p-values in tables are shaded and asterisked, and corresponding cross-tabulations are presented in full in Appendix Q. A copy of the online survey is available in Appendix O.

Section 1—About Respondents

This section covers the demographic characteristics of respondents and their use of the Map in the previous 12 months (survey Questions 1 to 10).

Response Rate and Demographics of Respondents

A total of 148 staff members completed the Map survey (two staff members who submitted incomplete surveys were excluded from the analysis). All 148 respondents were from the Faculty of Medicine. There were slightly more male than female respondents (57.4% to 42.6% respectively), and most respondents (83.0%) were aged between 31 and 60 years (Table 7.2).

The majority of respondents (69.6%) were from clinical schools (Tables 7.3), and the majority were conjoint staff members (54.7%) (Table 7.4).

Table 7.2: Respondents by gender and age.

General demographic characteristics	Frequency (*n* = 148)	Percentage
Gender		
Female	63	42.6%
Male	85	57.4%
Age range		
20 to 30	8	5.4%
31 to 40	35	23.6%
41 to 50	48	32.4%
51 to 60	40	27.0%
61 and above	17	11.5%

Table 7.3: Respondents by school location.

School location	Frequency (*n* = 148)	Percentage
Campus schools	41	27.7%
Clinical schools	103	69.6%
Research centres or institutes	4	2.7%

Table 7.4: Respondents by staff type.

Staff type	Frequency (*n* = 148)	Percentage
Academic	44	29.7%
General	19	12.8%
Conjoint	81	54.7%
Casual, sessional, affiliated or visiting	4	2.7%

In relation to UMP roles, most survey respondents were clinical school based teachers (61.5%), and a number of respondents indicated having more than one UMP role (Table 7.5). The results of all UMP roles held by each respondent (Table 7.6) showed that most respondents were either clinical school based teachers only (47.3%), campus-based teachers only (16.2%) or administrators only (9.5%), and that the remaining 27.0% of respondents had two or more roles.

Table 7.5: Responses by each UMP role, and percentage of cases per role.

UMP Role	Responses		Percentage of cases (*n* = 148)
	Number	Percentage	
Teacher—campus based	46	23.0%	31.1%
Teacher—clinical school based	91	45.5%	61.5%
Teacher—general practice or primary care	6	3.0%	4.1%
Convenor / co-convenor (course, element or phase)	14	7.0%	9.5%
Curriculum design, overview or evaluation group or committee member	18	9.0%	12.2%
Administrator	17	8.5%	11.5%
Other	8	4.0%	5.4%
Total	**200**	**100.0%**	**135.1%**

"Other": examiner (2), ILP supervisor (3), interviewer (1), researcher (1), and Learning and Teaching Fellow (1).

Table 7.6: All UMP roles held by respondents.

All UMP Roles (coded)	Frequency	Percentage
1 only	24	16.2%
2 only	70	47.3%
3 only	2	1.4%
4 only	2	1.4%
6 only	14	9.5%
7 only	4	2.7%
1 & 2	5	3.4%
1 & 3	1	0.7%
1 & 5	4	2.7%
2 & 3	1	0.7%
2 & 4	1	0.7%
2 & 5	2	1.4%
2 & 7	3	2.0%
5 & 6	1	0.7%
1, 2 & 3	1	0.7%
1, 2 & 4	1	0.7%
1, 2 & 5	2	1.4%
1, 3 & 4	1	0.7%
1, 4 & 5	2	1.4%
2, 4 & 5	1	0.7%
4, 5 & 6	1	0.7%
1, 2, 4 & 5	3	2.0%
1, 4, 5 & 7	1	0.7%
2, 4, 5 & 6	1	0.7%
Total	**148**	**100.0%**

Code: (1) Teacher—campus based; (2) Teacher—clinical school based; (3) Teacher—general practice or primary care; (4) Convenor / co-convenor (course, element or phase); (5) Curriculum design, overview or evaluation group or committee member; (6) Administrator; (7) Other.

Respondents were relatively evenly distributed across all three phases of the UMP, with many being involved in Phase 3 (39.1%) (Table 7.7). Just over half (53.4%) the respondents were involved in more than one Phase, with Phases 2 and 3 being the most frequent combination

(30.4%) (Table 7.8). The majority of respondents (96.0%) used the Internet every one to three days (Table 7.9).

Table 7.7: Respondents by UMP Phase involvement, and percentage of cases per phase.

UMP Phase involvement	Responses		Percentage of cases (*n* = 148)
	Count	Percentage	
Phase 1 (Years 1 and 2)	57	22.5%	38.5%
Phase 2 (Years 3 and 4)	97	38.5%	65.5%
Phase 3 (Years 5 and 6)	99	39.1%	66.9%
Total	**253**	**100.0%**	**170.9%**

Table 7.8: Respondents by combined UMP Phases

All UMP Phase involvement	Count	Percentage of Total
Phase 1 only	23	15.5%
Phase 2 only	19	12.8%
Phase 3 only	27	18.2%
Phases 1 & 2	7	4.7%
Phases 1 & 3	1	0.7%
Phases 2 & 3	45	30.4%
Phases 1, 2 & 3	26	17.6%
Total	**148**	**100.0%**

Table 7.9: Frequency of Internet use (excluding email).

Use of the Internet (excluding email)	Frequency	Percentage
Every day	125	84.5%
Every two or three days	17	11.5%
Once a week	3	2.0%
Once a fortnight	0	0%
Once a month	1	0.7%
Rarely	2	1.4%
Total	**148**	**100.0%**

Map Users and Non-Users

Of the 148 staff members who responded to the survey, 109 (73.6%) had not used the Map in the last 12 months and 39 (26.4%) had used it. Table 7.10 shows the breakdown of Map users and non-users according to their staff demographics. These results show that the distribution of data across the sets of categories was somewhat unbalanced, particularly for the staff type and school location groups. There were about three times more conjoint staff than academic staff (75 to 24) amongst Map non-users, and three times more academic staff than conjoint staff (20 to 6) amongst Map users.

Table 7.10: Map users and non-users grouped by staff demographics.

Groups and corresponding categories		Q9. Have you used the Map in the past 12 months? (n = 148)		Total (n = 148)
		Yes (n = 39)	No (n = 109)	
Staff type	Academic	20	24	44
	General	10	9	19
	Conjoint	6	75	81
	Casual, sessional, affiliated, visiting	3	1	4
School location	Campus schools	16	25	41
	Clinical schools	22	81	103
	Research centres or institutes	1	3	4
UMP roles	Teacher—campus based	22	24	46
	Teacher—clinical school based	15	76	91
	Teacher—general practice or primary care	3	3	6
	Convenor/co-convenor (course, element, phase)	9	5	14
	Curriculum design, overview or evaluation group/committee member	13	5	18
	Administrator	10	7	17
	Other	2	6	8
UMP phase involvement	Phase 1 (Years 1 and 2)	26	31	57
	Phase 2 (Years 3 and 4)	32	65	97
	Phase 3 (Years 5 and 6)	23	76	99
Internet use (excluding email)	Every day	33	92	125
	Every two to three days	5	12	17
	Once a week	0	3	3
	Once a fortnight	0	0	0
	Once a month	1	0	1
	Rarely	0	2	2

The association between a respondent's use of the Map and his or her gender, age, staff type, school location, UMP role, Phase involvement or Internet use was explored through cross-tabulation analysis and the Fisher's Exact Test. Table 7.11 shows that while there was no statistically significant association between respondents' use of the Map in the previous 12 months and their gender, age, school location or Internet use, there were statistically significant associations between Map use and the following variables (see Appendix Q for cross-tabulations):

- Specific schools: more staff from MESO had used the Map (66.6% or 6 of 9; FET (n = 148) = 22.642, p = 0.043, 99% CI [0.038, 0.048]; *Cramer's V* = 0.406) (see Appendix Q Table 1).
- Staff types: more conjoint staff had not used the Map (92.5% or 75 of 81; FET (n = 148) = 36.166, p = 0.000, 99% CI [0.000, 0.000]; *Cramer's V* = 0.486) (see Appendix Q Table 2).

- UMP roles (all roles): more staff whose only role was as a clinical school-based teacher had not used the Map (94.3% or 66 of 70; (FET (n = 148) = 68.349, p = 0.000, 99% CI [0.00, 0.000]; *Cramer's V* = 0.698) (see Appendix Q Table 3).
- UMP phases (all phases): more staff whose UMP involvement was only in Phase 3 had not used the Map (100% or 27 of 27; (FET (n = 148) = 32.523, p = 0.000, 99% CI [0.00, 0.000]; *Cramer's V* = 0.462) (see Appendix Q Table 4).

Table 7.11: Results of the association of Map use with various staff demographics.

Demographic characteristics	Use of the Map in the previous 12 months (n = 148)		Fisher's Exact Test result (p-value)
	Yes	No	
Gender	39 (26.4%)	109 (73.6%)	$p = 0.352$
Age			$p = 0.239$
School location			$p = 0.085$
School (specific)			$p = 0.043$*
Staff type			$p = 0.000$*
UMP Role (for all roles)			$p = 0.000$*
UMP Phase (for all phases)			$p = 0.000$*
Internet use (excluding emails)			$p = 0.459$

Reasons for Not Using the Map

Respondents who had not used the Map in the previous 12 months were asked to briefly explain why (most respondents provided one reason, eight provided two reasons and 20 provided none). Over 80% of responses mentioned not knowing about the Map, having no need to use it, and/or not knowing how or why to use it (Table 7.12). The 109 respondents who had not used the Map had no further questions to answer and, therefore, had completed the survey.

Table 7.12: Reasons for not using the Map.

Reason for not using the Map	Responses		Percentage of cases (n = 109)
	Number	Percentage	
Did not know about it	51	43.6%	46.8%
Had no need to use it	31	26.5%	28.4%
Did not know how or why to use it	12	10.3%	11.0%
Information too detailed	1	0.9%	0.9%
Lacked time to learn about it	1	0.9%	0.9%
Time consuming to find information on UNSW website	1	0.9%	0.9%
No reason provided	20	17.1%	18.3%
Total	**117**	**100%**	**107.3%**

Associations between Demographic Variables

The association between each of the demographic variables (gender, age, staff type, school location, UMP roles, UMP phase and Internet use) for the following three population groups was also explored: (a) the 39 respondents who had used the Map, (b) the 109 respondents who had not used the Map and (c) all 148 respondents. Results of the FET p-values for each population group and combination of variables are shown in Appendix Q Table 5. These results showed significant associations between some demographic variables, although many of these were highly predictable due to the characteristics of the UMP and the staff involved. One consistent result for all three populations groups was that there was no significant association between Internet use and any of the other demographic variables. The population group of main interest was the 39 UMP Map users, and those results showed statistically significant associations between the following variables (full details in Appendix Q):

- Gender and age: more females were in the 41-50 age group ($p = 0.031$).
- Gender and staff type: more females were general staff ($p < 0.001$).
- Gender and UMP role: more females were UMP administrators ($p = 0.001$).
- Staff type and UMP role: more general staff were UMP administrators ($p < 0.001$).
- School location and UMP role: more clinical school staff were clinical school-based teachers or general practice/primary care based teachers ($p = 0.025$).
- School location and UMP phase: more campus school staff were in Phase 1 or Phases 1 and 2, and more clinical school staff were in Phases 2 and 3 ($p = 0.001$).

Section 2—Frequency of Map Use

The 39 respondents who had used the Map in the previous 12 months were required to complete a series of items covering various aspects of Map use (Questions 11 to 15 of survey). Some Likert-scale levels used in the survey were combined to facilitate the cross-tabulation analysis. In one scale, the levels 'strongly agree' and 'agree' were combined into 'agree', and the levels 'strongly disagree' and 'disagree' were combined into 'disagree', but the 'don't know' and 'neutral' levels were kept separate. In the other scale, the levels 'often' and 'sometimes' were combined into 'often', while the levels 'rarely' and 'never' were combined into 'rarely'.

The exact p-value of the Fisher's exact test (as opposed to the Monte Carlo approximation of the exact p-value) is reported in this and subsequent sections. The only two staff demographic variables used in the cross-tabulation analysis of item responses by the 39 Map users were the staff type and school location variables (this decision was in line with the analysis done in the web log and data linkage study). Table 7.13 shows the breakdown of Map users according to these two variables. Although some categories contained only one case, these categories were distinct from other categories and, therefore, were not merged. The Fisher's exact test analysis between these two variables showed no statistically significant association.

Table 7.13: Number of Map users by staff type and school location.

Staff Type	School location			Total
	Campus	Clinical	Centre/Institute	
Academic	9	10	1	**20**
General	4	6		**10**
Conjoint	1	5		**6**
Casual*	2	1		**3**
Total	**16**	**22**	**1**	**39**

*Casual: includes sessional, affiliated or visiting staff.

Of the 39 Map users, 27 (69.2%) had experienced no problems accessing the Map, and 12 (30.8%) had experienced problems. These ranged from technical problems due to the Internet or browser (3); access problems due to their password, log-in or access level (4); problems with the information's availability or accuracy (2); difficulty with navigation (1); had forgotten how to use the Map (1). Three respondents noted that their problems had been resolved. There was no statistically significant association between the response to this question and the respondent's school location (p = 0.810, FET) or staff type (p = 0.267, FET).

Table 7.14 shows the results for the frequency of Map use in the previous 12 months. Results showed a statistically significant association with the respondents' school location (FET (n = 39) = 15.438, p = 0.001; *Cramer's V* = 0.434), and the cross-tabulation showed that significantly more staff from campus schools used the Map often (75.0% or 12 of 16), and more from clinical schools used it sometimes (68.2% or 15 of 22) (also see Appendix Q Table 6).

Table 7.14: Map use in the previous 12 months.

Frequency of Map use	Frequency and percentage of responses (n = 39)	Fisher's Exact Test p-values	
		Staff type	School location
Often (daily, weekly or fortnightly)	16 (41.0%)	p = 0.091	p = 0.001*
Sometimes (monthly, or once or more per teaching period)	18 (46.2%)		
Rarely (once per year, or seldom to rarely)	5 (12.8%)		

The three most commonly used sources to find information about UMP courses were the course guide for teachers, the online course sites in WebCT Vista (or Blackboard), and the Map (see Table 7.15). Statistically significant results for this item were as follows:

- Staff type: significantly more general staff often used the course guide for students (90.0% or 9 of 10; FET (n = 37) = 8.814, p = 0.017; *Cramer's V* = 0.488) (also see Appendix Q Table 8).
- School location: significantly more campus school staff often used the online WebCT Vista/Blackboard course sites (93.7% or 15 or 16) while more clinical school staff rarely used these course sites (52.4% or 11 of 21; FET (n = 38) = 9.556, p = 0.006; *Cramer's V* = 0.498) (also see Appendix Q Table 7).

Table 7.15: Use of various sources to find information about UMP courses.

Source of UMP course information	**Frequency and percentage of responses**		**Response total (n = 39)**	**Fisher's Exact Test p-values**	
	Often	**Rarely**		**Staff type**	**School location**
Course guide for teachers	27 (71.1%)	11 (28.9%)	38	p = 0.132	p = 0.492
Online course site in WebCT Vista (or Blackboard)	26 (68.4%)	12 (31.6%)	38	p = 0.084	p = 0.006*
The Map	23 (60.5%)	15 (39.5%)	38	p = 0.401	p = 0.182
Course guide for students	20 (54.1%)	17 (45.9%)	37	p = 0.017*	p = 0.619
Open-access online course site (e.g. Primary Care website)	6 (16.2%)	31 (79.5%)	37	p = 0.629	p = 0.114

Just over 50% of respondents often used the Learning Activity Form and the content files attached to forms, while less than 50% often used any of the other Map forms, features or functions (Table 7.16). Items with statistically significant results were as follows:

- Staff type: significantly more academic staff rarely used the COF (89.5% or 17 of 19; FET (n = 38) = 9.789, p = 0.010; *Cramer's V* = 0.530) (also see Appendix Q Table 9).
- School location: significantly more clinical schools rarely used the Map's export function (91.0% or 20 of 22; (FET (n = 39) = 6.350, p = 0.028; *Cramer's V* = 0.411)) (also see Appendix Q Table 10). Analysis of specific schools showed that significantly more MESO staff often used the export function (83.3% or 5 of 6; FET (n = 39) = 15.503, p = 0.023; *Cramer's V* = 0.707).

Table 7.16: Use of various Map forms, features and functions.

Source of UMP course information within Map	Frequency and percentage of response		Response total (n = 39)	Fisher's Exact Test p-values	
	Often	Rarely		Staff type	School location
Learning Activity Forms (LAFs)	21 (53.8%)	18 (46.2%)	39	p = 0.600	p = 0.106
Content files attached to forms	20 (51.3%)	19 (48.7%)	39	p = 0.160	p = 0.258
Assessment Activity Forms (AAFs)	16 (41%)	23 (59%)	39	p = 0.275	p = 0.603
Map hyperlinks in online course sites	15 (38.5%)	24 (61.5%)	39	p = 0.702	p = 0.482
Learning Context Forms (LCF)	14 (36.8%)	24 (63.2%)	38	p = 0.830	p = 0.561
Search tool	13 (33.3%)	26 (66.7%)	39	p = 0.056	p = 0.162
Course Outline Forms (COF)	11 (28.9%)	27 (71.1%)	38	p = 0.010*	p = 0.397
Views menu	11 (28.9%)	27 (71.1%)	38	p = 0.249	p = 0.807
Export function (only available to those with editing access)	9 (23.1%)	30 (76.9%)	39	p = 0.314	p = 0.028*
Archive tool	5 (12.8%)	34 (87.2%)	39	p = 0.881	p = 0.679

A large majority (over 86%) rarely used the Map Help site or the eMed Help sites (Table 7.17). There was no statistically significant association between the use of these Help sites and the staff type or school location variables.

Table 7.17: Use of the Map and eMed help sites.

Map help site or eMed help site	Frequency and percentage of responses		Response total (n = 39)	Fisher's Exact Test p-values	
	Often	Rarely		Staff type	School location
Map Help	5 (13.2%)	33 (86.8%)	38	p = 0.378	p = 0.682
eMed Help website	4 (10.5%)	34 (89.5%)	38	p = 0.717	p = 0.370
Map online tutorial	3 (7.7%)	36 (92.3%)	39	p = 0.411	p = 0.596

Section 3—Types of Map Use

Respondents were asked to indicate how often they had used the Map for various purposes in the past three years (survey Question 16). Table 7.18 shows that over half the respondents had often used the Map either to find course information (74.4%) or provide course content (51.3%), and over half the respondents had rarely used it for any of the other reasons. Items with statistically significant results were as follows:

- Staff type: significantly more academic staff often used the Map to develop course activities (70.0% or 14 of 20; FET (n = 39) = 11.965, p = 0.003; *Cramer's V* = 0.558); prepare themselves to teach students (65.0% or 13 of 20; FET (n = 39) = 13.882, p = 0.001; *Cramer's V* = 0.587); or prepare themselves to assess students (50.0% or 10 of 20; FET (n = 38) = 8.406, p = 0.021; *Cramer's V* = 0.478). All academic staff rarely used the Map to learn about the process of learning and teaching (100.0% or 20 of 20; FET (n = 39) = 6.326, p = 0.047; *Cramer's V* = 0.426). (Also see Appendix Q Tables 11 to 14).

- School location: significantly more staff in clinical schools rarely used the Map to prepare themselves to teach students (77.3% or 17 of 22; FET (n = 39) = 5.855, p = 0.030; *Cramer's V* = 0.394). (Also see Appendix Q Table 15.)

Table 7.18: Types of Map use in the past three years.

Type of Map use	Frequency and percentage of responses		Response total (*n* = 39)	Fisher's Exact Test p-values	
	Often	Rarely		Staff type	School location
Find course information (e.g. learning activities, assessments, lecture notes, key references)	29 (74.4%)	10 (25.6%)	39	$p = 0.311$	$p = 0.222$
Provide course content	20 (51.3%)	19 (48.7%)	39	$p = 0.151$	$p = 0.630$
Review/revise activities (in a course, phase or program)	18 (46.2%)	21 (53.8%)	39	$p = 0.054$	$p = 0.251$
Develop course activities	17 (43.6%)	22 (56.4%)	39	$p = 0.003$*	$p = 0.406$
Prepare yourself to teach students	15 (38.5%)	24 (61.5%)	39	$p = 0.001$*	$p = 0.030$*
Search & retrieve information	15 (38.5%)	24 (61.5%)	39	$p = 0.096$	$p = 0.584$
Prepare timetables	14 (35.9%)	25 (64.1%)	39	$p = 0.221$	$p = 0.065$
Prepare course guides	13 (35.1%)	24 (64.9%)	37	$p = 0.707$	$p = 0.053$
Prepare assessments	12 (30.8%)	27 (69.2%)	39	$p = 0.230$	$p = 0.425$
Prepare yourself to assess students	12 (31.6%)	26 (68.4%)	38	$p = 0.021$*	$p = 0.512$
Check for gaps or redundancies (in a course, phase or program)	9 (24.3%)	28 (75.7%)	37	$p = 0.576$	$p = 1.000$
Explore the whole curriculum	9 (23.1%)	30 (76.9%)	39	$p = 0.501$	$p = 0.774$
Export data	8 (21%)	30 (79%)	38	$p = 0.356$	$p = 0.076$
Integrate data with other systems (e.g. eMed Timetable)	5 (12.8%)	34 (87.2%)	39	$p = 0.881$	$p = 0.251$
Answer professional enquiries (e.g. from medical colleges)	5 (12.8%)	34 (87.2%)	39	$p = 0.356$	$p = 0.251$
Align outcomes, activities and assessments (in a course, phase or program)	4 (10.8%)	33 (89.2%)	37	$p = 0.689$	$p = 0.364$
Learn about the process of learning and teaching	3 (7.7%)	36 (92.3%)	39	$p = 0.047$*	$p = 0.307$
Research (e.g. in an Independent Learning Project)	3 (7.9%)	35 (92.1%)	38	$p = 0.246$	$p = 1.000$
Staff development (e.g. to help staff understand the UMP)	3 (7.9%)	35 (92.1%)	38	$p = 1.000$	$p = 0.145$
Audit data (e.g. for data quality)	3 (7.9%)	35 (92.1%)	38	$p = 0.399$	$p = 0.602$
Student learning (e.g. to help students integrate what they learn in the UMP)	3 (8.1%)	34 (91.9%)	37	$p = 0.074$	$p = 1.000$
Prepare organisational reports on the UMP (e.g. Faculty reports, AMC accreditation)	2 (5.1%)	37 (94.9%)	39	$p = 0.730$	$p = 0.213$
Workforce management	1 (2.6%)	38 (97.4%)	39	$p = 1.000$	$p = 0.436$

Section 4—Effects of Map use

Respondents were asked to indicate their level of agreement with a list of statements relating to the effects of the Map on helping the UMP and the Faculty (survey Question 17). Results in Table 7.19 show that between 33.3% and 59.0% of respondents agreed with statements which directly related to developing, delivering and updating the UMP curriculum. However, about 50% were either neutral or did not know about statements which related to how the Map had helped change the human dynamics in the Faculty. Less than 25% of respondents disagreed with any one statement. Items with statistically significant results were as follows:

- Staff type: significantly more academic staff agreed that the Map supported the delivery of an integrated curriculum (75.0% or 15 of 20; FET (n = 39) = 15.555, p = 0.019, *Cramer's V* = 0.385), and encouraged teacher responsibility for course activities (50.0% or 10 of 20; FET (n = 39) = 14.868, p = 0.032, *Cramer's V* = 0.379) (also see Appendix Q Tables 16 and 17).
- School location: significantly more clinical schools staff were neutral about the Map reducing the workload of updating a course (45.5% or 10 of 22; FET (n = 39) = 12.813, p = 0.016, *Cramer's V* = 0.405) (also see Appendix Q Table 18).

Table 7.19: Effects of the Map on the UMP and the Faculty.

Effect of using the Map	Frequency and percentage of responses				Response total (n = 39)	Fisher's Exact Test p-values	
	Agree	Neutral	Disagree	Don't know		Staff type	School location
Items related to curriculum development, delivery and review (curriculum management)							
Support the delivery of an integrated curriculum	23 59.0%	7 17.9%	4 10.3%	5 12.8%	39	p = 0.019*	p = 0.654
Reduce the use of paper-based course materials	23 59.0%	7 17.9%	5 12.8%	4 10.3%	39	p = 0.435	p = 0.750
Provide a transparent curriculum	21 53.8%	7 17.9%	5 12.8%	6 15.4%	39	p = 0.305	p = 0.258
Simplify the process for updating the curriculum	19 48.7%	11 28.2%	1 2.6%	8 20.5%	39	p = 0.237	p = 0.644
Reduce the workload of updating a course	15 38.5%	13 33.3%	4 10.3%	7 17.9%	39	p = 0.195	p = 0.016*
Reduced information duplication	13 33.3%	13 33.3%	9 23.1%	4 10.3%	39	p = 0.529	p = 0.051
Items related to human dynamics in the Faculty (organisational culture)							
Encourage teacher responsibility for course activities	14 35.9%	11 28.2%	7 17.9%	7 17.9%	39	p = 0.032*	p = 0.579
Promote a shared ownership of the curriculum amongst staff	14 35.9%	11 28.2%	8 20.5%	6 15.4%	39	p = 0.322	p = 0.619
Break down discipline barriers	12 30.8%	14 35.9%	5 12.8%	8 20.5%	39	p = 0.052	p = 0.059
Promote a knowledge-sharing culture amongst staff	10 25.6%	17 43.6%	5 12.8%	7 17.9%	39	p = 0.223	p = 0.711

Section 5—Factors affecting Map use

Respondents were asked to indicate their level of agreement with a series of statements relating to the personal, technical, and organisational factors affecting the use of the Map (Questions 18 to 30 of survey). Some items applied to all Map users, while others applied only to principal teachers, course convenors/co-convenors and/or DIG members only.

Personal Factors Affecting Map Use

Respondents were asked to indicate their level of agreement with a list of statements relating to the following user-specific factors (survey Questions 18 to 22):

- Attitude
- Knowledge

- Needs
- Effect
- Rewards
- Perspectives
- Advocacy

Table 7.20 shows that of the 39 Map users, 73.7% liked using IT but only 38.5% liked using the Map to find information about the UMP with 41.0% preferring to use the paper-based course guides instead. However, 51.3% noted that they needed to use the Map.

Over half the respondents (57.9%) generally knew how to use the IT functions of the Map, and many did not think they needed IT training (43.6%) or educational training (43.6%) on how to use it. However, there were more respondents who said they needed educational training than IT training (35.9% compared to 28.2%).

Many respondents were neutral about the Map having too much information (33.3%) or too little information (38.3%) for what they needed, although a larger percentage (43.6%) did not think it had too little information. An equal percentage of respondents either agreed (28.2%) or disagreed (28.2%) that there was too much information duplication or inconsistencies between the Map, course guides and WebCT course sites, and a considerable percentage were neutral (23.7%). Considerably more agreed (38.5%) than disagreed (17.9%) that staff and students should be referred to information in the Map instead of duplicating it in the course guide, though many were neutral (30.8%).

Almost half the respondents (48.7%) generally found the Map information useful although almost as many (43.6%) were neutral or did not know. Only 21.1% said that they had too much other work to do to be using the Map. In relation to advocacy, the majority (about 50% to 54%) were neutral or did not know if it helped to have a colleague show or remind them to use the Map, although slightly more (28.2%) preferred to be shown than reminded (21.1%).

Items with statistically significant results were as follows:

Staff type:

- No conjoint staff disagreed that they generally did not need to use the Map and significantly more were neutral (66.6% or 4 of 6; FET (n = 39) = 18.463, p = 0.004, *Cramer's* V = 0.438) (also see Appendix Q Table 18).

- No conjoint staff disagreed that they needed educational training on how to use the Map, significantly more conjoint staff were neutral (50.0% or 3 of 6) and more academic staff disagreed (55.0% or 11 of 20; FET (n = 39) = 13.918, p = 0.050, *Cramer's V* = 0.370) (also see Appendix Q Table 19).

School location:

- Significantly more clinical school staff agreed that they generally did not need to use the Map (40.9% or 9 of 22) and more campus staff disagreed (75.0% or 12 of 16; FET (n = 39) = 11.057, p = 0.046; *Cramer's V* = 0.345) (also see Appendix Q Table 20).
- Significantly more campus school staff (87.5% or 14 of 16) agreed that they generally knew how to use the IT functions of the Map and fewer clinical school staff agreed (38.0% or 8 of 21; FET (n = 38) = 15.495, p = 0.004; *Cramer's V* = 0.443) (also see Appendix Q Table 21).
- Significantly more clinical school staff agreed that they needed IT training on how to use the Map (45.5% or 10 of 22) and more campus school staff disagreed (81.2% or 13 of 16; FET (n = 39) = 21.517, p = 0.000; *Cramer's V* = 0.504) (also see Appendix Q Table 22).
- Significantly more clinical school staff agreed that they needed more educational training on how to use the Map (50.0% or 11 of 22) and more campus school staff disagreed (75.0% or 12 of 16; FET (n = 39) = 19.591, p = 0.000; *Cramer's V* = 0.477) (also see Appendix Q Table 23).
- Significantly fewer clinical school staff disagreed that there was too much information duplication between the Map, course guides and WebCT Vista course sites (4.5% or 1 of 22; FET (n = 39) = 11.203, p = 0.038; *Cramer's V* = 0.396) (also see Appendix Q Table 24).

Table 7.20: Personal factors affecting Map use (all users).

Survey question and item on personal factor affecting Map use	Factor	*SUV Model		Type	Frequency and percentage of responses				Response total	Fisher's Exact Test p-value	
		*Cat.	*Level		Agree	Neutral	Disagree	Don't know		Staff type	School location
Question 18: for all Map users (*n* = 39)											
1. I generally like using the online Map to find information about the UMP	attitude	4	1	+	15 (38.5%)	13 (33.3%)	7 (17.9%)	4 (10.3%)	39	$p = 0.092$	$p = 0.309$
2. I generally prefer using the paper-based course guide to the online Map to find course information	attitude	4	1	-	16 (41.0%)	7 (17.9%)	12 (30.8%)	4 (10.3%)	39	$p = 0.403$	$p = 0.892$
3. I generally don't need to use the Map	attitude	4	1	-	10 (25.6%)	7 (17.9%)	20 (51.3%)	2 (5.1%)	39	$p = 0.004$*	$p = 0.046$*
4. I generally don't like using information technology (IT)	attitude	4	1	-	1 (2.6%)	7 (18.4%)	28 (73.7%)	2 (5.3%)	38	$p = 0.226$	$p = 0.437$
5. I generally know how to use the IT functions of the Map (e.g. its views, search, exports, archive, help functions)	knowledge	3	1	+	22 (57.9%)	7 (18.4%)	7 (18.4%)	2 (5.3%)	38	$p = 0.489$	$p = 0.004$*
6. I need IT training on how to use the Map	knowledge	3	1	+/-	11 (28.2%)	9 (23.1%)	17 (43.6%)	2 (5.1%)	39	$p = 0.423$	$p = 0.000$*
7. I need educational training on how to use the Map	knowledge	3	1	+/-	14 (35.9%)	7 (17.9%)	16 (41.0%)	2 (5.1%)	39	$p = 0.050$*	$p = 0.000$*
8. The Map has too much information for what I need	need	6	1	-	11 (28.2%)	13 (33.3%)	11 (28.2%)	4 (10.3%)	39	$p = 0.071$	$p = 0.608$
9. The Map has too little information for what I need	need	6	1	-	3 (7.7%)	15 (38.5%)	17 (43.6%)	4 (10.3%)	39	$p = 0.427$	$p = 0.839$
10. There is too much duplication of information between the Map, course guides and WebCT Vista course sites	effect	3	2	-	11 (28.2%)	15 (38.5%)	7 (17.9%)	6 (15.4%)	39	$p = 0.063$	$p = 0.038$*
11. I often find inconsistencies in information between the Map, course guides and WebCT Vista course sites	effect	3	2	-	11 (28.9%)	9 (23.7%)	11 (28.9%)	7 (18.4%)	38	$p = 0.948$	$p = 0.157$
12. I think we should refer staff and students to information in the Map instead of duplicating it in the course guides	effect	3	2	+	15 (38.5%)	12 (30.8%)	7 (17.9%)	5 (12.8%)	39	$p = 0.559$	$p = 0.593$
13. I generally find the Map information useful	reward	6	1	+	19 (48.7%)	12 (30.8%)	3 (7.7%)	5 (12.8%)	39	$p = 0.132$	$p = 0.382$
14. I have too much other work to do to be using the Map	perspective	7	1	-	8 (21.1%)	14 (36.8%)	13 (34.2%)	3 (7.9%)	38	$p = 0.773$	$p = 0.752$
15. It helps when a colleague shows me how to use the Map	advocacy	2	1	+	11 (28.2%)	16 (41.0%)	7 (17.9%)	5 (12.8%)	39	$p = 0.953$	$p = 0.379$
16. It helps when a colleague reminds me to use the Map	advocacy	2	1	+	8 (21.1%)	15 (39.5%)	11 (28.9%)	4 (10.5%)	38	$p = 0.747$	$p = 0.486$

*SUV categories: (1) goal-seeking; (2) hierarchy and relations; (3) differentiation and entropy; (4) inputs; (5) transformation process; (6) outputs; (7) regulations.
*SUV levels: (1) individual; (2) technology; (3) organisation.

Table 7.21 shows that of the 17 principal teachers, course convenors or DIG members who responded, the majority (58.8%) found it useful to complete the 'principal teacher' fields in their LAFs, and a large percentage (41.2%) made use of the information in the 'course convenor' fields to develop their learning activity although many were neutral (23.5%) or disagreed (23.5%).

While most (58.8%) thought the Map forms were suitable to capture the on-campus learning activities, most (58.8%) were neutral or did not know if the same applied to learning activities in the clinical setting. The great majority (76.5%) updated their own Map forms and did so directly online (62.5%) although some used a Word document (17.6%). A considerable percentage (41.2%) did not think that completing Map forms took up a lot of their time, although almost one quarter (23.5%) did think so. While a considerable percentage (47.1%) did not think that they had too much other work to do to be completing Map forms, more than one quarter (29.5%) did think so. While many (41.2%) felt that they personally benefitted from entering information in the Map, the majority (70.6%) felt that they got no recognition for doing so.

Table 7.21 shows that of the 12 course convenors, co-convenors or DIG members who responded, over half (58.3%) found it useful to complete the Map forms. While more than half (58.3%) regularly updated or helped to update their course's Map forms, the majority (83.3%) updated or helped to update their course guide.

Items with statistically significant results were as follows:

Staff type (principal teacher, course convenors, co-convenors and/or DIG members only):

- Significantly more academic staff disagreed with the statement that they had too much other work to do to be completing Map forms (57.1% or 8 of 14) and all general staff were neutral (100.0% or 2 of 2; FET (n = 17) = 10.392, p = 0.040; *Cramer's V* = 0.617) (also see Appendix Q Table 25).
- Significantly more academic staff agreed with the statement that they did not get any staff recognition for entering information in the Map (78.6% or 11 of 14) and none disagreed, and all general staff disagreed with this statement (100.0% or 2 of 2; FET (n = 17) = 12.671, p = 0.026; *Cramer's V* = 0.713) (also see Appendix Q Table 26).

Table 7.21: Personal factors affecting Map use (principal teachers or convenors).

Survey question and item on personal factor affecting Map use	Factor	*SUV Model		Type	Frequency and percentage of responses				Response total	Fisher's Exact Test p-value	
		*Cat.	*Level		Agree	Neutral	Disagree	Don't know		Staff type	School location
Question 20: for principal teachers, course convenors, co-convenors or DIG members only (*n* = 17)											
1. As a principal teacher, I find it useful to complete the "principal teacher" fields in my Learning Activity Forms (LAFs) in the Map	knowledge	4	1	+	10 (58.8%)	1 (5.9%)	3 (17.6%)	3 (17.6%)	17	$p = 0.169$	$p = 0.162$
2. As a principal teacher, I use the information provided in the "course convenor" fields of my LAF to help me develop my learning activity	knowledge	4	1	+	7 (41.2%)	4 (23.5%)	4 (23.5%)	2 (11.8%)	17	$p = 0.413$	$p = 1.000$
3. I generally find the Map forms suitable to capture the on-campus learning activities	need	5	2	+	10 (58.8%)	5 (29.4%)	1 (5.9%)	1 (5.9%)	17	$p = 0.603$	$p = 0.219$
4. I generally find the Map forms suitable to capture learning activities in the clinical setting	need	5	2	+	3 (17.6%)	3 (17.6%)	4 (23.5%)	7 (41.2%)	17	$p = 0.259$	$p = 0.248$
5. I generally update my own Map forms	effect	5	1	+	13 (76.5%)	2 (11.8%)	1 (5.9%)	1 (5.9%)	17	$p = 0.579$	$p = 0.099$
6. I generally update my Map forms directly online	effect	5	1	+	10 (62.5%)	3 (18.8%)	2 (12.5%)	1 (6.3%)	16	$p = 0.625$	$p = 0.206$
7. I generally use a Word document to update my Map information	effect	5	1	-	3 (17.6%)	4 (23.5%)	9 (52.9%)	1 (5.9%)	17	$p = 0.559$	$p = 0.096$
8. Completing the Map forms takes up a lot of my time	effect	5	1	-	4 (23.5%)	5 (29.4%)	7 (41.2%)	1 (5.9%)	17	$p = 0.355$	$p = 0.451$
9. I've got too much other work to do to be completing Map forms	perspective	7	1	-	5 (29.4%)	3 (17.6%)	8 (47.1%)	1 (5.9%)	17	$p = 0.040$*	$p = 0.383$
10. I don't get any personal benefits from entering information in the Map	reward	7	1	-	6 (35.3%)	3 (17.6%)	7 (41.2%)	1 (5.9%)	17	$p = 0.876$	$p = 0.771$
11. I don't get any staff recognition for entering information in the Map	reward	7	1	-	12 (70.6%)	2 (11.8%)	2 (11.8%)	1 (5.9%)	17	$p = 0.026$*	$p = 0.584$
Question 22: for course convenors, co-convenors or DIG members only (*n* = 12)											
1. As a convenor, co-convenor or DIG member, I find it useful to complete the Map forms	knowledge	5	1	+	7 (58.3%)	1 (8.3%)	3 (25.0%)	1 (8.3%)	12	$p = 0.364$	$p = 0.231$
2. I regularly update or help update the various Map forms for my course	effect	5	1	+	7 (58.3%)	3 (25.0%)	1 (8.3%)	1 (8.3%)	12	$p = 0.555$	$p = 0.470$
3. I regularly update or help update the course guide for my course	effect	5	1	+	10 (83.3%)	1 (8.3%)	0 (0%)	1 (8.3%)	12	$p = 0.455$	$p = 0.682$

*SUV categories: (1) goal-seeking; (2) hierarchy and relations; (3) differentiation and entropy; (4) inputs; (5) transformation process; (6) outputs; (7) regulations.
*SUV levels: (1) individual; (2) technology; (3) organisation.

Table 7.22 shows the results of the analysis of the internal consistency of these items. The Cronbach's coefficient alpha results of between 0.804 and 0.894 shows that the items within each of the three survey questions were relatively homogeneous for measuring the personal factors domain (i.e. these items were internally consistent and reliable).

Table 7.22: Reliability statistics of items on personal factors affecting Map use.

Reliability statistics		Q. 18: all Map users	Q. 20: principal teachers, course convenors, co-convenors or DIG members only	Q. 22: course convenors, co-convenors or DIG members only
Cases	Valid	35	16	12
	Excluded *	4	1	0
	Total	39	17	12
Number of items		16	11	3
Cronbach's alpha		0.877	0.804	0.894

*Listwise deletion based on all variables in the procedure.

Information Technology Factors Affecting Map Use

Respondents were asked to indicate their level of agreement with a list of statements relating to the following technology-specific factors (survey Questions 23 to 25):

- Data and data structure
- IT features
- Other IT systems.

Table 7.23 shows that of the 39 Map users, almost half (48.7%) agreed that the information in the Map for Phase 1 was good, although many were neutral or did not know. Many did not know about the information for Phase 2 (33.3%) or Phase 3 (43.6%).

Many (30.8%) agreed that the Map information was readable, clear and well formatted, although almost as many disagreed (28.2%) or were neutral (25.6%). A large percentage (43.6%) was neutral about the Map information being easy to understand, although more agreed (25.6%) than disagreed (17.9%). The majority (66.7%) liked having the content files attached to the Map forms and no one disagreed.

In relation to finding the Map simple to use, an equal percentage of respondents agreed (35.9%) as disagreed (35.9%). The IT features and functions of the Map met the needs of over one-third (37.8%) of respondents but many were neutral (32.4%).

The majority had experienced IT glitches when using the Map (53.8%) and when using other eMed systems (61.5%), with the majority (59%) reporting IT glitches when they occurred. A large percentage (44.7%) liked the IT features of the eMed system, although many (26.3%) were neutral.

Table 7.23 shows that of the 15 principal teachers, convenors and DIG members, the majority (53.3%) found the Map's controlled vocabulary suitable. Many (42.9%) found the Excel export function in Map Search useful, although equally as many (42.9%) did not know about it (note that only those with 'Designer' access to the Map could use this function, so those with only 'Teacher' access could not).

Items with statistically significant results were as follows:

School location:

- Significantly more clinical school staff did not know if the quality of information in the Map for Phase 1 was good (45.5% or 10 of 22) and more campus school staff agreed (68.7% or 11 of 16; FET (n = 39) = 18.562, p = 0.001; *Cramer's V* = 0.482) (also see Appendix Q Table 27).
- Significantly more campus school staff disagreed about the Map information being readable, clear and well formatted (43.7% or 7 of 16), and more clinical school staff were neutral (36.4% or 8 of 22) or did not know (27.3% or 6 of 22; FET (n = 39) = 11.676, p = 0.031; *Cramer's V* = 0.388) (also see Appendix Q Table 28).
- Significantly more campus school staff agreed that they found the Map information easy to understand (43.7% or 7 of 16), while fewer clinical school staff agreed (9.1% or 2 of 22; FET (n = 39) = 11.546, p = 0.034; *Cramer's V* = 0.382) (also see Appendix Q Table 29).
- Significantly more campus school staff agreed that they found the Map simple to use (62.5% or 10 of 16), while fewer clinical school staff agreed (13.6% or 3 of 22; FET (n = 39) = 12.090, p = 0.027; *Cramer's V* = 0.388) (also see Appendix Q Table 30).

Table 7.23: Information technology factors affecting Map use (all users and principal teachers).

Information technology factor affecting Map use	Factor	*SUV Model		Type	Frequency and percentage of responses				Response total	Fisher's Exact Test p-value	
		*Cat.	*Level		Agree	Neutral	Disagree	Don't know		Staff type	School location
Question 23: all Map users (n = 39)											
1. I find the quality of information in the Map for Phase 1 is good	data	6	2	+	19 (48.7%)	5 (12.8%)	4 (10.3%)	11 (28.2%)	39	p = 0.079	p = 0.001*
2. I find the quality of information in the Map for Phase 2 is good	data	6	2	+	12 (30.8)	10 (25.6%)	4 (10.3%)	13 (33.3%)	39	p = 0.771	p = 0.698
3. I find the quality of information in the Map for Phase 3 is good	data	6	2	+	8 (20.5)	8 (20.5%)	6 (15.4%)	17 (43.6%)	39	p = 0.512	p = 0.451
4. I find the Map information to be readable, clear and well formatted	IT feature	6	2	+	12 (30.8)	11 (28.2%)	10 (25.6%)	6 (15.4%)	39	p = 0.971	p = 0.031*
5. I find the Map information easy to understand	IT feature	6	2	+	10 (25.6)	17 (43.6%)	7 (17.9%)	5 (12.8%)	39	p = 0.207	p = 0.034*
6. I like having the content files (e.g. lecture notes, audio files) attached to the Map forms	IT feature	6	2	+	26 (66.7)	6 (15.4%)	0 (0%)	7 (17.9%)	39	p = 0.061	p = 0.369
7. I find the Map simple to use	IT feature	6	2	+	14 (35.9)	6 (15.4%)	14 (35.9%)	5 (12.8%)	39	p = 0.379	p = 0.027*
8. The IT features and functions of the Map meet my needs	IT feature	6	2	+	14 (37.8)	12 (32.4%)	5 (13.5%)	6 (16.2%)	37	p = 0.341	p = 0.458
9. I have experienced IT glitches when using the Map	IT feature	6	2	-	21 (53.8)	6 (15.4%)	7 (17.9%)	5 (12.8%)	39	p = 0.265	p = 0.175
10. I have experienced IT glitches when using other eMed systems	Other IT	6	2	-	24 (61.5)	3 (7.7%)	7 (17.9%)	5 (12.8%)	39	p = 0.254	p = 0.163
11. I generally report IT glitches when they occur	Other IT	7	2	+	23 (59.0)	8 (20.5%)	4 (10.3%)	4 (10.3%)	39	p = 0.363	p = 0.350
12. I generally like the IT features of the eMed system	Other IT	6	2	+	17 (44.7)	10 (26.3%)	5 (13.2%)	6 (15.8%)	38	p = 0.098	p = 0.656
Question 25: principal teachers, course convenors, co-convenors or DIG members only (n = 15)											
1. I find the Map's controlled vocabulary (i.e. streams, themes, content topics, graduate capabilities, thesaurus keywords) suitable for tagging the various activities, contexts and courses captured in the Map	data	5	2	+	8 (53.3)	4 (26.7%)	1 (6.7%)	2 (13.3%)	15	p = 0.478	p = 0.534
2. I find the Excel export function in Map Search useful	IT features	5	2	+	6 (42.9)	2 (14.3%)	0 (0%)	6 (42.9%)	14	p = 0.308	p = 0.775

*SUV categories: (1) goal-seeking; (2) hierarchy and relations; (3) differentiation and entropy; (4) inputs; (5) transformation process; (6) outputs; (7) regulations.
*SUV levels: (1) individual; (2) technology; (3) organisation.

Table 7.24 shows the results of the analysis of the internal consistency of these items. The Cronbach's coefficient alpha result of 0.923 for Question 23 indicates that the items within this question were relatively homogeneous for measuring the technical factors domain (i.e. items were internally consistent and reliable). However, the alpha result of 0.015 for the two items in Question 25 indicates that these items were heterogeneous (i.e. items were not internally consistent or reliable), in addition to which the negative average covariance among these two items violated the reliability model assumptions.

Table 7.24: Reliability statistics of items on technical factors affecting Map use.

Reliability statistics		**Q. 23: all Map users**	**Q. 25: principal teachers, course convenors, co-convenors or DIG members only**
Cases	Valid	37	14
	Excluded*	2	1
	Total	39	15
Number of items		12	2
Cronbach's alpha		0.923	0.015#

*Listwise deletion based on all variables in the procedure.
Negative average covariance among items violated the reliability model assumptions.

Organisational Factors Affecting Map Use

Respondents were asked to indicate their level of agreement with a list of statements relating to the following organisation-specific factors (survey Questions 26 to 30):

- Communication
- Culture
- Management
- Administration

Table 7.25 shows that of the 39 general Map users who responded, the majority (61.5%) were informed about the Map when they first got involved in the UMP, although 21.1% found out about the Map by chance. The majority agreed with using the Map to share curriculum information with staff members (66.7%) and with students (71.8%). The majority (51.3%) would like to see more teaching information such as teaching tips and ideas, lesson plans and marking guides shared through the Map's teacher-only fields, although about 33% were neutral or did not know. The majority were either neutral (30.8%) or did not know (28.2%) if they agreed with using the Map for teaching workload calculations, or with using other eMed tools for this purpose (35.9% neutral and 30.8% did not know).

In general, the majority had used the Map on their own (69.2%) and only 30.8% had used it while working with other staff members. While a large percentage (41.0%) agreed that their colleagues involved in the UMP used the Map, many (30.8%) did not know. Many (34.2%) disagreed that their School did not use the Map, although many did not know (28.9%) or were neutral (21.1%), and a considerable percentage agreed (15.8%). Most (56.4%) disagreed that their School did not use the eMed system. Most (56.4%) indicated that their School had a strong commitment to supporting the UMP, although some were neutral (17.9%) or did not know (17.9%).

Items with statistically significant results were as follows:

Staff type:

- All general staff agreed that in general they used the Map on their own (100.0% or 10 of 10) and significantly more conjoint staff were neutral (50.0% or 3 of 6; FET (n = 39) = 16.268, p = 0.012; *Cramer's V* = 0.436) (also see Appendix Q Table 31).

School location:

- Significantly more campus school staff disagreed that they had found out about the Map by chance (87.5% or 14 of 16) and fewer clinical school staff disagreed (38.1% or 8 of 21, FET (n = 39) = 13.068, p = 0.023; *Cramer's V* = 0.379) (also see Appendix Q Table 32).

Table 7.25: Organisational factors affecting Map use (all users).

Organisational factors affecting Map use	Factor	*SUV Model		Type	Frequency and percentage of responses				Response total	Fisher's Exact Test p-value	
		*Cat.	*Level		Agree	Neutral	Disagree	Don't know		Staff type	School location
Question 26: All Map users (n = 39)											
1. I was informed about the Map when I first got involved in the UMP (e.g. by a course convenor, teacher, general administrator, senior academic manager)	communication	2	3	+	24 (61.5%)	7 (17.9%)	8 (20.5%)	0 (0%)	39	*p* = 0.342	*p* = 0.571
2. I found out about the Map by chance (e.g. through an email broadcast, newsletter, casual conversation)	communication	2	3	-	8 (21.1%)	6 (15.8%)	23 (60.5%)	2 (2.6%)	38	*p* = 0.325	*p* = 0.023*
3. I agree with the organisation's use of the Map to share curriculum information with staff members	culture	2	3	+	26 (66.7%)	5 (12.8%)	3 (7.7%)	5 (12.8%)	39	*p* = 0.700	*p* = 0.207
4. I agree with the organisation's use of the Map to share curriculum information with students	culture	2	3	+	28 (71.8%)	4 (10.3%)	2 (5.1%)	5 (12.8%)	39	*p* = 0.382	*p* = 0.216
5. I would like to see more teaching information (e.g. teaching tips and ideas, lesson plans, marking guides) shared through the Map's teacher-only fields	culture	2	3	+	20 (51.3%)	6 (15.4%)	6 (15.4%)	7 (17.9%)		*p* = 0.530	*p* = 0.902
6. I agree with the organisation's use of the Map for teaching workload calculations	management	7	3	+/-	9 (23.1%)	12 (30.8%)	7 (17.9%)	11 (28.2%)	39	*p* = 0.652	*p* = 0.327
7. I agree with the organisation's use of other eMed tools for teaching workload calculations	management	7	3	+/-	8 (20.5%)	14 (35.9%)	5 (12.8%)	12 (30.8%)	39	*p* = 0.593	*p* = 0.801
8. In general I use the Map on my own	culture	2	3	+	27 (69.2%)	5 (12.8%)	5 (12.8%)	2 (5.1%)	39	*p* = 0.012*	*p* = 0.407
9. I have used the Map while working with other staff members	culture	2	3	+	12 (30.8%)	8 (20.5%)	16 (41.0%)	3 (7.7%)	39	*p* = 0.675	*p* = 0.441
10. In general my colleagues involved in the UMP use the Map	management	5	3	+	16 (41.0%)	7 (17.9%)	4 (10.3%)	12 (30.8%)	39	*p* = 0.112	*p* = 0.240
11. In general my school does not use the Map	management	5	3	-	6 (15.8%)	8 (21.1%)	13 (34.2%)	11 (28.9%)	38	*p* = 0.286	*p* = 0.678
12. In general my school does not use the eMed system	management	5	3	-	1 (2.6%)	8 (20.5%)	22 (56.4%)	8 (20.5%)	39	*p* = 0.496	*p* = 0.942
13. My school has a strong commitment in supporting the UMP	management	3	3	+	22 (56.4%)	7 (17.9%)	3 (7.7%)	7 (17.9%)	39	*p* = 0.246	*p* = 0.655

*SUV categories: (1) goal-seeking; (2) hierarchy and relations; (3) differentiation and entropy; (4) inputs; (5) transformation process; (6) outputs; (7) regulations.
*SUV levels: (1) individual; (2) technology; (3) organisation.

Table 7.26 shows that of the 17 principal teachers who responded, the majority (76.5%) disagreed with the statement that a general staff member usually completed and updated their Map forms online for them, and all disagreed with the statement that they were unable to complete or update the form because they did not have editing access to the Map.

Table 7.26 also shows that of the 11 course convenors, co-convenors or DIG members, the majority (81.8%) shared the Map work with other academic staff involved in the course, and no one agreed with the statement that they had no other academic staff to share the Map work with. The majority (54.5%) agreed that they made sure all their course's Map forms were up-to-date, although the majority (63.6%) were neutral about generally inviting principal teachers in their course to update their Map forms and instead the majority (72.7%) indicated that usually a general staff member invited their principal teachers. A large percentage (45.5%) indicated that they would like some Map procedures and guidelines to help them manage their Map work, although few (18.2%) said they would like some Map timelines to help them plan their Map work. Only one respondent (9.1%) thought the Map administrators or course administrators should do all the Map data entry for them, although five (45.5%) were neutral.

The one item with a statistically significant result was as follows:

School location:

- Amongst principal teachers, significantly more campus school staff disagreed that usually a general staff member completed the Map forms online for them (91.7% or 11 of 12) while more clinical school staff agreed (40.0% or 2 of 5; FET (n = 7) = 7.525, p = 0.027; *Cramer's V* = 0.721) (also see Appendix Q Table 33).

Table 7.26: Organisational factors affecting Map use (principal teachers or convenors).

Organisational factors affecting Map use	Factor	*SUV Model		Type	Frequency and percentage of responses				Response total (*n* = 39)	Fisher's Exact Test p-value	
		*Cat.	*Level		Agree	Neutral	Disagree	Don't know		Staff type	School location
Question 28: Principal teachers only (*n* = 17)											
1. Usually, a general staff member (e.g. map administrator, course administrator, school administrator) completes and updates my Map forms online for me	administration	3	3	-	2 (11.8%)	1 (5.9%)	13 (76.5%)	1 (5.9%)	17	$p = 0.219$	$p = 0.027$*
2. I am unable to complete or update my Map forms online because I have no online editing access to the Map	central services	3	4	-	0 (0%)	0 (0%)	17 (100%)	0 (0%)	17	NA	NA
Question 30: Convenors, co-convenors and DIG members only (*n* = 11)											
1. I share the Map work with other academic staff involved in the course (e.g. convenor, co-convenor, other DIG members, principal teachers)	culture	2	3	+	9 (81.8%)	2 (18.2%)	0 (0%)	0 (0%)	11	$p = 0.055$	$p = 1.000$
2. I have no other academic staff involved in the course to share the Map work with	management	2	3	+	0 (0%)	2 (18.2%)	9 (81.8%)	0 (0%)	11	$p = 0.055$	$p = 1.000$
3. I generally make sure that all my course's Map forms (LAFs, AAFs, LCFs and COFs) are up-to-date	administration	4	3	+	6 (54.5%)	4 (36.4%)	1 (9.1%)	0 (0%)	11	$p = 1.000$	$p = 1.000$
4. I generally invite the principal teachers in my course to update their Map forms	administration	4	3	-	1 (9.1%)	7 (63.6%)	2 (18.2%)	1 (9.1%)	11	$p = 0.618$	$p = 1.000$
5. Usually, a general staff member (e.g. map administrator, course administrator, school administrator) invites the principal teachers in my course to update their Map forms	administration	4	3	+	8 (72.7%)	2 (18.2%)	0 (0%)	1 (9.1%)	11	$p = 1.000$	$p = 1.000$
6. I would like some Map procedures and guidelines to help me manage my Map work	administration	7	3	+	5 (45.5%)	3 (27.3%)	3 (27.3%)	0 (0.0%)	11	$p = 0.758$	$p = 0.455$
7. I would like some Map timelines to help me plan my Map work	administration	7	3	+	2 (18.2%)	5 (45.5%)	4 (36.4%)	0 (0.0%)	11	$p = 1.000$	$p = 0.758$
8. I think the map administrators or course administrators should do all my Map data entry for me	administration	2	3	-	1 (9.1%)	5 (45.5%)	5 (45.5%)	0 (0.0%)	11	$p = 0.596$	$p = 0.697$

*SUV categories: (1) goal-seeking; (2) hierarchy and relations; (3) differentiation and entropy; (4) inputs; (5) transformation process; (6) outputs; (7) regulations.
*SUV levels: (1) individual; (2) technology; (3) organisation.

Table 7.27 shows the results of the analysis of the internal consistency of these items. The Cronbach's coefficient alpha result of 0.863 for Question 26 indicates that items within this question were relatively homogeneous for measuring the organisational domain (i.e. items were internally consistent and reliable). However, the alpha result of 0.320 for Question 30 indicates that its items were not homogeneous, although the deletion of item 8 ("I think the map administrators or course administrators should do all my Map data entry for me") would increase Cronbach's alpha to 0.509. The alpha result 2.353×10^{-15} for Question 28 indicates that these two items were not homogenous, in addition to which the negative average covariance among these two items violated the reliability model assumptions.

Table 7.27: Reliability statistics of items on organisational factors affecting Map use.

Reliability statistics		Q. 26 (SPSS Q33): all Map users	Q. 28: principal teachers only	Q. 30: course convenors, co-convenors or DIG members only
Cases	Valid	37	17	11
	Excluded*	2	0	0
	Total	39	17	11
Number of items		13	2	8
Cronbach's alpha		0.863	2.353×10^{-14}#	0.320

*Listwise deletion based on all variables in the procedure.
Negative average covariance among items violated the reliability model assumptions).

Section 6—Overall Perceptions of the Map

Respondents were asked to indicate their level of agreement with a list of statements relating to their overall perceptions of the Map (survey Question 31), which were based on the IS-impact measurement model by Gable et al. (2008). These items were answered by all 39 Map users. The Fisher's exact test showed no statistically significant associations between each of these five items and the staff type or school location variables. Table 7.28 shows that of the 39 Map users, a large percentage agreed that:

- The overall impact of the Map on them had been positive (46.2%), although many were either neutral or did not know (38.0% in total)
- The overall impact of the Map on the UMP had been positive (46.2%), although many were either neutral or did not know (41.0% in total)
- The overall quality of the Map as an IT system was satisfactory (43.6%), although many were either neutral or did not know (41.0% in total)

- Their overall perception of the usefulness of the Map had improved over the years (46.2%), although many were either neutral or did not know (41.0% in total)
- The overall quality of the information in the Map was satisfactory (43.6%), although many were either neutral or did not know (46.2% in total).

Table 7.28: Overall perceptions of the Map.

Impact and quality of the Map	Global items (from Gable 2008)	Frequency and percentage of responses				Response total (*n* = 39)	Fisher's Exact Test p-value	
		Agree	Neutral	Disagree	Don't know		Staff type	School location
Overall the impact of the Map on me has been positive	Individual impact of Map	18 46.2%	12 30.8%	6 15.4%	3 7.7%	39	$p = 0.209$	$p = 0.655$
Overall the impact of the Map on the UMP has been positive	Organisational impact of Map	18 46.2%	9 23.1%	5 12.8%	7 17.9%	39	$p = 0.129$	$p = 0.864$
Overall the quality of the Map as an IT system is satisfactory	System quality	17 43.6%	11 28.2%	6 15.4%	5 12.8%	39	$p = 0.527$	$p = 0.851$
Overall the quality of information in the Map is satisfactory	Information quality	17 43.6%	12 30.8%	4 10.3%	6 15.4%	39	$p = 0.154$	$p = 0.448$
Overall my perception of the usefulness of the Map has improved over the years	Individual impact	18 46.2%	13 33.3%	5 12.8%	3 7.7%	39	$p = 0.228$	$p = 0.396$

Section 7—Summated Response Scores

While previous sections reported the results of responses to single survey items, this section reports the results of the summated scores of respondents for sets of items in Sections 3 to 8 of the survey (i.e. items on the types, effects, factors and overall perceptions of Map use).

Summated Scores for Map Use

This analysis consisted of two different sets of cross-tabulations. The first set explored whether total response scores were associated with certain staff demographics, and these results were related to Hypothesis 1 (staff demographics). The second set explored other factors of Map use, and these results related to either Hypothesis 2 (types of Map use) or Hypothesis 3 (effects of Map use). Table 7.29 shows the summated range of scores used as the scales in this analysis (refer to this study's Methods section for a description of the summative scaling procedure used).

Table 7.29: Scales for total scores used in Sections 3 to 7 of survey.

Section 3: Types of Map use scale
Nil score (0) Low score (1 to 5) Medium score (6 to 10) High score (11 and above)
Section 4: Effects of Map use scale
Negative score (<=-1) Neutral score (0) Positive score (>=+1)
Sections 5, 6 and 7: Factors affecting Map use scale
Negative score (<=-1) Neutral score (0) Positive score (>=+1)

Staff demographics

The range of total scores for Section 3 to Section 7 of the survey were analysed using descriptive statistics (frequency, central tendency and dispersion measures), and were then cross-tabulated against the staff type and the school location variables using the Fisher's exact test. Table 7.30 provides a summary of the descriptive results. The FET results showed no statistically significant association between the total scores and these variables. However, as shown in Table 7.30, top scores were achieved mostly by academic staff, and many by campus-school staff.

Table 7.30: Descriptive statistics of total scores for sets of items in survey Sections 3 to 7.

Section 3: Types of Map use
Q. 16. Cases = 39 Items = 23 Mean (SD) = 5.7 (4.4) Median = 6.0 Maximum= 16 Minimum = 0 **Description of scores:** just over half the scores (51.3%) were in the medium to high range, and just under half (48.7%) were in the nil to low range. However, most scores (71.8%) were within the low to medium ranges. Of the five respondents who achieved a high score (11+), four were academic staff, and four were from campus schools. No respondent achieved the maximum score.
Section 4: Effects of Map use on the UMP and Faculty
Q. 17. Cases = 39 Items = 10 Mean (SD) = 2.8 (4.8) Median = 2.0 Maximum= 10 Minimum = -10 **Description of scores:** over half the scores (64.1%) were in the positive range, and the remaining (35.8%) were in the neutral to negative range. Most of those in the positive range were academic staff, and most were from clinical schools.
Section 5: Personal factors affecting Map use
Q. 18. Cases = 39 Items = 16 Mean (SD) = 2.3 (4.6) Median = 2.0 Maximum= 10 Minimum = -9 **Q. 20.** Cases = 17 Items = 11 Mean (SD) = 2.4 (5.0) Median = 5.0 Maximum= 8 Minimum = -7 **Q. 22.** Cases = 12 Items = 3 Mean (SD) = 1.7 (1.6) Median = 2.5 Maximum= 3 Minimum = -1 **Description of scores:** between 61.6% and 75.0% of scores were >=1. While no respondent achieved the maximum score for Questions 18 or 20, six respondents achieved the maximum score for Question 22. Except for one general staff, all those who achieved the maximum score for each question were academic staff.
Section 6: IT factors affecting Map use
Q. 23. Cases = 39 Items = 12 Mean (SD) = 1.7 (4.3) Median = 1.0 Maximum= 12 Minimum = -8 **Q. 25.** Cases = 15 Items = 2 Mean (SD) = 0.9 (0.9) Median = 1.0 Maximum= 2 Minimum = -1 **Description of scores:** between 53.9% and 66.7% of scores were >=1. One respondent achieved the maximum score for Question 23, and four respondents achieved the maximum score for Question 25. Those who achieved the maximum score for each question were academic or general staff.
Section 7: Organisational factors affecting Map use
Q. 26. Cases = 39 Items = 13 Mean (SD) = 4.4 (4.2) Median = 5.0 Maximum= 11 Minimum = -6 **Q. 28.** Cases = 17 Items = 2 Mean (SD) = 1.6 (0.7)..Median = 2.0 Maximum= 2 Minimum = 0 **Q. 30.** Cases = 11 Items = 8 Mean (SD) = 3.1 (2.4) Median = 2.0 Maximum= 8 Minimum = 0 **Description of scores:** between 76.9% and 90.9% of scores were >=1. While no respondent achieved the maximum score for Questions 26, thirteen respondents achieved the maximum score for Question 28 and one respondent for Question 30. Most of those who achieved the maximum score for each question were academic staff, and most were from campus schools.

Types, effects and factors of Map use

This analysis explored the factors of Map use in relation to Hypothesis 2 and Hypothesis 3. To test Hypothesis 2, the analysis explored the association between the range of total scores for the types of Map use (Section 3) and the range of total scores for the personal (Section 5), technical (Section 6) or organisational factors (Section 7) affecting Map use. To test Hypothesis 3, the analysis explored the association between the range of total scores for the effects of Map use (Section 4) and the range of total scores for the personal (Section 5), technical (Section 6) or organisational factors (Section 7) affecting Map use.

The total score range for Question 16 on the types of Map use (Section 3) and Question 17 on the effects of Map use on the UMP and the Faculty (Section 4) were each cross-tabulated with the total score range for Questions 18 to 30 on the personal, technical and organisational factors affecting Map use (Sections 5 to 7). As shown in Table 7.31, results were statistically significant for a number of these cross-tabulations as follows:

Types of Map use:

- Significantly more respondents with medium total scores (93.3% or 14 of 15) or high total scores (100.0% or 5 of 5) for their types of Map use had positive total scores for the personal factors affecting Map use (FET (n = 39) = 21.576, p < 0.001; *Cramer's V* = 0.541) (also see Appendix Q Table 34).
- Significantly more respondents with medium total scores (80.0% or 12 of 15) for their types of Map use had positive total scores for the technical factors affecting Map use (FET (n = 39) = 14.264, p = 0.011; *Cramer's V* = 0.472) (also see Appendix Q Table 35).
- Significantly more respondents with medium total scores (86.6% or 13 of 15) and all respondents with high total scores (100.0% or 5 of 5) for their types of Map use had positive total scores for the organisational factors affecting Map use (FET (n = 39) = 11.940, p = 0.014; *Cramer's V* = 0.441) (also see Appendix Q Table 36).

Effects of Map use:

- Significantly more respondents with a positive total score for the effects of Map use had a positive total score for the personal factors affecting Map use (80.0% or 20 of 25; FET (n = 39) = 15.549, p = 0.001; *Cramer's V* = 0.496) (also see Appendix Q Table 37).
- All course convenors and DIG members with a positive total score for the effects of Map use had a positive total score for the personal factors affecting Map use (100.0% or 7 of 7, FET (n = 12) = 9.484, p = 0.009; *Cramer's V* = 0.833) (also see Appendix Q Table 38).
- Significantly more respondents with a positive total score for the effects of Map use had positive total scores for the technical factors affecting Map use (68.0% or 17 of 25; FET (n = 39) = 9.513, p = 0.025; *Cramer's V* = 0.385) (also see Appendix Q Table 39).

Table 7.31: Results between the total scores for survey Question 16 (type of Map use) or Question 17 (effect of Map use) and Questions 18 to 30 (factors affecting Map use).

Experiences of factor affecting Map use	Question, type of respondent and number of cases	Fisher's Exact Test p-value	
		Q. 16: Types of Map use (*n* = 39)	Q. 17: Effects of Map use (*n* = 39)
Personal factors	Q. 18: all Map users (*n* = 39)	*p* = 0.000*	*p* = 0.001*
	Q. 20: principal teachers, course convenors and DIG members (*n* = 17)	*p* = 0.635	*p* = 0.145
	Q. 22: course convenors and DIG members) (*n* = 12)	*p* = 0.127	*p* = 0.009*
Technical factors	Q. 23: all Map users (*n* = 39)	*p* = 0.011*	*p* = 0.025*
	Q 25: principal teachers, course convenors and DIG members (*n* = 15)	*p* = 0.231	*p* = 0.632
Organisational factors	Q 26: all Map users (*n* = 39)	*p* = 0.014*	*p* = 0.263
	Q 28: principal teachers (*n* = 17)	*p* = 0.294	*p* = 1.000
	Q 30: course convenors and DIG members (*n* = 11)	*p* = 0.182	*p* = 0.364

Summates Scores for Certain Type of Responses

A respondent's summated score for selecting either 'don't know' or 'neutral' for items in Sections 4 to 8 of the survey were analysed to establish if there was any difference between the use of these two response levels (either individually or in combination) and a respondent's staff type or school location (i.e. these results related to Hypothesis 1). This analysis was done using a one-way between group analysis of variance (ANOVA).

The ANOVA test results for the staff type variable showed no significant difference between this variable and the mean total scores for the 'don't know' response (p = 0.514) or 'neutral' response score (p = 0.341), or for the combined 'don't know/neutral' response score (p = 0.624). Similarly, results for the school location variable showed no significant difference between this variable and the mean total scores for the 'don't know' response (p = 0.638) or the 'neutral' response (p = 0.175). However, the ANOVA result was statistically significant between the school location variable and the combined 'don't know/neutral' response score (F (2, 39) = 3.950, p = 0.028). These results showed that the mean score for clinical school staff (M = 34.05, SD = 14.03, n = 22) was significantly different from campus school staff (M = 23.38, SD = 11.66, n = 16) or centre/institute staff (M = 12.00, n = 1). The effect size, calculated using the eta squared, was 0.18 which indicated a large effect size. A post-hoc test could not be computed since there was only one case in the centre/institute group. However, the ANOVA result remained statistically significant (F (1, 38) = 6.149, p = 0.018; eta = 0.15) after excluding this one case, indicating that the significant difference in the mean score was between clinical school staff and campus school staff.

Section 8—Final Comments

Two optional open-ended questions for Map users were included at the end of the survey (Questions 32 and 33). The first question looked at what else respondents thought about the Map, and the second question looked at what they thought about other IT systems used in the UMP. All comments were classified according to the categories and factors of Map use identified in the qualitative study, and according to the levels and categories of the SUV evaluation model. Comments ranged from being highly favourable to highly unfavourable (see Appendix R for a complete list of comments).

Ten of the 39 respondents answered the Map question, and many responses covered more than one issue. There were 15 user-related issues, 14 technical issues and nine organisational issues. The most frequently mentioned issues for each category were as follows:

- Not knowing how to use the Map effectively; needing clear instructions on how to use it; not familiar with what it offers or provides (User: knowledge, need—15 issues)
- Not easy to navigate; user-unfriendly; would be more useful if links between content were visible through graphical maps (Technical: IT features—14 issues)
- Access by certain teachers was prevented due to existence of many Map access levels; many conjoint staff did not use it because of access problems (Organisational: administration, central services—nine issues).

Five of the 39 respondents answered the question on eMed and other IT systems used in the UMP. There were five user-related issues, seven technical issues and five organisational issues. The most frequently mentioned issues for each category were as follows:

- Preference for WebCT Vista as a starting point; WebCT was easier to navigate and to find course materials in, and was more reliable and user-friendly (Technical: other IT systems—seven issues)
- eMed functions could do more—e.g. monitoring/mentoring assignment and project marking; need a real map to show content links to aid students to study across topics rather than activities (User: needs—five issues)

- eMed was sometimes slow to load and work with (Organisational: central services—five issues).

Discussion

This survey study focussed on staff members involved in the UMP who had or had not used the Map in the 12 months prior to the survey's release in October 2009. These results uncovered new information on why staff members had not used the Map as well as information on those who had used it, and provided credible supportive evidence in favour of the three hypotheses. A discussion of these results follows.

Map Non-Users

The most striking result of this study was that almost three quarters of the 148 UMP staff members who completed the survey had not used the Map in the previous 12 months, and most of these were conjoint staff, clinical school-based teachers only, or involved in UMP Phases 2 and/or 3 only. Their reasons for not using the Map indicated the need to better inform staff members about the existence of the Map, its purpose and its uses. That over one quarter thought they had no need to use the Map could either indicate that they did not know what the system could be used for, or that clinical school-based teachers saw little reason to use the Map because it contained limited information about clinical teaching sessions in Phases 2 and 3 of the UMP. Another reason, as noted in a final comment, was that conjoint staff members in particular had problems accessing the Map.

Map Users

Although the number of respondents who had used the Map in the previous 12 months was small (39), their diligence in completing the required survey items, as well as the broad demographics of these respondents in relation to their staff type, school location, and UMP role as principal teacher or course convenor/DIG member meant that valuable new information was uncovered about a variety of issues pertaining to their use, perceptions, attitudes and experiences of the Map (as discussed below).

General Aspects of Map Use

While most users had no problems accessing the Map, conjoint staff members did have problems, indicating that access problems varied across staff types. The Map's many levels of user-access had also caused problems, although this could be difficult to resolve since various access levels are needed for data security reasons. Campus school staff often used the Map while clinical school staff rarely used it. This could indicate that clinical school staff may lack the knowledge, skills or perceived need to use the Map.

That the course guide for teachers was used more so than the Map or WebCT/Blackboard course sites may indicate either a preference for paper-based information or that the Map was difficult to use as was noted in some final comments. That clinical school staff rarely used the WebCT/Blackboard course sites may indicate access problems for this group in particular.

While the Map's learning and assessment forms and attachments were used often, the searching and browsing tools were rarely used which may indicate that few were using the Map to gain a holistic or 'big picture' view of the curriculum which is one of the main benefits of curriculum mapping reported in the literature. That the export function was used mostly by MESO staff and rarely by others was likely due to the administrative activities of this central office (e.g. course guide creation, curriculum audits and reviews, and the like). The archive tool was rarely used indicating that few were looking back at the curriculum from previous years.

The three online help sites with information on the technical and educational aspects of the Map were rarely used. This could indicate that users were either unaware of these sites, did not find them useful or had chosen to learn through trial and error instead of using these help sites.

Types of Map Use

The Map was being used mostly for basic information management purposes such as finding or providing course information. Some academic staff often used it for educational purposes such as reviewing, revising or developing course activities, and preparing to teach or assess students. However, clinical school staff rarely used it to prepare themselves to teach students, indicating differences in use between staff groups. The Map was rarely used for organisational purposes such as staff development, to prepare organisational reports, to audit data, or to answer professional enquiries. Staff rarely used it for more advanced educational purposes such as exploring the whole curriculum, checking for gaps or redundancies, aligning outcomes, activities and assessments, learning about the process of learning, or in student learning. These results show that the more advanced educational and organisational uses of the Map were not being realised and, hence, neither were the potentials of curriculum mapping often reported in the literature.

Effects of Map Use

The Map was seen as helping with curriculum management issues such as supporting the delivery of an integrated curriculum, providing a transparent curriculum, reducing paper-based course materials, and simplifying the process of updating the curriculum. However it was generally not seen as reducing the workload of updating a course or with reducing information duplication. Fewer thought the Map had helped with changes in organisational culture and human dynamics such as encouraging teacher responsibility for course activities, promoting shared ownership of the curriculum, breaking down discipline barriers or promoting a knowledge sharing culture. So, in general the Map was perceived as supporting curriculum management but not cultural change. While the benefits of curriculum mapping in cultural change are often reported in the literature, these results indicate that this was not being realised in this case-study.

Factors Affecting Map Use

Survey items on the factors affecting Map use covered personal, IT and organisational issues affecting all Map users, principal teachers, or course convenors and DIG members. Key topics in each of the three groups of factors, as derived from the qualitative study and embedded in survey items, are shown in bold. General references to the literature made in this section refer to issues covered in depth in the Literature Review chapter.

Personal factors

The general **attitude** seemed to be that while most liked using the Internet, and most acknowledged needing to use the Map, most also preferred using the course guides instead of the Map to find information, which once again may indicate a continued dependence on paper-based resources.

While most users were comfortable with their **knowledge** of the IT aspects of the Map, more thought they needed training on its educational aspects. This perceived need for educational training over IT training is important when organising staff development, and when promoting the learning and teaching aspects of the Map. Most principal teachers and course convenors found it useful to complete their sections of the Map and to develop their learning activities, and this supports the inherent benefit of having teachers (not administrators) complete their own mapping forms, as recommended in the literature. Even though most convenors regularly updated their forms, a substantially larger number updated their course guides, which again showed a preference for using course guides over the Map.

While most principal teachers thought the Map could suitably capture **information** about on-campus learning activities they were uncertain if the same applied to activities in the clinical setting, which may indicate that these two distinct information needs were not being met equally. Having too much or too little information, information duplication or inconsistencies between the Map, course guides and online course sites did not seem to have a major **effect** on users.

The general **perspective** was that other workload did not seem to prevent respondents from using the Map, although many were uncertain about this issue. Most principal teachers updated their own Map forms, preferring to do so online and not on paper. While most did not think this took up too much of their time or that they had too much other work to be completing forms, almost one quarter did think this was a time consuming task and that they had too much other work to be doing it. Hence, completing Map forms had a negative workload effect for one quarter of principal teachers. The added workload of curriculum mapping on teachers has been noted in the literature.

While many respondents found the Map information useful **(rewarding)**, most were uncertain, and while many principal teachers felt a benefit from completing their forms (personal reward), a large majority felt they received no recognition for it (organisational reward). There was no clear support for or against having Map **advocates**, though slightly more users preferred being shown how to use the Map than simply being reminded to use it, which is an issue that Map advocates and trainers should keep in mind.

Information technology factors

While the Map's **data quality** for Phase 1 was generally considered to be good, users were uncertain about the data quality for Phases 2 and 3. Since many staff involved in Phases 2 and 3 did not use the Map this result may explain why they did not use it and the reason for the uncertainty over data quality. Most principal teachers and course convenors found the Map's controlled vocabulary suitable for data tagging, and although many were uncertain, this result was promising since finding the right granularity for data-tagging had proven difficult over the years, and has often been reported as problematic in the medical education literature on curriculum mapping.

There was a fair degree of uncertainty and some polarised views on the Map's **IT features** relating to information readability, clarity and ease of use, and this was confirmed by a number of final comments which noted that the Map was difficult to navigate, user-unfriendly and in need of graphical maps. Hence, these issues warrant further consideration. Most respondents were uncertain as to whether the Map's IT features and functions met their needs, although most liked the content file attachments (a function introduced in mid-2008) and those with access to the Excel export function in Map Search had found it useful. Most had experienced IT glitches with the Map and other eMed systems **(other IT)**, and had reported these. In general, most liked the eMed system's IT features.

Organisational factors

Communication about the Map was generally good, with most users being informed about the Map when they got involved in the UMP. While most did not find out about the Map by chance, it is worth noting that almost one quarter of the 39 users did find out by chance. Being properly informed could well be one of the main reasons why many of these staff members were actually using the Map, particularly since many of the 109 respondents who did not use it said they did not know about it.

The **culture** of sharing curriculum information amongst staff and students was well supported by most users, who also wanted to see more teaching information shared through the Map's teacher-only fields. However, the culture of using the Map with other staff members was not prominent, with most using it on their own. However, most course convenors shared their Map work with other academics involved in the course, and all of them had other academics to share their Map work with. This result seems to indicate that course convenors were developing a more collaborative approach to curriculum mapping and course development, while others were tending to use the Map on their own.

Most were uncertain about the organisation's use of the Map or other eMed tools for the **management** of teaching workload calculations. While slightly more agreed than disagreed, and one comment indicated that the Map did not go far enough in providing accurate information on teaching workload, the literature generally discourages using curriculum mapping for staff promotion or workload issues. Respondents generally thought that their colleagues used the Map, but most were uncertain if their schools used it, which is concerning in light of recommendations in the literature that management show strong support for and leadership in curriculum mapping. In comparison, more thought that their schools were using eMed, which may indicate that some schools used other eMed tools more so than the Map. Most thought their schools had a strong commitment to supporting the UMP, which is promising since this could be harnessed to increase support for curriculum mapping.

Regarding the **administration** of the Map, most principal teachers and course convenors completed and updated their own Map forms, which is promising due to the educational and organisational benefits for teachers to be personally involved in curriculum mapping. Most course convenors indicated that a general staff member invited principal teachers to update their Map forms, which is a positive finding since inviting teachers is a time-consuming task which is best done by an experienced Map administrator. Many course convenors wanted some procedures and guidelines to help them manage their Map work, but few wanted timelines. While only one course convenor thought the Map administrator or course administrators should do all the Map data entry for them, many were neutral although just as many disagreed. These results may indicate that there are interacting educational benefits and workload challenges at play.

Overall Perceptions and Comments

A large percentage of respondents were satisfied with the IT system, with its impact on them and on the UMP, and with its improved usefulness over the years, although almost as many were uncertain about these issues. Many were uncertain about the quality of the Map's information, which is concerning since good data quality is an essential requirement of curriculum mapping as noted in the literature.

Many comments indicated that users were unfamiliar with the Map and its potential uses and wanted to know more about it. This indicates a need for better communication, staff development and cross-fertilisation of ideas, as suggested in the following comment:

> It will be tremendously helpful to have a course to visually observe the depth the use of the map has to offer. Even doing this questionnaire has motivated me to explore the use of the map a bit further. I would like to be able to be part of a hands-on group to explore the uses of the map. (Case #125)

Others said that they found the Map to be user-unfriendly and difficult to navigate, with some suggesting that the Map should show the links between topics through diagrammatic maps, and these recommendations are strongly supported in the medical education literature on curriculum mapping. The following comment about eMed in general, brought together a number of issues relating to the potential educational and organisational uses of the Map:

> I reckon that eMed functions could be used to do more than currently offered (e.g. monitoring / mentoring assignment and project marking, a real map to show content links to aid students to study across topics rather than activities etc.). (Case #33)

Evidence in Support of Hypotheses

The survey results provided clear statistically significant evidence in favour of all three working hypotheses. A discussion of this evidence follows.

From Single Items

The results for single survey items provided significant evidence in favour of Hypothesis 1, which proposed that certain staff demographics were associated with Map use. This was clearly evident amongst the Map non-users, since this group contained significantly more staff members with conjoint appointments, who were clinical school-based teachers only, or involved in Phases 2 and/or 3 of the UMP only.

Amongst the Map users, there were many statistically significant differences in the behaviours, attitudes and experiences of: (a) academic staff compared with conjoint staff, and (b) campus school staff compared with clinical school staff. Academic staff were using the Map more often to prepare their courses and to prepare themselves to teach and assess students, and were aware of the Map's purpose in delivering an integrated curriculum and in encouraging teacher responsibility for course activities. In contrast, conjoint staff were uncertain about what to use the Map for, its overall purpose in the UMP, and their actual need to use the Map, and many agreed that they needed educational training on how to use it.

Clinical school staff were often uncertain about many of the Map issues covered in the survey. They used the Map less often than campus staff. More disagreed that they generally knew how to use the Map and more agreed that they needed educational and IT training on how to use it. Few used the Map to prepare themselves to teach, while most did not know about the quality of information in the Map for Phase 1. Many found the Map difficult to use, and only clinical school staff agreed that usually a general staff member completed the Map forms online for them.

From Summated Scores

The results of summated scores for sets of items in Sections 3 to 7 of the survey (items on the types, effects and experiences of Map use) did not provide statistical evidence in favour of Hypothesis 1, although many of the top scores were achieved by academic staff, and by campus-school staff. However, results of the mean total score for the combined 'don't know/neutral' responses for items in Sections 4 to 8 of the survey did support Hypothesis 1, since the mean total score for clinical schools staff was significantly higher than for campus schools staff. This result indicates that clinical school staff seemed less certain about many of the issues covered in the survey, possibly due to a general unfamiliarity with the Map.

Summated scores also provided statistically significant evidence in favour of Hypothesis 2, since Map users who scored in the medium to high range for their types of Map use (Section 3) had significantly higher positive scores for their experiences of Map use at a personal, technical and organisational level (Sections 5 to 7). This result appears to indicate that staff members who used the Map in a variety of ways had a more positive overall experience in using it. This could be due to these users having a better understanding of the Map and its purpose, which allowed them to use it more effectively and hence to have a more positive experience. Hence, having a good understanding of what the Map can be used for is important, as reflected by this comment:

> I have managed to get information from eMed as required, but I am unaware how much more efficiently or satisfyingly the Map might have provided me with that information. (Case #120)

Summated scores also provided statistically significant evidence in favour of Hypothesis 3, since Map users with a positive score for the effects of Map use (Section 4) had significantly higher positive scores for their experiences of Map use at a personal and technical level (Section 5 and 6) but not at an organisational level (Section 7). Items on the effects of Map use explored a user's perceptions of the beneficial effects of curriculum mapping often reported in the literature. This result appears to indicate that staff members who thought the Map had helped to meet the intended effects of curriculum mapping had a more positive experience in using it, at least at a personal and technical level. The lack of statistical significance at the organisational level may indicate that organisational issues are more complex and go beyond a person's knowledge or understanding of curriculum mapping.

This evidence in support of Hypotheses 2 and 3 is important in that it tends to indicate that Map users need to know what they can use the Map for and what the beneficial effects of using the Map are. Hence, staff training should explore not only how to use the Map at a technical or administrative level but also at an educational and organisational level. This user's comment reflects this issue:

> I hope it's clear from my answers above that I have hardly used the Map and am not really familiar with what it offers. (Case #120)

Conclusion

Up until now the researcher has looked at the findings from each study separately, and from the perspective of single staff demographic factors and Map use factors. In the final Discussion chapter the researcher will bring together the findings and factors from all three studies by using the SUV evaluation model, GST and the systems thinking approach previously described in the Theoretical Framework chapter. Hence, the classification of survey items against the SUV model included in this study will be discussed in the next chapter. The final Discussion will triangulate and synthesise the results from the three studies, and discuss the empirical findings from this case-study with reference to the curriculum mapping literature covered in the Literature Review chapter.

Part 4: Discussion and Conclusion

Chapter 8 : Discussion

Overview

This final discussion chapter triangulates the results from the three studies and provides an overall interpretation of these findings using a systems thinking approach, as highlighted in Figure 8.1. This chapter synthesises the empirical findings, links these to the relevant educational literature and to systems thinking and system dynamics principles, derives practical implications from this research and offers key recommendations on curriculum map use. By combining reductionist analytical thinking methods with holistic systems thinking methods the researcher brings together what Checkland defines as “the twin components of scientific thinking” (Checkland, 1993, pp. 74-75). As Rapoport observes, “The holistic approach need not supplant the analytic. It should complement it. There is no reason why both the trees and the forest cannot be studied, each in the proper context” (Rapoport, 1976, p. 236).

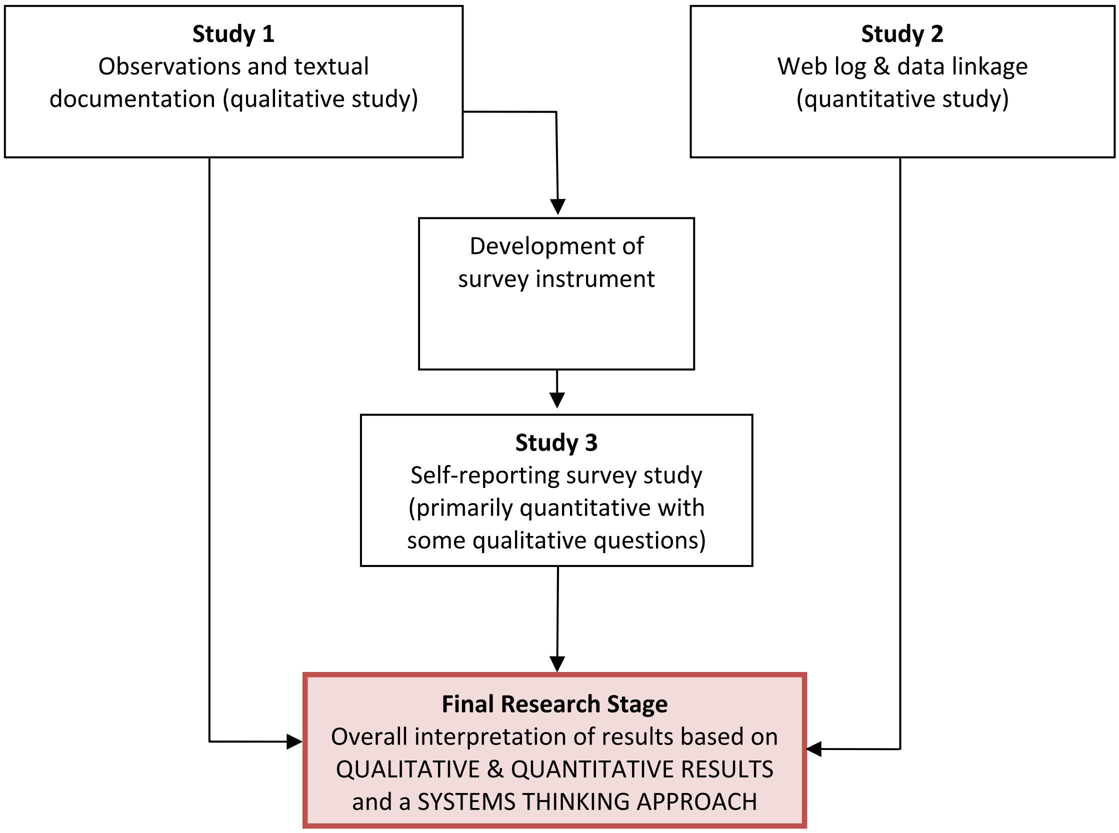

Figure 8.1: Synthesis of findings from all three studies using a systems thinking approach.

Contribution of Thesis

As discussed in Chapter 2, the educational literature has identified many of the expected benefits and desired outcomes of curriculum mapping. However, this literature has also noted the need for empirical studies that explore if these benefits or outcomes are actually being achieved, with some authors calling for research into the use and impacts of curriculum mapping in medical education and other higher education programs (Harden, 2001a; Lai et al., 2012; Sumsion & Goodfellow, 2004; Willett, 2008).

This comprehensive, mixed-methods case-study evaluation of the use of eMed Map by UMP staff represents a unique contribution to the literature. It details the different types of map use from an educational, organisational and information systems perspective. It identifies various factors and problems affecting map use related to the individual user, the educational program, the technology and the organisation. It reinterprets the domains of map use as nested and complexly interrelated systems and sub-systems. It quantifies the number and type of staff who had or had not used a curriculum map over a seven-year period and identifies their collective and individual patterns of map use. It investigates the behaviours, practices, values, beliefs and attitudes of staff towards the curriculum mapping tool and process.

This thesis clearly shows that staff type and school location are two variables strongly associated with curriculum map use in a Medical Faculty. It identifies the need to regularly inform, train and support all teaching staff in understanding the educational and organisational benefits of curriculum mapping. It recognises the need for clear policies, procedures and guidelines on map use, and for map advocates and champions to improve the system's penetration amongst staff and depth of use in education.

This thesis strengthens the existing knowledge on curriculum mapping by identifying the multiplicity of personal, educational, technical and organisational factors which can affect map use. It also extends this knowledge by using systems theory and systems thinking to understand the dynamic interactions between these factors, as discussed next in this chapter. Therefore, this thesis meets the call by Sumsion and Goodfellow (2004) for comprehensive case-study evaluations which explore the complexity and non-linearity of the curriculum mapping task.

Summary of Findings

The triangulation of data from the three studies provided empirically-based answers to the research questions posed in each study on the use of eMed Map by UMP staff. These research questions are summarised in Table 8.1.

Table 8.1: Summary of key research questions from each study.

Study 1	Study 2	Study 3
• Was eMed Map being used by UMP staff members? If so, how and if not why not? • What were staff members using it for? • What were the factors affecting its use?	• What were the general patterns of Map use? • How many UMP staff had used the Map (including Map Help) and how many had not? • Was there a relationship between the patterns of Map use and the staff characteristics of users (i.e. could the first hypothesis from Study 1 be confirmed)?	• Which staff members were or were not using the Map? • What did staff members use the Map for? • What were staff members' perceptions of the Map? • What personal, technical and organisational factors were Map users experiencing? • Was the original purpose of the Map being achieved? • Could any of the three hypotheses from Study 1 be confirmed?

Each study's results have been discussed in detail in the corresponding empirical chapter. Briefly, Study 1 identified the types of Map use, the factors affecting Map use, nine key problems related to Map use and three working hypotheses. The survey results in Study 3 confirmed the existence of many of these problems, and provided further evidence on the types and effects of Map use and the factors affecting Map use, as well as evidence in support of the three hypotheses derived from Study 1. Results from Study 2 provided quantitative evidence in support of H_1, as well as supportive evidence on the general patterns of Map use, the Map sections used, the type of UMP staff who were or were not using the Map and their UMP roles, the frequency of Map use, and the percentage of those with or without a staff ID number. This triangulation of results strengthens and corroborates findings from each individual study, and compensates for the inherent weaknesses of each study's methods (see Table 4.1). A summary of the empirical evidence from this evaluation in support of the three working hypotheses follows:

H_1: This hypothesis proposed that particular staff characteristics were associated with certain patterns of Map use (hypothesis derived from Study 1 findings that focussed on staff demographics). Results from Studies 2 and 3 provided evidence in favour of this hypothesis since there were many statistically significant relationships between Map use and staff member characteristics; and the existence of sub-groups of Map users was also evident. Study 2 showed that conjoint staff and clinical school staff did not use the Map, used it for non-meaningful session durations or used it only infrequently. Study 3 showed that there were significantly more Map non-users who had conjoint appointments, were clinical school-based teachers only, or were involved in Phases 2 and/or 3 only; and that many of these individuals did not know about the Map, what to use it for or that they needed to use it. Study 3 also showed that, amongst those who did use the Map, there were many significant differences in the behaviours, attitudes and experiences of conjoint staff compared with academic staff, and of clinical school staff compared with campus school staff. Study 3 showed no significant association between the gender, age or level of Internet use of staff members and their level of Map use; and Study 2 supported the findings on gender and age. Hence, all these findings lent support to this hypothesis.

H_2: This hypothesis proposed that what staff members used the Map for was associated with certain factors affecting Map use (hypothesis derived from the Study 1 findings on the types of Map use). The corresponding summated scores in Study 3 showed that those who used the Map in a variety of ways had significantly more positive experiences with using the system. This result may indicate that these users had a better understanding of the Map and its purpose, and hence used it more effectively.

H_3: This hypothesis proposed that what staff perceived as being effects of the Map was associated with certain factors affecting Map use (hypothesis derived from the Study 1 findings on the effects of Map use). The corresponding summated scores in Study 3 showed that those who thought the Map had helped to meet the intended effects (or goals) of curriculum mapping had a significantly more positive experience in using it at a personal and technical level, but not at an organisational level. Hence, these results lent support to the hypothesis in relation to the personal and technical levels only. That results did not lend support to the organisational level could indicate that organisational issues are more complex and go beyond an individual's knowledge, understanding or IT experience of curriculum mapping.

Typology of Map User

As suggested by Patton, after looking at patterns, categories and themes, "… the analyst can construct a typology to further elucidate findings …" (Patton, 2002, p. 459). In discussing the use of qualitative and mixed methods in system dynamics, Akcam et al. (2011) suggested a somewhat similar approach through the identification of 'reference modes' which they define as "… an abstract concept that represents a pattern of behaviour in a qualitative, intuitive, organized, integrated, and noise-free way to describe problem behaviour" (Saeed as cited in Akcam et al., 2011, p. 20). They observe that a researcher using mixed methods and qualitative data analysis can deliver reference modes with important behavioural insights about key variables.

The quantitative evidence from Study 2 on the patterns of Map use and on the staff characteristics and UMP roles of Map users revealed the existence of a typology of Map users (or reference modes), and Studies 3 and 1 supported this typology by confirming many of those findings through explanatory and qualitative evidence. What follows is a description of each of the five groups in this typology. The description also includes potential goals regarding the future behaviour of those in each group based on findings from all three studies. (A justification of the criteria and temporal thresholds used in this typology can be found in the Conclusion of Study 2.)

1. **UMP Map non-user**: Fifty three percent of all UMP staff (682 of 1292) were in this group. These staff members did not use the Map at all. There were significantly more conjoint staff and rural school staff in this group, and 57% of UMP roles were held by these Map non-users. The aim would be to substantially reduce the number of UMP staff in this group.
2. **Non-meaningful UMP Map user:** Eight percent of UMP staff were in this group (103 of 1292), which represented about 17% of UMP Map users (103 of 610). These staff members used the Map for less than one minute in seven years. Significantly more metropolitan clinical school staff members were in this group. All UMP roles had non-meaningful Map users, including two convenors (3%). The role of eMed Timetable teacher represented the largest percentage (12%), followed by the roles of principal teacher (9%) and Phase 1 facilitator (9%). The aim would be to substantially reduce the number of UMP staff in this group.
3. **Occasional meaningful UMP Map user:** Thirty three percent of UMP staff were in this group (430 of 1292), which represented about 70% of UMP Map users (430 of 610). These staff members used the Map for more than one minute in seven years, but did so infrequently at about once or twice per year (median of 9 sessions in seven years). The frequency of use by conjoint, casual and external staff in this group was significantly lower than the frequency of use by academic and general staff. Over a seven-year period, this

group had more conjoint staff and metropolitan clinical school staff in the lower range of use (1-2 sessions), more general staff in the middle range (10-17 sessions) and more academic staff in the top range (46+ sessions). In relation to UMP roles, this group also had significantly more principal teachers from metropolitan clinical schools and who were conjoint staff in the 1-2 session range, more eMed Timetable teachers who were conjoint staff in the 1-2 session range, and more committee/group members who were conjoint staff in the 6-9 session range. The aim would be to have all Phase 1 facilitators and all tutors from campus and clinical schools and from primary care in this group at least. This group would be encouraged to visit the Map at least once at the beginning of each course in which they teach to gain an overview of the course's various learning and assessment activities beyond what they teach. In general, principal teachers and committee/group members would be encouraged to become regular users and therefore move into the next group of users.

4. **Regular meaningful UMP Map user:** Six percent of UMP staff (77 of 1292) were in this group, which represented about 13% of UMP Map users (77 of 610). These staff members were identified as 'model Map users'. They used the Map regularly at about two to three times per teaching period (median of 99 sessions in seven years). There was no significant association between Map use and staff demographics, indicating that homogeneity of staff characteristics had developed at this higher level of Map use. The majority of these top Map users were eMed Timetable teachers, P1 facilitators, principal teachers and/or committee/group members, about one third were convenors, about one fifth were administrators and none were primary care clinical teachers. The aim would be to have most if not all principal teachers and committee/group members in this group at least. This group would be encouraged to visit the Map regularly so as to keep their respective Map forms up-to-date (i.e. LAFs and AAFs), and to ensure that what they teach is horizontally and vertically integrated with other activities in courses.
5. **Advanced UMP Map user**: Amongst the 6% of regular meaningful Map users (model users) there were 10 top Map users, which represented about 1% of UMP staff (10 of 1292). These staff members used the Map intensively at about two to three times per week (median of 884 sessions in seven years). Nine of these users were general or academic staff from MESO and one was a rural school administrator, and some held high-level educational administration positions. The aim would be to have all program, phase and course convenors in this group. This group would be encouraged to visit the Map frequently or for dedicated intensive periods of time each year to check that all forms for

their respective courses or phases are up-to-date (i.e. LAFs, AAFs and COFs), and to ensure their courses are horizontally and vertically integrated with other UMP courses. Another aim would be to continue having the chief Map administrators from MESO in this group, but to reduce their workload by delegating some of their Map data processing work to course convenors, phase convenors and principal teachers, and potentially to some key administrators in clinical schools (this issue will be discussed in-depth later in this chapter).

Figure 8.2 summarises the percentage of UMP staff in each of the five groups of the typology. Two major categories can be identified from this typology: (a) target groups and (b) model groups. Target groups need further training and support to improve their map awareness and use. Model groups can be used as role models of good map use behaviour and habits.

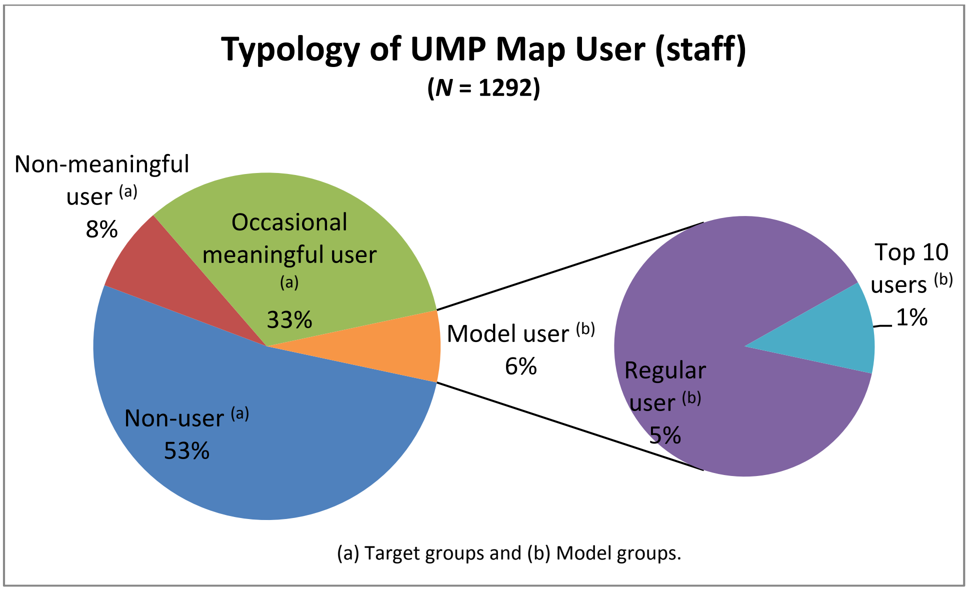

Figure 8.2: Percentage of UMP staff in each group of the typology of Map user.

An awareness of this typology of Map user should help senior UMP managers and administrators decide which groups need training, and what type of training they need. As is evident from the findings of Studies 3 and 1, each group is likely to have different levels of Map knowledge and need. School location and staff type were the two variables in Study 2 that were significantly associated with different patterns of Map use. This finding lends support to the idea that staff training be based on school location (e.g. clinical schools) as well as staff type (e.g. conjoint staff), and be targeted to those in Groups 1 and 2. Although the Map Help site provides ample information about the Map and user-specific instructions for all staff and for various UMP roles (facilitator/tutor, principal teacher, convenor, administrator), Study 2 clearly showed that almost no UMP staff accessed this information for meaningful periods (only 4% or 24 of 610), and this result was confirmed by Study 3. This finding tends to indicate that the original intention of relying on self-directed staff development (or staff development by stealth) did not work, and that different staff development approaches are needed (this issue is explored in-depth later in this chapter).

Results also suggest the need for strategic organisational change to significantly reduce the number of UMP staff in Groups 1 and 2, and increase the number of UMP staff in Groups 3, 4 and 5. This issue is explored later in this chapter, along with potential approaches to promote and support Map use. While this typology of Map user relates only to the UMP, other educational programs or organisations using online curriculum mapping systems may benefit in identifying their own typology of map user to better understand the patterns of use by their own staff and their training needs.

It is important to acknowledge that the development and maintenance of a curriculum mapping system is not only labour-intensive and time-consuming but financially expensive (Harden, 2001a; Sharma et al., 2011a; Willett, 2008). This justifies the desire to increase Map use to exploit not only its administrative advantages (e.g. content management, keeping the curriculum up-to-date) but also its pedagogical and organisational advantages (e.g. ensuring curricular alignment and integration, improving teaching, learning and cognition, promoting curriculum ownership and fostering a CoP amongst teachers). Using the Map to its full pedagogical, organisational and administrative potential may warrant a better return on investment for the Faculty in terms of the financial and human resources invested in the system.

Insights through Systems Theory

This discussion now brings together all findings from the three studies by using the holistic approach of systems theory, systems thinking and qualitative system dynamics. It synthesises the research findings, explores their implications and identifies potential intervention strategies to improve the Map's use, therefore becoming a pragmatic evaluation for action as proposed in Chapter 4. Thus far, this evaluation has analysed the two top levels of systems thinking—namely events and patterns of Map use. Next it will analyse the two bottom levels—namely systemic structures and mental models of Map use (see Figure 3.2). Therefore it will move from an 'event-event' analysis to an 'event-behaviour-structure' analysis (Maani &

Cavana, 2007). As far as the researcher is aware, this systemic type of analysis has not been done previously in a comprehensive curriculum mapping evaluation study such as this one. While Hale (2008) briefly refers to the use of systems thinking when introducing curriculum mapping into an organisation, there is no evidence from the literature that this actually has been applied to a curriculum map evaluation study.

First, this discussion employs the SUV evaluation model described in Chapter 3 to synthesise the findings from the three studies. Second, systems thinking and system dynamics principles are applied to identify leverage points in the curriculum mapping system. Third, qualitative causal loop modelling is used to identify dynamic interactions between key variables. Implications and suggestions derived from this synthesis are related to the relevant educational literature. Key recommendations to improve curriculum map use are also provided.

The process is somewhat similar to the mixed methods ICT evaluation approach recommended by Jokela et al. (2008) and by Akcam et al. (2011). As noted by Salisbury (1989, 1996), instructional design itself is strongly linked with general system theory (even though instructional designers may not be fully aware of this). Instructional designers who embrace systems theory and systems thinking describe the processes as 'systems design for change' and 'systemic change', which they define as follows:

> Systems design is the process of determining what characteristics a new system should have, resulting in a model of the new system and a plan for creating it. Systemic change is the process of changing a system from one paradigm to another by applying systems thinking and systems theory (Watson et al., 2008, p. 692).

Synthesis of Findings using the SUV Model

The SUV evaluation model by Jokela et al. (2008) was used as one of the guiding frameworks in the development of survey items in Study 3. The three levels and seven categories of the SUV model were aligned with each survey item (see Appendix P), and included in tables containing item results on factors affecting Map use (see tables in Section 5 of Chapter 7) and the last two open-ended items (see tables in Appendix R). The SUV levels and categories were also used *post factum* to classify key findings from Study 2 (see Appendix S).

The retrospective categorisation of key results from the three studies into one SUV level and category allowed for a holistic synthesis of results by systematically considering the parts of the curriculum mapping system and their mutual relations through the principles of systems theory. The definitions of the seven categories in the SUV evaluation model were adapted to incorporate the process of curriculum mapping in the UMP, as shown in Table 8.2. The categories of Map use from Study 1 were aligned with the three SUV levels which happened to be the same (i.e. individual, technology and organisation). Each of the 15 factors affecting Map use from Study 1 was aligned with one or more of the seven SUV categories. Hence, each factor was exclusive to an SUV level but not necessarily to an SUV category (see Table 8.2).

Table 8.2: SUV categories defined in relation to eMed Map use in the UMP, and the types or factors of Map use from Studies 1 and 3 arranged by SUV levels.

SUV Category	Definition of SUV category in relation to eMed Map use (adapted from Jokela et al, 2008)	Types or factors of Map use from Studies 1 & 3 arranged by SUV level		
		Individual level	**Technology level**	**Organisation level**
Goal-seeking	Overarching goals of curriculum mapping in the UMP (these goals equate to the types and effects of Map use topics described in Studies 1 and 3)	**Educational use:** -Curriculum development & improvement -Learning & teaching -Staff development -Research	**Information management use:** -Data management (index, search, export & audit curriculum data; accreditation; professional enquiries) -IT integration	**Organisational use:** -Curriculum administration & management, transparency & integration -Cultural change -Workload tracking
Hierarchy and relations	Distribution of responsibilities and information amongst staff members involved in curriculum mapping and the UMP at different hierarchical levels of the organisation.	-Advocacy		-Culture -Communication -Management -Administration
Differentiation and entropy	Specialisation of parts (individuals, technology, organisation) to perform certain tasks. Balanced degree of work distribution. Includes skills of users, alternative IT systems, training provided by organisation.	-Knowledge (skills of users)	-Other IT systems	-Administration -Management -Central services
Inputs	Resources and conditions available to implement the curriculum mapping process. Knowledge, competencies and experiences of individuals involved; attitudes and motivations; demands, expectations and fears. Technical capabilities of the Map as an IT system.	-Knowledge -Attitude -Perspective	-IT feature -Data and data structure	-Administration -Central services
Transformation process	Actual interaction where the resource inputs (input of information into the Map) is transformed into products and services (curriculum information and knowledge on learning activities, assessments, courses, graduate capabilities, teachers etc.). Interaction between human and computer.	-Effect -Knowledge	-Data and data structure -IT feature	-Management
Outputs	Results of the curriculum mapping process taking place. The services and products delivered (curriculum information and integration, and learning resources such as course guides, lecture notes, readings). Level of satisfaction with the type and quality of information in the Map, and with the IT system.	-Perspective -Need -Reward -Individual impact*	-IT feature -Other IT -Information quality* -System quality*	-Central services -Organisational impact*
Regulation	Directing transformation process towards goals of curriculum mapping through (1) policies and procedures, (2) continuous evaluation to adapt to external and internal demands and (3) opening new paths and goals within the organisation.	-Advocacy -Reward -Perspective	-Other IT	-Communication -Management -Administration

*Dimension from IS-impact measurement model by Gable (2008).

This first section covers the types and factors of Map use from Study 1 categorised according to the three SUV levels. As explained by Jokela et al. (2008), each level in the SUV model not only includes but also transcends the previous level so that complexity increases successively as one moves from the lower to the higher level (i.e. from the individual to the technology to the organisation). The categorisation of findings follows (also see Table 8.2):

Individual (personal) level: This SUV level comprises individuals and interactions between them. The educational types of Map use identified in Study 1 belong to this level since they related to various personal aspects of learning and teaching, curriculum development and improvement, staff development and research. Studies 1 and 3 showed that factors affecting Map use at a personal level related to the following topics: attitude, knowledge, need, effect, reward, perspectives, advocacy and individual impact.

Technological level: This SUV level includes individuals, computer systems and networks, and the human-computer interaction. The information management types of Map use from Study 1 belong to this level since they related to the management of curriculum data such as indexing, searching and retrieving; audit, accreditation and professional networks; and integration with other information systems. Studies 1 and 3 showed that factors affecting Map use at a technical level related to the following topics: data and data structure, IT features, other IT systems, information quality and system quality.

Organisational level: This SUV level emphasises how individuals and IT-systems are embedded in the organisational structure. The organisational types of Map use from Study 1 belong to this level since they related to curriculum management and administration; curriculum transparency and integration; change of organisational culture through breakdown of discipline barriers and shared ownership of curriculum; and teaching workload tracking. Studies 1 and 3 showed that factors affecting Map use at an organisational level related to the following topics: communication, culture, management, administration, central university services and organisational impact.

This second section looks at the key findings from all three studies organised according to the seven SUV categories. For the sake of brevity, the three levels in each category have been combined. However, single levels and categories are shown in the corresponding appendices (Appendices P, R and S). The summary of key findings under each SUV category follows. The ‘relevant factors’ come from Studies 1 and 3 (also see Table 8.2), and the ‘key findings’ come mostly from Study 3 but also from Study 2:

Goal-seeking: This category considers the overarching goals of eMed Map. These goals included various educational, information management and organisational issues already covered under the description of SUV levels in the previous section. The key findings were: (a) the Map was mostly being used to find course information and provide course content while its more advanced educational and organisational uses were not being realised, (b) many conjoint staff and clinical school staff were uncertain about the Map's goals, (c) many users agreed about the Map's positive effects on developing and delivering the curriculum but few knew about its effects on organisational change, (d) many were unsure about its potential use in teaching workload tracking, and (e) proportionally more UMP general staff than teaching staff used the Map which possibly indicates a greater use in educational administration than in learning and teaching. Hence, in general the Map was perceived as supporting curriculum management but not cultural change, and it was not being used to its full potential.

Hierarchy and relations: This category looks at the distribution of responsibilities and information amongst staff at different level of the organisation. Relevant factors were: advocacy, culture, management, communication, administration. The key findings were: (a) the existence of sub-groups of UMP Map users based around school location (campus versus clinical) and staff type (academic versus general versus conjoint) (this finding relates to H_1), (b) a general willingness by Map users to share curriculum information, (c) a tendency for staff to use the Map on their own but to also share the Map work with others, and (d) uncertainty about the benefits of having a colleague show or remind staff to use the Map. Hence, in general there were sub-groups of Map users in different areas and levels of the organisation, and there was a general willingness amongst users to share information and collaborate on Map work.

Differentiation and entropy: This category considers the specialisation of individuals, IT systems and the organisation to perform certain tasks, and includes staff training and work distribution. Relevant factors were: knowledge/skills, other IT systems, administration, management and the university's central services. Some results from the 'typology of Map user' belong to this category. The key findings were: (a) an uneven distribution of Map knowledge in which conjoint and clinical school staff knew less about the Map than general, academic and campus school staff (this finding relates to H_1), (b) conjoint and clinical school staff requested more educational and IT Map training, (c) a preference for using course guides and WebCT over the Map, (d) a perception that schools had a strong commitment to supporting the UMP, and (e) an unbalanced distribution of work between the top UMP

Map users and other users. Hence, in general there was substantial variation in the levels of Map skills and Map work across the organisation, and a preference for using other sources of UMP information instead of the Map.

Inputs: This category looks at resources and conditions to implement the curriculum mapping process, and includes the capabilities of users and the IT system. Relevant factors were: knowledge, attitude, perspective, IT features, data and data structure, administration and central services. Some results from the 'typology of Map user' belong to this category. The key findings were: (a) an uneven use of the Map and of Map Help across staff types and school locations, with clinical school and conjoint staff using these less than general, academic and campus school staff (this finding relates to H_1), (b) only LAFs were used regularly while other Map forms were rarely used, (c) course convenors favoured updating their course guides over the Map, (d) most course convenors said they ensured their Map forms were up-to-date, (e) usually a general staff member invited principal teachers to update their forms, (f) conjoint staff had more access problems, and (g) many UMP staff did not appear to have a staff ID number (most primary care teachers, some eMed Timetable teachers, and some principal teachers). Hence, in general the use of the Map and of Map Help was unevenly distributed (also evident in the typology of Map user); while convenors and principal teachers were updating the Map they preferred to update their course guides; and some staff members did not have a staff ID number so they could not access the Map by themselves.

Transformation process: This category looks at human/computer interactions where resource inputs are transformed into products and services. Relevant factors were: effect, knowledge, data and data structure, IT feature and management. The key findings were: (a) most teachers and convenors updated their own Map forms and did so directly online, and a large percentage did not find this too time consuming (significantly more were academic staff) although about one third were uncertain (significantly more were general staff), (b) the Map's controlled vocabulary was suitable for indexing the curriculum, (c) Map forms were suitable for campus activities but there was uncertainty for clinical activities, (d) in general colleagues and schools used the Map and eMed, (e) the extent and depth of Map use was limited as observed by the duration of sessions and number of session events, and (f) use of Map Help and other help sites was extremely limited. Hence, while the curriculum mapping process and system were generally suitable to capture campus activities they were considered less suitable to capture clinical activities, and the extent and depth of Map use by UMP staff was highly variable and often limited.

Outputs: This category looks at services and products delivered, and levels of satisfaction with the information and system. Relevant factors were: perspective, need, reward, individual impact, IT features, other IT, information quality, system quality, central services, organisational impact. The key findings were: (a) the Map was accessed at all times of the day and from various geographical locations, (b) the Map's LAFs and PDF documents were accessed the most, (c) the Excel export file in Search was rarely accessed, (d) the quality of Phase 1 information in the Map was considered good but there was uncertainty about the information for Phase 2 and Phase 3, (e) there were polarised views about the Map's IT features relating to information readability, clarity, ease of use, navigation and interface, (f) there were requests for graphically displayed maps with links between content, disciplines and topics (to help students study across topics rather than activities), (g) most staff had experienced glitches when using the Map, (h) many were satisfied with the Map, its impact on them and on the UMP, and its improved usefulness although almost as many were neutral, and (i) those who had a good understanding of the Map's purpose and intended effects had a better experience in using it (this finding relates to H_2 and H_3). Hence, in general users were uncertain about the quality of information in the Map for Phases 2 and 3, and about the system's information readability and clarity, ease of use, navigation and interface, with some users requesting visual maps.

Regulation: This final category looks at directing the transformation process towards the goals of curriculum mapping through policies and procedures. Relevant factors were: advocacy, perspective, reward, other IT, communication, management and administration. The key findings were: (a) while staff found it useful to use the Map, they got little recognition for using it, (b) users wanted Map procedures and guidelines (but not necessarily timelines), (c) the Map would be more useful if all staff were to use it at the same level including clinical teachers, and (d) the need for a hands-on group to explore its uses. Hence, in general Map users required more procedures and guidelines, staff recognition, and a way of promoting and exploring the Map's potential uses through a hands-on group.

Use of the SUV evaluation model helped to synthesise all results and to re-define these findings within the context of a 'whole curriculum mapping system'. However, as noted by Jokela et al "… the SUV model does not focus on causal connections but rather on pointing to possible influential factors" (Jokela et al., 2008, p. 203). Hence, causal connections are explored using the causal loop modelling phase of the Systems Thinking and Modelling (ST&M) methodology of Maani and Cavana (2007). This will help develop further insights into the practical implications of these findings.

Practical Implications and Remaining Challenges

One of the steps in the causal loop modelling phase of the ST&M methodology is to identify the leverage points of a system (see Chapter 3). Meadows' list of leverage points (see Chapter 3 and Meadows, 2005; Meadows & Wright, 2009) will now be used to explore the practical implications of the evaluation's findings and the remaining challenges. Table 8.3 aligns the Map study's key findings with their corresponding SUV category and with one or more of Meadows' leverage points. While the alignment between the SUV and leverage categories may not be exact, it neatly brings together the key research findings with these two systems-based components.

Table 8.3: Key evaluation findings aligned with the SUV categories, and with Meadows' leverage points categorised from least (L12) to most powerful (L2) intervention.

Overview of key findings from the Map evaluation in relation to SUV categories	SUV category	Leverage point category
Sub-groups of Map users existed in different areas and levels of the organisation. Willingness amongst users to share information and collaborate on Map work.	Hierarchy and relations	L2: Paradigm or mindset
The Map was not being used to its full potential in learning and teaching or in organisational change.	Goal-seeking	L3: Goals
Substantial variation in the levels of Map skills and Map work across the organisation. A preference for using other sources of UMP information other than the Map.	Differentiation and entropy	L4: Self-organisation
Map users required more procedures and guidelines, staff recognition, and a way of promoting and exploring the Map's potential uses such as a hands-on group.	Regulation	L5: Rules
In general users were uncertain about the quality of information in the Map for Phases 2 and 3, and about the system's information readability and clarity, ease of use, navigation and interface, with some users requesting visual maps to use with students.	Outputs	L6: Information flows L9: Delays
While some UMP staff were using the Map, the extent and depth of their use was highly variable and often limited. While the curriculum mapping process and system were generally suitable to capture campus activities they were considered less suitable to capture clinical activities.	Transformation	L7: Reinforcing feedback loops L8: Balancing feedback loops
Use of the Map and of Map Help was unevenly distributed (also evident in the typology of Map user). Convenors and principal teachers were updating the Map but they preferred to update their course guides. Some staff had no ID number to access the Map.	Inputs	L10: Material stocks and flows L11: Buffers L12: Numbers

This discussion will go through each of Meadows' leverage points and their characteristics, relate each point to the relevant findings from this Map study and to the relevant educational literature, and derive practical implications and potential interventions for improving the overall use of the curriculum mapping system. The discussion starts with the leverage of numbers (the least powerful intervention on the list) and finishes with the leverage of paradigms (the second most powerful intervention on the list). It will then use causal loop modelling to identify one key condition in the system that requires special attention.

Numbers, Buffers, Stock and Flow Structures

Numbers are the constants or parameters related to the stocks and flows in the system. Stock and flow structures are the physical systems and their nodes of intersection. Buffers are the sizes of stabilising stocks relative to their flows. Although numbers are popular intervention points because they can be varied, they come last on Meadows' list of powerful interventions because changing these variables rarely changes the system's behaviour. While the physical structure in a system is crucial it is a low leverage point because changing the structure is rarely quick or simple. The physical structure's leverage point is in proper design in the first place and, after it is built, in understanding its limitations and bottlenecks, using it with maximum efficiency and refraining from fluctuations or expansions that strain its capacity. All these leverage points are mostly physical entities and are hard to change, and therefore are at the bottom of Meadows' list (i.e. levels 12, 11 and 10). In general, these points relate to the SUV 'inputs' category.

The Map is the physical structure of the whole curriculum mapping system. The number of UMP Map users is part of the stock while the level of Map use (number of sessions, durations and events per user per unit of time) and the information in and out of the Map (data, information, learning materials, knowledge) are part of the flow. The number of UMP staff is part of the buffer. This evaluation has provided concrete data on these quantitative variables, which is essential in understanding the whole system. It has also provided evidence on the patterns of these Map use variables over time (see Figure 6.24 and Table 6.16, and Figure 6.26). Behaviour over time is an important tool in systems thinking and causal loop modelling since it provides significant insights into the underlying dynamics present in the system (Maani & Cavana, 2007). For example, Figure 6.24 showed that an increase in Map users did not necessarily equate to an increase in the duration of Map use or the number of session events, and knowing that this dynamics exists between variables is important when interpreting overall Map use results. The typology of Map user provided information on the numbers and material stocks and flows—namely how many people were involved in the UMP, how many UMP staff used the Map, how many did not, which Map sections and forms (i.e. information) they accessed etc. Knowing that this typology exists and that there are distinct sub-groups of Map users based on school location and staff type variables is important in understanding the whole system and its limiting variables. The previous suggestions to increase or decrease the number of users based on this typology also relate to these leverage points. However, these are the lowest of leverage points on Meadows' list.

The Map's physical design had been based on sound instructional design principles and information systems development practices (see Chapter 1). Most of the Map's IT system requirements had been built by late 2008 except for its data visualisation functions. The Map's educational design had been intended to support not only the administration and management of curriculum information, but also self-directed staff development (or staff development by stealth), learning, teaching and cognition, and a UMP CoP. Built into the Map's physical design exists what Cabrera defines as 'expert or distributed knowledge' (Cabrera & Colosi, 2008; Cabrera, 2007a). (Using Cabrera's analogy, an ergonomic chair contains distributed knowledge designed 'into' the chair that is interacting with one's body to remind one how to sit.) Like Cabrera's ThinkBlocks (which were designed to teach systems thinking) the Map had expert knowledge designed into its structure to help staff and students think about the UMP and about medicine in general as they used the tool. The Map's various browsing views and search functions were intended to allow the user to 'zoom in and out' of curriculum information and to start seeing the relations between its parts in line with Reigeluth's elaboration theory of instructional design (Van Patten et al., 1986). In using the Map, it was thought a staff member (or student) would be able to learn about the UMP's content and activities, structure and sequencing, educational goals and graduate capabilities, and therefore appreciate the knowledge, skills and attitudes that students would need to develop to become safe beginning medical practitioners. Cabrera observes that by distributing knowledge into a tool one can free up cognitive knowledge to think about higher levels of things (Cabrera, 2007b). It is in this sense that the Map was thought to have potential as a cognitive and meta-cognitive tool. The link between Reigeluth's elaboration theory and the educational uses of hypermedia and of hierarchical maps similar to Reigeluth's graphical synthesisers has also been noted by others (Hoffman, 1997; Rouet & Potelle, 2005). However, to benefit from the Map's built-in 'distributed knowledge', UMP staff needed to use the tool and this research has clearly shown that most UMP staff had not used it. Yet, comments from some UMP staff about how using the Map had 'sharpened the brain' (Study 1) show some promise. Although improving the Map's navigation and graphical interface may well improve its use, too much focus on the technology (the system's physical structure) may prove counterproductive if other strategies to increase staff uptake are not implemented as well.

This evaluation also uncovered a main physical limitation and bottleneck with Map access related to staff ID numbers, since without this number staff members were unable to access the system by themselves. A potential intervention would be to provide teaching staff with administrative assistance in acquiring an ID number. However, Study 1 revealed that this issue was complex since there were University rules for acquiring a staff ID number and protocols for activating it once acquired. Hence, not all primary care teachers would be able to acquire a staff ID number, and clinical or conjoint teachers often did not have to time to activate it. An alternative intervention would be to encourage senior UMP students in Phases 3 and 2 to show their clinical and primary care teachers the Map since all students have access to it. Learning activities could be built into the curriculum whereby students and clinicians sit side by side exploring the Map in relation to particular clinical disciplines (e.g. at the start of a new clinical or community placement). This intervention would not only get around the technical problem of staff ID numbers and access, but it would promote the adult teacher-learner relationship designed into the UMP (McNeil et al., 2006), a practicing partnership between students and teachers (Dean, 2004), and use of the curriculum map in actual learning and teaching activities (Harden, 2001a).

In general, the increases in Map use proposed in the typology of users section should not strain the system's IT capacity or risk the Map's data quality since most users would have 'Readers' access only. However, access from clinical sites (e.g. behind hospital firewalls) or from rural and remote areas need checking since Study 3 revealed that conjoint staff in particular had access problems. The proposed increased use by principal teachers and course convenors was partly intended to increase data quality. However, care is needed since having editing privileges to the Map allows users to edit forms other than their own, and this could unintentionally compromise data quality (this issue is discussed further under the 'rules' leverage point).

The curriculum mapping literature also provides useful recommendations regarding the technology's physical structure and access issues. Recommendations include having a system that is dynamic, user-friendly and interactive (Harden, 2001a; Lee et al., 2003), that provides a range of views and allows for easy query of data and retrieval of accurate answers (Harden, 2001a; Mattern et al., 1992; Nowacek & Friedman, 1995), and that can capture the past, present and planned curriculum of various student cohorts (Harden, 2001a). Data should be clean, accurate and consistent (Weinstock, 2009). The IT system should use a relational (or relation-like) database or a series of linked databases (Mattern et al., 1992; Willett, 2008), and the smallest unit of analysis (e.g. course, time block, individual learning activity) should be carefully selected (Mattern et al., 1992; Nowacek & Friedman, 1995). Since the most expensive part in developing a curriculum mapping system is the personnel cost (programmers, support staff, educational designers, content creators), making good choices in system design can reduce the cost by avoiding the need to overhaul the system every few years to stay in line with IT changes (Lee et al., 2003). Access to the map should be open to all potential users within an educational program including students (Harden, 2001a).

Balancing and Reinforcing Feedback Loops

Balancing or reinforcing feedback loops are the information and control parts of the system, and more leverage can be found here than in the physical parts. A balancing or negative feedback loop needs a goal (e.g. a thermostat setting), a monitoring device (e.g. a thermostat) and a response mechanism (e.g. a heater or cooler). The strength of the balancing loop is to keep its appointed stock at or near its goal. A complex system usually has a number of balancing feedback loops so it can self-correct under different conditions, including during rare emergencies. A reinforcing or positive feedback loop is a source of growth which drives system behaviour in one direction. If unchecked a reinforcing loop tends to lead to system collapse. Reducing the gain around a reinforcing loop (e.g. slowing the growth down) is usually a more powerful leverage point than strengthening the balancing loops, and far more preferable than letting the reinforcing loop run. These leverage points sit at number 8 and 7 on Meadows' list. In general, they relate to the SUV 'transformation' category.

The balancing loops of the Map should aim to keep the number of Map users at or near its goal, as proposed in the 'typology of Map user' section. This evaluation has itself acted as monitoring device and its implications and suggestions could be seen as part of the response mechanisms which aim to achieve the Map's goals. Results have shown that the original goals of the Map have only partially been met. While in general the curriculum mapping process and system is working for campus activities and staff, this evaluation has shown that it is not working as well for clinical activities and staff. Hence, the Map's 'transformation' process needs further monitoring and improvement to achieve the system's goals. However, the feedback loop is currently lacking a long-term monitoring device and timely response mechanisms. The central roles played by the Map administrators, the UMP's eMed Reference Group and the Program Evaluation and Improvement Group (PEIG) lends support to the idea that the Map's monitoring system be located in one or more of these groups. Monitoring devices could include simplified versions of the methods used in this evaluation (e.g. analysis of web log reports or use of surveys), and other qualitative evaluation methods such as focus groups and key informant interviews.

Study 2 showed that while rates of Map use by most staff were small to moderate, this was not the case for the top Map users and in particular for the Map administrators. This finding points to an over-reliance on the input from Map administrators, and to a reinforcing feedback loop in the system's administrative support mechanism that may be growing out of control. While having the support of administrative staff and expert librarians is recognised as being highly beneficial in curriculum mapping (Howard, 2010; Lee et al., 2003) there is also danger in over-relying on one or two individuals to sustain the system. Hence, it would be important not to let this reinforcing loop run to collapse. Slowing down the growth of Map use by the Map administrators could be achieved by re-distributing some of their workload back to the course convenors and principal teachers, and potentially to some clinical school administrators if those schools were to increase their Map use in future. While Map administrators would need to refrain from over-assisting model Map users, they may need to strengthen their assistance of one-off principal teachers who may never become regular users. This issue is discussed in-depth under the section on 'shifting the burden'.

It is essential to acknowledge that curriculum mapping is a continuous and dynamic process that requires a long-term commitment to ongoing data management, since the curriculum is a living entity and maps need continuous revision, review and re-alignment (Bell et al., 2009; Hale & Dunlap, 2010; Harden, 2001a; Kopera-Frye et al., 2008; Mills, 2003; Tramaglini, 2005; Uchiyama & Radin, 2009). A curriculum map's content requires continuous maintenance (e.g. for consistency, accuracy, currency). Hence, it is necessary to decide who will do this task (e.g. teachers, administrators, students) (Mattern et al., 1992) while also keeping in mind that teachers need to develop a sense of ownership of the map (Britton et al., 2008; Hale, 2008; Hale & Dunlap, 2010; Harden, 2001a). As well, in encouraging teachers to take responsibility for creating and maintaining the system's content, they are sharing the responsibility of producing their teaching community's body of knowledge, and are therefore cultivating a CoP (Wenger et al., 2002) and a learning organisation (Hale, 2008; Senge, 2006). As noted by Hale

(2008), if a learning organisation is truly committed to long-term curriculum mapping then personal and collective understanding and application needs to grow steadily until implementation naturally gives way to sustainability and normalcy.

Information Flows and Delays

Information flows relate to who does or does not have access to information. This is a high leverage point in the system's information structure (number 6 on the list). Meadows notes that missing information flows is one of the most common causes of system malfunction, and adding or restoring information can be a powerful intervention which is easier and much cheaper than re-building physical infrastructure. Delays refer to the length of time relative to the rates of system changes. Since delay length is not easy to change (e.g. building the physical components of a system takes time) it is number 9 on Meadow's list. However, if there is a delay in the system that can be changed then doing so can have big effects on the system. In general, these two leverage points relate to the SUV 'outputs' category.

Findings from the survey showed that a significant problem existed with the provision of Map information to clinical school staff, conjoint staff and those in Phase 2 or 3 of the UMP. Many of these UMP staff members did not know about the Map or did not know how to use it or even if they needed to use it. How best to transmit this information to clinical and conjoint staff who already may be suffering from information overload warrants careful consideration. One option would be to use Map advocates (colleagues or senior students) to introduce them to the Map and show them how to use it. Survey results also showed that users were doubtful about the quality of Map information for Phases 2 and 3, so improving the quality of this mostly clinical information could provide a more compelling reason than exists now for clinical teachers to use the system. The literature often cites the need to provide adequate training and information (e.g. Britton et al., 2008; Harden, 2001a; Salas et al., 2003), and this is discussed in depth-under the section on 'shifting the burden'.

Study 1 revealed two major delays in the overall system which affected the Map's use. These were delays in the development of the Map application (the system's physical structure) and unavoidable delays in the development of the UMP (a 6-year program which commenced in 2004). Study 1 showed that delays in the Map's physical structure in 2007–2008 were affecting how the Map was being used. These delays were resolved by late 2008 when most of the system's outstanding functions were completed except for its graphical interface. This was made possible by the formation of the eMed Reference Group and its process for prioritising IT development tasks. Study 3 showed that a number of Map users were dissatisfied with the Map's navigation functions (i.e. ways of extracting information) and some suggested having visual maps with links to topics for students and staff to use. This continuing delay in providing a graphical interface seems to be affecting the Map's use in learning and teaching, and in data-driven decision making. Hence, the Map's current information outputs, navigation functions and graphical interface need further development.

Based on the curriculum mapping literature, there may be a need for two distinct graphical interfaces—one for learning and teaching (e.g. concept maps) and another for data-driven decision making (e.g. a dashboard function for data mining). The literature on concept mapping techniques and technologies for education is extensive and warrants careful consideration (e.g. Coffey et al., 2003; Novak, 1990; Novak & Cañas, 2008; Novak & Gowin, 1984; Sherborne, 2008). Some authors have explored the benefits of various types of content representation such as hierarchical maps, network maps and site maps (Earl, 2007; Kiewra, 2002; Robinson & Kiewra, 1995; Rouet & Potelle, 2005; Shapiro, 2005), and of integrating course management, concept mapping and digital libraries (e.g. Marshall, Chen, Shen, & Fox, 2006). Others have explored the use of concept maps in curriculum development (Edmondson, 1995; Morsi, Ibrahim, & Williams, 2007; Starr & Krajcik, 1990), in learning activities and cognition (Buzan & Buzan, 1993; Horton et al., 1993; Jairam & Kiewra, 2010; Tohyama & Miyake, 2011; van Boxtel, van der Linden, Roelofs, & Erkens, 2002; Wandersee, 1990), and in student assessments (Kassab & Hussain, 2010). The use of knowledge management systems in curriculum development and teaching has also been explored (e.g. Cain, Rodman, Sanfilippo, & Kroll, 2005; Dutta, 2009; Marshall et al., 2003; Paquette, Rosca, Mihaila, & Masmoudi, 2007; Spector, 2002; Spector & Edmonds, 2002; Wigal, 2005). Concept mapping technologies currently exist which could integrate with the Map such as the Visual Understanding Environment (VUE) system (Tufts University, 2008), and the Dynamic Learning Maps system (JISC The Design Studio, 2010; McGill, 2011; Newcastle University UK, 2010). The automated document indexing functions of the KnowledgeMap system (Denny, Irani, et al., 2003; Denny & Smithers, 2002; Denny et al., 2005; Denny, Smithers, et al., 2003) could also be considered, particularly in light of a comment from a UMP course convenor in Study 1 about maybe needing to map not only what is being taught in the UMP but also what is not being taught but should be. The automated indexing and concept extraction solutions of KnowledgeMap could also be useful since lecturers and course directors have limited time and resources to do this manually (Denny, Smithers, et al., 2003; Willett, 2008). The graphical interface needed for data-driven decision making and statistical analysis for curriculum improvement (e.g. Streifer, 2002) is likely to require a dashboard function to analyse and interpret the data visually (e.g. Weinstock, 2009). Some curriculum mapping and management systems used in medical education already contain such data visualisation and reporting systems, including the CATs reports (McGrath et al., 2006) and the AAMC MedAPS curriculum reports (Association of American Medical Colleges, 2012b).

The survey showed that most users were satisfied with the Map's controlled vocabulary. This indexing vocabulary is standardised, consistent, known to users and based on a modified version of the Medical Subject Headings (MeSH) as recommended by others (Mattern et al., 1992; Willett et al., 2008), so theoretically it should work well in linking elements for concept mapping.

The Map's educational design and original system requirements were developed in 2003-2004, and without full knowledge of the mapping needs of Phase 3 which commenced in 2008. Although parts of the Map were adapted in 2007–2008 to meet the Phase 3 mapping requirements, survey findings showed a considerable user uncertainty about the suitability of the Map's forms to capture clinical activities. Now that the development of the UMP has been completed and its rate of change has stabilised, it would be timely to revisit the curriculum mapping needs of clinical teachers in Phases 3 and 2 of the UMP, and re-explore the need to capture information about senior students' clinical encounters. Educational technology systems to capture such encounters are reported in the medical education literature (e.g. Benjamin et al., 2006; Crouch et al., 2005; Hatfield & Bangert, 2005; Prince et al., 2011; Wardle et al., 2011). The benefits and challenges experienced by Faculty staff and clinical supervisors in curriculum mapping clinical activities in other higher education programs are also starting to appear in the literature (Baecher, 2012).

Finally, delays were not only due to educational design and IT development issues but also due to funding the Map's continued development. Although external educational grants were not secured, the Faculty continued providing good financial support (Study 1). As noted by Mattern, "The true worth of a system is often revealed by the willingness of an institution, having invested once to set it up, to invest continuously in its maintenance" (Mattern et al., 1992, p. 17).

Rules

The rules of the system define its scope, boundaries and degrees of freedom. Rules relate to incentives, punishments and constraints, and are high leverage points (number 5 on list). Meadows notes that those setting the rules of a system yield a certain amount of power, and suggests that "If you want to understand the deepest malfunctions of a system, pay attention to the rules and to who has power over them" (Meadows & Wright, 2009, p. 158). In general, this leverage point relates to the SUV 'regulations' category.

Rules exist on who can or cannot edit information in the Map. Some rules are encoded in the technology (through access restrictions to individual fields or forms) and in the user's access level (reader, teacher, convenor or administrator access), and other rules are general protocols or social agreements. Although some survey respondents commented that having different access levels affected their use of the Map, these rules are necessary to ensure data quality and are unlikely to change. In general, the technology's existing editing rules are flexible in that those with editing rights (i.e. teacher, convenor or administrator access) can edit not just their own Map forms but those of others. This design was intentional to facilitate collaboration and teamwork amongst staff when revising curricular activities. While so far this procedure has worked well, it will be important to regularly remind those with editing rights to only edit their own forms. In the case of one-off principal teachers, the protocol noted in Study 1 whereby the Map administrators update these forms on behalf of the teacher should prevail. Study 1 showed that being a principal teacher of an activity in the Map carried some kudos, and that a protocol exists for changing a principal teacher in the Map. Study 1 also showed the importance of properly maintaining the eMed Access Manager system and the editing rights of Map users once they were no longer involved in the UMP (e.g. after leaving the Faculty). While the problem with out-dated information in eMed Access Manager identified in Study 1 was brought under control in 2009, this system will need continued monitoring and updating at a central level (e.g. through MESO and/or the MCSU).

Study 1 also showed that course convenors and DIG members needed clear rules on when they (or their principal teachers) should or should not update their Map forms, and Study 3 confirmed that these staff members required some guidelines. It was also observed that regular reminders of existing rules were necessary to encourage principal teachers and convenors to update their own Map information and be accountable for its quality.

Study 3 showed that a significant number of staff felt they got no recognition for using the Map. Associating the Map's rules with incentives (or punishments) could help recognise the effort of those who use the system and update their forms. The literature generally recommends offering appropriate incentives to encourage and reinforce curriculum mapping amongst staff, such as recognising map work as a teaching activity which attracts credits (Harden, 2001a), or stipends, presentations at teaching conferences, publications and the like (Kopera-Frye et al., 2008). However, Studies 1 and 3 showed that DIG members often shared their mapping task, so crediting only one person could have unintended consequences. Hence, UMP incentives may need to be more intrinsic, and be built on the attitude of staff towards collaborative curriculum mapping, sharing information with students and teachers, and building a CoP (Hale, 2008; Kallick & Wilson, 2004). Along with the kudos of being a principal teacher or course convenor comes the responsibility of mapping the curriculum, and this should be factored into a staff member's workload and time management. Mapping one's activities should become part of the teaching routine. An intrinsic punishment would be that students and other teachers can easily see that a particular teacher's information in the Map is out-of-date.

All Map users will need to be informed and regularly reminded of these rules particularly since, as shown in Study 2, the population of UMP staff (and hence of potential Map users) is constantly changing. While most of these rules are explained in the Map Help site, the negligible use of this site by staff shows a need for other intervention strategies to disseminate this information. It is also important to identify who has the power of setting and implementing the Map's rules. Map administrators and UMP convenors seem to be in an ideal position to develop and disseminate the Map's rules, protocols, guidelines and timelines. For example, Map administrators could remind teachers and convenors of the rules when inviting them to review their course activities. Phase convenors could remind course convenors at phase committee meetings, and program convenors could do likewise at other relevant UMP meetings. If in future clinical school administrators were to assist with the Map administration, they too should be properly informed of these rules.

Some rules will be 'law', some 'incentives' and some 'social agreements'. All need to be made explicit to current and new UMP staff and Map users, be reinforced at strategic times by those in positions of power, and be reviewed as necessary. As noted in the literature, a curriculum mapping initiative must have the full institutional support of teaching staff including the Dean and updating the map should be institutionalised as part of the accepted curriculum planning and revision process (Harden, 2001a).

Self-organisation

Self-organisation refers to the ability of the system to change itself by creating whole new structures and behaviours (physical structures, rules, balancing or reinforcing loops, social structures and culture) so that the system becomes more resilient—meaning, it has the capacity to weather difficulties, evolve and survive change. Meadows notes that a system that gets encrusted and cannot self-evolve is doomed to fail, while a system that encourages suitable levels of variability, experimentation and diversity can become more resilient. This leverage point is number 4 on the list and in general, it relates to the SUV 'differentiation and entropy' category.

A number of suggestions have already been made on how the Map could be improved by intervening at lower leverage points. Hence, suggestions for this leverage point will focus on encouraging variability and experimentation on how the Map is used, and on leadership. Results showed that the Map was basically being used for content management and educational administration, but that its potential uses in learning and teaching and in organisational change had not been realised. However, certain comments in Study 3 showed interest amongst some staff members to explore the Map's educational potentials. Study 1 revealed that the eMed reference group focussed mostly on technical and administrative issues, and less so on educational issues. Hence, forming an eMed education group that explores and experiments with the educational potentials of the Map (and of other eMed tools) seems to be a suitable intervention strategy. The eMed education group could be a sub-group of the existing eMed reference group or a separate group. It could be guided by the leadership of senior UMP academic administrators (top down approach) and of interested UMP teachers (bottom up approach). Although input from the Map administrators and IT developers would be essential, the group would primarily focus on educational uses of the Map and eMed as opposed to administrative uses.

The eMed education group could start by exploring the Map's current information outputs and navigation functions since, as mentioned under the information and delay leverage points, a significant number of users found these problematic. This group could also explore how to form a UMP CoP in line with Wenger's ideas (Wenger, 1998, 2009, 2010; Wenger et al., 2002), and which is supported through digital technologies or 'habitats' such as eMed (Wenger et al., 2010). It could also explore the development of a learning organisation as proposed by Senge (Senge, 2006; Senge et al., 1994). Having such a group could help distribute the workload of improving the Map's structural design, educational uses and organisational effects, and build the skills and knowledge of teachers involved in the group and eventually in the UMP community. This type of self-organisational intervention would allow the whole curriculum mapping system to evolve and to increase its resilience or capacity to survive change at a technical, educational and organisational level.

The curriculum mapping literature emphasises the importance of leadership amongst teaching staff and their commitment to mapping (Britton et al., 2008; Kallick & Wilson, 2004), as well as the need to capacity-build and empower teaching staff since they are the main source of curriculum development (Oliver et al., 2010). It is important to have persons who will communicate, articulate, create and promote the system, build relationships with teachers and identify and address their needs, identify resources, educate school members, and provide ongoing technical and instructional leadership, and become change agents (Tramaglini, 2005). While one member of staff should provide the academic leadership for coordinating the curriculum mapping activities, it is also essential to give teaching staff, administrators and students some ownership of the map and the mapping process to avoid top-down mandates (Harden, 2001a; Kopera-Frye et al., 2008; Mills, 2003). Well crafted, thoughtful leadership is also needed to move staff members beyond personal self-interests and insecurities common in any institution of higher education when curriculum matters are raised (Britton et al., 2008).

Goals

Goals refer to the purpose or function of the system. This leverage point is superior to the self-organising ability of a system since everything down the list can be changed to conform to that goal. While most balancing feedback loops in a system have their own goals (these are important for pieces of the system), this higher-leverage goal refers to the entire system. While changing the players in a system is a low leverage intervention, Meadows explains that the exception is at the top, where one person can have the power to change the system's goals by articulating, repeating, standing up for and insisting upon the new goals. In general, this leverage point relates to the SUV 'goal-seeking' category.

The educational literature has defined the goals of curriculum mapping in detail as well as many of its challenges. It has emphasised that the process should address pedagogical issues (as opposed to managerial issues) to ensure teaching staff (and students) understand the value of mapping and become engaged in the process (Harden, 2001a; Lee et al., 2003; Oliver et al., 2010). Chapter 1 defined the original goals of the Map when it was designed, and this thesis has shown that its actual use fell short of those goals. Hence, it is time to reconsider the original goals since some may no longer be desirable or achievable. If it is decided that the Map's goal is only to be a curriculum indexing and content management tool, then this has mostly been achieved (except for clinical activities in senior years). However, if its goal is also to be a tool for learning and teaching and organisational change then major challenges remain, some of which have been discussed.

The eMed education group proposed in the previous leverage point could review the original goals of the Map (see Appendix B), select those goals that they would still like to achieve (e.g. develop graphical maps, capture clinical activities, form a CoP etc.) and prioritise them. The group would need to become familiar with the curriculum mapping literature, and in particular with the article by Harden (2001a) on which the Map was based. They would also need to explore the relevant literature and technologies related for each goal they want to achieve, and consider any IT development issues and funding needs. These prioritised goals could then be reviewed by the eMed reference group or the UMP program convenor(s) for their approval.

Study 1 showed that some staff thought the Map could be used to track teaching workloads, and this was confirmed by a comment in Study 3, although the survey item on this issue showed significant staff uncertainty about this use. While this goal warrants further consideration, care should be taken since this type of use may have unintended negative consequences on team teaching and collaborative curriculum development in the UMP. A number of authors have warned that curriculum mapping should not be used for staff evaluation purposes, or be part of a staff members' review or renewal process either formally or informally (English as cited in Clough, James, & Witcher, 1996; Jacobs, 1997; Kopera-Frye et al., 2008; Moss Curtis & Moss, 2010). English (1978) observed that curriculum mapping can become a political football if cross-currents of suspicion exist in a school about the activity's ultimate purpose. Moss Curtis (2010) notes staff concerns with providing information about what they taught and how it could be used against them.

Paradigms

Paradigms are the mind-set out of which the system arises, and the shared ideas and unstated assumptions in the minds of a community. Paradigms are the sources of systems, and from them come the system's goals, information flows, feedbacks, stocks and everything else about the system. Intervening at the level of paradigm can totally transform a system. Although seen as difficult, Meadows observes that there is nothing physical or expensive or even slow in the process of paradigm change. In a single individual it can happen in a millisecond; all it takes is a click of the mind—a new way of seeing. Paradigms can be changed by pointing at the anomalies and failures in the old paradigm, and by inserting people with the new paradigm in places of public visibility and power. Meadows suggests to work with active change agents and the vast number of people who are open-minded, and not waste time with reactionaries. In general, this leverage point relates to the SUV 'hierarchy and relations' category.

The development and implementation of the UMP itself had required a major paradigm shift in the Faculty from a traditional discipline-based curriculum to an integrated and student-centred curriculum (McNeil et al., 2006), and the eMed system had been developed to support this shift. As noted in Chapter 1, the Map had been designed to facilitate a CoP, and the need to develop a knowledge network culture within the Faculty had been highlighted by Watson et al. (2007). Since the UMP was fully implemented only in 2009 the concept of an integrated, spiral and transparent curriculum is relatively new within the Faculty. Some staff may still be coming to terms with the educational changes, and this may have partly caused a delay in their Map adoption. Education in general has also experienced a paradigm shift which has moved away from a 20th century industrial age mentality towards a 21st century information age mentality (Reigeluth, 2005, 1999c). Along with this shift has come the concept of using web-based technologies such as curriculum mapping systems (Hale, 2008; Jacobs, 2010) and information technologies to steward communities of practice in organisations (Wenger et al., 2010). While the eMed system has been described in the literature as a vivid example of educational informatics (Rudzajs et al., 2011)—a statement clearly supported in relation to eMed Map by Ford's definition of educational informatics (Ford, 2008)—this same view does not seem to be held across the Faculty. This may partly be due to a mismatch between the 21st century learning paradigm reflected in the UMP and in eMed, and the view of some UMP teachers which may still be focussed on 20th century teaching practices. Hence, more targeted initiatives and leadership by those 'in places of public visibility and power' are needed within the Faculty for all UMP staff to shift their view towards 21st century educational practices including the adoption of curriculum mapping (Costa & Kallick, 2010; Jacobs, 2010; Reigeluth, 2005; Wilmarth, 2010).

Although this evaluation indicates that the Map has not fulfilled its goal in developing a knowledge network culture or a UMP CoP, some findings clearly show the potential for this to happen. For example, Study 2 showed the existence of sub-groups of Map users in different areas and levels of the organisation, as well as the existence of 77 model Map users (see Figure 8.2). Study 3 showed a significant willingness by Map users with specific UMP roles to share curriculum information and the workload of curriculum mapping, as well as a general support of the UMP by schools. Some survey comments revealed an interest in learning more about the Map and in exploring its uses, and some of these comments came from clinical school staff. Hence, there is a small pool of staff that could become curriculum mapping advocates and could help build a UMP CoP. While survey comments also revealed some 'reactionaries', as suggested by Meadows their views could be set aside (although exploring what triggered such negative comments could help overcome those triggers in future).

An intervention strategy at the paradigm level will require strategically placing active change agents in areas of public visibility and power. For example, one or two active agents could be placed in every campus and clinical school, and in every formal UMP group and committee. These change agents should be supported and assisted by the Faculty to develop the proposed CoP and knowledge network culture amongst all levels of staff—from teachers to administrators, from campus to clinical schools, from full time academics to conjoint, affiliated and casual staff. The need for strong leadership and change agents is highly recommended in the curriculum mapping literature (Britton et al., 2008; Herbold, 2012; Kallick & Wilson, 2004; Lee et al., 2003; Tramaglini, 2005), as is the need to develop a sense of map ownership amongst staff (Hale, 2008; Harden, 2001a; Mills, 2003).

Consideration should be given not only to the technology (the curriculum map) but also to the culture within the organisation using the technology (Bell et al., 2009; Costa & Kallick, 2010; English, 1978; Kallick & Wilson, 2004; Mills, 2003; Moss Curtis & Moss, 2010). Since medical programs such as the UMP are taught not only in campus and clinical schools but also in healthcare settings (hospitals, community services, GP practices) consideration should be given to the culture, practices, attitudes and needs of clinical teachers in the healthcare setting, and to student learning opportunities available in that setting (Jaye & Egan, 2006). Also worth noting are contextual differences within healthcare settings when implementing information systems (Callen, Braithwaite, & Westbrook, 2008). This evaluation clearly showed a significant quantitative difference in Map use between campus and clinical schools, and between academic, general and conjoint staff. Study 1 also showed a subtle divide in the perception of campus staff towards clinical staff. This cultural divide may have fuelled the perception by some campus staff that clinical and primary care teaching staff were not interested in the Map (Study 1). However, other evidence from this evaluation tends to negate this perception such as: (a) the majority of those who took the time to complete the survey were clinical and conjoint teachers, (b) a clinical school academic provided one of the most enlightened comments in the survey, (c) on separate occasions a primary care teacher and a conjoint clinical teacher approached the researcher and asked to be shown how to use the Map, and (d) it was a conjoint clinical teacher who at a large school gathering praised the usefulness of the Map.

This evidence tends to show that it may be time to re-evaluate the campus/clinical divide, to consider that clinical teachers may also want to use the Map, and to better explore how the Map could be used in the clinical context and healthcare setting. Hence, a paradigm shift is needed to view clinical teachers in healthcare settings as part of the UMP CoP along with campus teachers and medical students. While acknowledging that major differences exist between learning on campus and in clinical settings (Jaye & Egan, 2006), a common pursuit of the UMP CoP could be to ensure medical students develop the graduate capabilities required to become safe beginning practitioners (Dowton, 2005; McNeil et al., 2006; McNeil et al., 2011), and which are embedded in the Map. A previous suggestion of encouraging senior students to explore the Map with their clinical teachers would not only help them share information about the curriculum, but also start developing a sense of CoP membership and practicing partnerships that comes from working together (Dean, 2004; Jaye & Egan, 2006; Wenger, 1998). CoPs in the healthcare sector facilitate learning, knowledge exchange and evidence-based best practice, and are often supported by web-based communication technologies (Ranmuthugala et al., 2011). Cultivating such communities could gradually lead to an increase in sociability and solidarity between medical students and clinical teachers, and to changes in the predominant cultures in medical education and healthcare organisations (Dowton, 2005) and in clinical leadership styles (Dowton, 2004; Oates, 2012). In citing von Stamm, Dowton notes that “the breakthrough to innovation is more about removing obstacles to innovation than encouraging innovation in the first place” (Dowton, 2005, p. 6). Goulston and Oates (2012) have also noted the importance of academic leadership in creating and sustaining changes in a medical curriculum, as well as the need for greater curriculum ownership by clinical teachers, the involvement of recent graduates, and equipping students for leadership roles.

Hence, as explained by Hale, the implementation of curriculum mapping involves a systemic change which causes members of an organisation to make a series of personal and collective mental model shifts. A learning organisation is a social setting and solutions must come from shared meaning. Shared meaning must be explored and established regarding the vision, skills, incentive, resources and action plans of curriculum mapping. While each component has its own attributes, they work together to form a synergistic environment (Hale, 2008). Kallick and Wilson (2004) reiterate the need to build a culture of collaboration, since knowledge creation requires trust and curricular changes need thoughtful dialogue and data-based conversations (as opposed to false-harmony-based conversations), and a culture engaged in constructive inquiry. Curriculum mapping also needs a shift in the mental models, habits and routines of educators, and the adoption of self-reflection, self-direction and metacognition by teachers as well as students (Costa & Kallick, 2010).

Meadows noted that paradigms can be changed "… by building a model of the system, which takes us outside the system and forces us to see it whole" (Meadows & Wright, 2009, p. 164). With this in mind, the next section offers a model of staff training and support for curriculum mapping that aims to gradually introduce the interventions derived from this research, and which is based on a system dynamics archetype.

Shifting the Burden

As noted by Watson et al., the eMed system requires that "… all essential data be entered in Map before each course starts in order to drive the student assessment for that course and to produce the course guides; this proves to be a compelling reason to get the data entry completed on time" (Watson et al., 2007, p. 358). While this compelling reason has been very successful in populating the Map with curriculum data, it has also put pressure to process Map data on time whenever a course is delivered or archived, as noted in Study 1. The original curriculum mapping process proposed in 2004 was for course convenors and principal teachers to enter their own learning and assessment activities in the Map, and this would constitute part of their mapping and UMP training (i.e. staff development by stealth). However, the pressure of getting courses and guides ready on time meant that Map administrators from MESO (the Faculty's central medical education office) started entering data on behalf of convenors and principal teachers. Findings from Study 2 seem to indicate that this short-term solution continued, as reflected in the following results from 2004 to 2010: (a) about 47% of principal teachers (195 of 414) and 18% of convenors (14 of 76) had not used Map at all (Appendix K, Table 5), and about 9% of principal teachers (19 of 215) and 3% of convenors (2 of 62) had used it for non-meaningful session durations (Appendix M, Table 5), (b) the median duration of Map sessions and number of session events per year tended to decrease (Table 6.16, Figure 6.24), (c) Map administrators were using the Map much more than any other UMP staff (Table 6.25 and Figure 6.26), (d) nine of the top ten Map users were from MESO and (e) the Map Help site was barely used.

Study 1 also revealed that a DIFM support mentality existed amongst some UMP teachers. While it was promising to note that most principal teachers and convenors who answered the survey said they generally updated their own Map forms (about 76% or 13 of 17) (Table 7.21), these survey respondents represented only a small proportion of all UMP principal teachers and convenors. While the support from Map administrators was very successful in populating the system with data and generating Map information from it, their high level of support appears to have caused a dependency on their expertise and an unintentional effect of reducing the motivation of other UMP staff to use or learn about the Map. Hence, a key condition of the curriculum mapping system appears to be the time pressure to process Map data, and its dynamic interaction with Map use variables relating to staff support, training, motivation, learning and capability building.

The system dynamics archetype which best illustrates these interactions is known as the ‘shifting the burden’ or ‘addiction’ archetype (Kim, 1993, 1994, 2000; Kim & Anderson, 1998; Maani & Cavana, 2007; Senge, 2006). This archetype (or generic model) is characterised by short-term, quick fixes that one comes to rely on. It can operate whenever someone is too helpful, and a potential way out is to gradually withdraw that support and replace it with something more appropriate that can build the capabilities of individuals and the resilience of the system. This pattern of behaviour is often seen in the workplace between workers and managers: “The side effects of such a relationship are growing dependence on the manager and a delay in training and empowerment of the workers” (Maani & Cavana, 2007, p. 43). The intervention should aim to break the vicious cycle, as implied in the saying: “Give a person a fish and you feed them for a day. Teach a person to fish and you feed them for a lifetime” (O'Connor & McDermott, 1997, p. 201). Figure 8.2 shows the causal loop diagram and dynamic interactions between variables related to this key condition of time pressure to process Map data. This diagram is based on the ‘shifting the burden’ archetype described by Kim (Kim, 1993, 1994, 2000; Kim & Anderson, 1998), and was developed in the software application Vensim PLE v6.0a-1. Key variables in this causal loop diagram are as follows:

Problem symptom (key condition): Immediate pressure to process curriculum map data on time prior to course delivery as well as during course reviews, program reviews, research etc. Data processing includes the entry, review, revision, browsing, searching, retrieval, use and analysis of curriculum data in the Map.

Symptomatic solution (quick fix)—top balancing loop (B1): Map data mostly being processed by Map experts from central office (i.e. Map administrators and medical educators from MESO) instead of by UMP course and phase convenors, principal teachers, other teachers and administrators from campus and clinical schools.

Unintended side-effect of symptomatic solution—reinforcing loop (R3): Dependence on Map experts from MESO appears to have led to: (a) less motivation for UMP staff to use or learn about the Map, (b) less motivation to improve the whole mapping system, and (c) a potential risk of Map expert attrition (e.g. due to excessive workload, burnout).

Fundamental solution—bottom balancing loop (B2): Provide all UMP staff, particularly teaching staff, with educational and IT Map training and with different types of staff support which build the mapping capabilities of individuals and the organisation (see Table 8.4). Delays may occur in transforming staff training into action (delay 1), and in building the capabilities of individuals into a UMP CoP and learning organisation (delay 2).

Together, the top balancing feedback loop (B1) and the reinforcing feedback loop (R3) in the causal loop diagram (Figure 8.2) represent a DIFM support model dependent on Map experts, and the unintended consequences of this support. The bottom balancing feedback loop (B2) shows a potential intervention strategy based on staff training and a DIY support model. Table 8.4 provides examples of potential Map training and support initiatives aimed at building the mapping capabilities of individuals, the organisation and the IT system. These initiatives include many of the interventions previously proposed under individual leverage points, and are based on this Map study’s findings. As noted in Table 8.4, some types of support would need to be increased and others would need to be decreased or retained to help build the mapping capabilities of UMP staff, and make the whole curriculum mapping system more resilient.

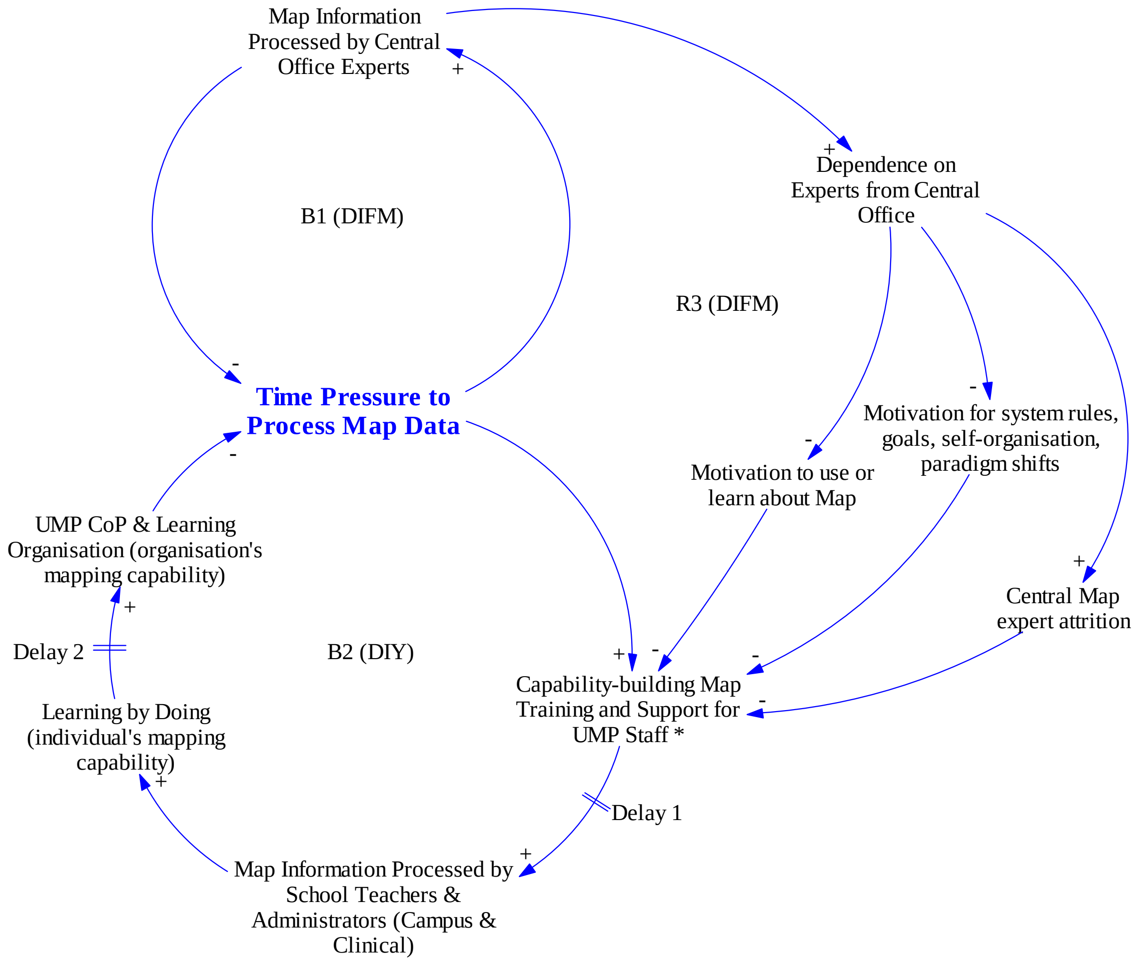

Figure 8.2: Causal loop diagram of 'shifting the burden' of curriculum mapping from Map experts in central office (B1) to teachers and administrators in schools (B2), to resolve the dependence on central office experts (R3) by building the mapping capabilities of staff and the organisation (B2).

Key:
Arrows indicate a causal link between two variables
(+) placed next to an arrowhead indicates a causal change in the same direction
(-) indicates a causal change in the opposite direction
R is a reinforcing feedback loop that amplifies change
B is a balancing feedback loop that seeks equilibrium
Starting variable is highlighted in blue
DIFM: Do it for me
DIY: Do it yourself
*See examples of training and support strategies in Table 8.4

Table 8.4: Potential capability-building initiatives in Map support and training for UMP staff and in relation to key leverage points of the curriculum mapping system.

Reduction in support for teaching staff	Increase in support for teaching staff	Continued support for teaching staff
From Map administrators (material stocks & flows) *Entering data on behalf of teaching staff *Updating forms on behalf of teaching staff (except for one-off principal teachers) *Indexing activities on behalf of teaching staff *Performing curriculum map searches for teaching staff *Performing curriculum data exports for teaching staff who have access to this function Note: increase in curriculum data processing by convenors and principal teachers aims to enhance their curriculum mapping skills and interest, and UMP knowledge through learning by doing	**From Map administrators (rules and feedback loops)** *Monitoring and evaluating Map use *Monitoring data quality *Developing rules, protocols and timelines for Map use *Assist in providing IT and educational training on Map use	**From Map administrators (information flow)** *Managing development of course and program guides *Managing all Map file attachments (quality control) *Managing Map's controlled vocabulary (thesaurus and other indexing lists) *Managing Map access (including eMed Access Manager) *Managing principal teacher invitations to update Map *Participating in eMed Reference Group *Maintaining Map help sites for staff and students *Assisting with Map's IT development and testing **From eMed Reference Group (IT self-organisation)** *Improving Map's physical structure (navigation etc.) **From Faculty (material stocks and flows, goals)** *Financial and organisational support for the Map
New staff support and professional development initiatives for teaching staff and administrative staff		
From senior academic administrators (paradigms): *Ensuring curriculum mapping rules, protocols and timelines are followed (e.g. strategic reminders) *Ensuring all current and new UMP staff are aware of the Map (i.e. campus, clinical, academic, conjoint, affiliated and casual staff) *Ensuring there are Map advocates/change agents in every UMP school and every UMP governance group or committee *Supporting the curriculum mapping needs of clinical school and clinical staff *Supporting an eMed education group & UMP CoP *Encouraging a paradigm shift towards 21st century teaching (e.g. collaborative curriculum development, evidence-based education)	**From Map advocates and change agents (goals, feedback loops, paradigms):** *Forming an eMed educational group and UMP CoP *Exploring educational potentials of the Map (concept mapping, metacognitive tool, data-driven education) *Identifying mapping needs of clinical teachers *Proposing IT system improvements for learning and teaching (e.g. better navigation, graphical interface) *Providing staff training on curriculum mapping in education (e.g. purpose, educational alignments, gaps & overlaps, concept mapping, metacognition, data-driven education) *Developing learning activities that require students to actively explore the Map with and without teachers *Involving senior students in curriculum mapping	**From senior medical students (information flow, paradigm shift)** *Introducing the Map to clinical and primary care teachers *Exploring the Map with clinical and primary care teachers *Encouraging clinical teachers with staff ID numbers to gain access to the Map *Improving the mapping of clinical years *Researching aspects of curriculum mapping through Independent Learning Projects (ILP)

Implementing the fundamental solution (B2) is likely to be a slow process since the current system of support (B1) has been in place since 2004. First, there would need to be increased training of UMP teachers (and administrators) on the educational and IT uses of the Map (B2). Then, Map experts from the central office would gradually need to withdraw their support in completing curriculum map forms and doing map searches for UMP teachers (data processing). Convenors and principal teachers would need to become more accountable for their content in the Map (i.e. data entry, review, revision, analysis and data-mining). Ideally, this work would somehow be recognised, particularly since about 70% of principal teachers and convenors who answered the survey thought it was not recognised (Table 7.21). The mapping workload on convenors and principal teachers would need to be monitored since although about 41% thought filling Map forms did not take up too much of their time, about 35% were uncertain and 23% thought it did (Table 7.21). While central office Map administrators would continue developing course guides and managing learning materials, they would also help to manage and monitor the whole curriculum mapping system and gradually reverse the effect of the reinforcing loop (R3) by intervening at higher leverage points in the system (e.g. system rules, goals and self-organisation). Table 8.4 provides various intervention strategies to build the mapping capabilities of staff and the organisation.

This fundamental solution is likely to bring its own problems and delays which may put into question the solution's soundness, and may require the symptomatic solution to be used for some time (Kim & Anderson, 1998). For example, there may be delays in data entry and a temporary reduction in data quality as all convenors and principal teachers learn how to use the Map (Delay 1). Building the organisation's mapping capabilities through a CoP and learning organisation will require a paradigm shift, and this is likely to take time (Delay 2). Hence, as recommended by Kim and Anderson (1998), it will be important to stay focused on the organisation's vision (i.e. its curriculum mapping goals) while managing to 'shift the burden'. While this will not be easy, not intervening could further weaken the curriculum mapping system—a system that, based on the results of this research project, is not being used by the majority of UMP staff or to its full educational or organisational potential.

As noted by Harden (2001a), the importance of staff development in curriculum mapping should not be under-emphasised. To motivate teachers to use such a technology they must understand the goals, have the required resources, and acquire the necessary skills through training and use of the tool and the process (Wigal, 2005). Ongoing educational efforts are needed to keep teachers informed of changes and improvements in the electronic system, and to inform them on how best to use the stored data to improve and refine their courses (Britton et al., 2008). Various types of support should be offered and it should include not only IT system support but pedagogical support (Lai, 2012). Training should be differentiated depending on the teacher's background and competencies, and it should use various strategies (e.g. workshops, site visits, peer coaching, mentoring) while using mapping as the common reference point (Jacobs, 2004a; Salas et al., 2003).

Teachers should not only be engaged in developing the map by providing data, but they should be actively using the map's data to make ongoing decisions about their teaching, and hence know how to use the map's search and report functions (Hale & Dunlap, 2010). Mapping is an active, mentally-engaging process that asks teachers to work individually and collaboratively to improve student learning through designing and reviewing the curriculum both horizontally and vertically (Hale & Dunlap, 2010).

Building communities of practice and learning organisations takes time and effort, and often requires a paradigm shift in the organisation's mental models (Senge, 2006; Senge et al., 1994; Wenger et al., 2002; Wenger et al., 2010), and has its own advantages and challenges in higher education institutions which adopt curriculum mapping (Ingleby & Hedges, 2012). As noted by Hunter and Ciotti in relation to the implementation of IT in healthcare in general "As much as the need for training and cultural transformation is understood by healthcare leaders today, often what is provided remains inadequate" (Hunter & Ciotti, 2006, p. 11).

Key Recommendations

The following ten key recommendations summarise the various suggestions made to improve the use of eMed Map by UMP staff. These high-level recommendations incorporate the specific suggestions provided in previous sections of this chapter including those in Table 8.4.

1. **Form an eMed Education Group:** This group would consist of Map advocates and change agents (see Table 8.4). It would be in charge of exploring, experimenting with and trialling the educational potentials of the Map (and of other eMed tools). This group would develop and implement a variety of Map training activities for teaching staff with a particular focus on the educational aspects of curriculum mapping, as well as learning activities that use the Map to support students' cognition and metacognition. It would also

be involved in the Map's continued research and development (see next recommendation).

2. **Continue the Map's research and development:** Re-examine the data visualisation functions of the Map. Reassess the data visualisation needed for learning and teaching (e.g. concept and hierarchical maps) and for educational administration (e.g. data-mining and statistical analysis); these two functions may need to be separate. Reconsider the possibility of mapping clinical components in Phase 3 of the UMP (e.g. clinical skills, activities or encounters) and involve clinical teachers in this process. The development of any new Map features and functions should be guided by the relevant educational literature and existing information technologies.
3. **Continue the financial and technical support:** Ensure the development of new IT features and functions of the Map are adequately funded, and properly tested prior to release.
4. **Use Map role models, champions and change agents:** Use the model Map users (see Figure 8.2) as role models and change agents to increase the system's penetration amongst UMP staff. Embed at least one Map role model or champion in every school and UMP governance group, and support him or her to adopt a curriculum mapping leadership role.
5. **Inform all UMP staff about the Map:** Inform all UMP teachers and administrators about the Map, including clinical teachers. Give everyone a chance to know about and use the tool. Do not assume that clinical teachers are disinterested. Invite those who express an interested in curriculum mapping to contribute to its development and use. Regularly remind staff about the Map (and other eMed tools).
6. **Provide the right level of training and support:** Expand Map training to include the educational aspects of curriculum mapping, and continue training on the IT and administrative aspects. Train and encourage convenors and principal teachers to do their own mapping. Discourage Map administrators from being too helpful in processing Map data for others (except for one-off principal teachers). Provide a variety of Map training and support depending on the staff member and his or her UMP role(s). Focus on training clinical school staff and conjoint staff. Do not rely solely on the Map's self-directed online training sites or on the concept of staff development by stealth.
7. **Set clear rules:** Develop clear rules and guidelines on who should be using the Map, how and when. Encourage those in leadership positions to implement these rules, to strategically remind staff about them, and to lead by modelling good Map use.

8. **Get senior students involved:** Encourage senior students to introduce the Map to their clinical teachers, including hospital-based teachers, GP teachers and teachers in community care settings. Consider senior students to be part of the UMP CoP.
9. **Encourage 21st century mental models:** Accept that curriculum mapping, collaboration and communication amongst teachers and student are new concepts that require a major shift in their mental models. Encourage model Map users to help change the mental models of their colleagues (remember that all it takes is a quick 'click in the mind'). Focus not only on encouraging Map use but also on removing obstacles to its use. Encourage staff (and students) to be creative and innovative in their use of the Map in learning and teaching.
10. **Continue evaluating the Map's use systemically**: Continue evaluating how staff members use the Map. Evaluate the effect of any major changes to the system (e.g. new IT functions such as concept maps, new staff training, new Map rules etc.). Continue using the holistic lens of systems theory and systems thinking to evaluate its use. Be mindful of the system's leverage points and of the unintended consequences of pushing them in the wrong direction. Consider evaluating Map use by UMP students since ultimately curriculum mapping is about helping students to learn.

The general aim of these recommendations is to use eMed Map to its full educational capacity to achieve a better return on investment for staff and students. Another general aim is to exploit its organisational capacity as a tool that can help develop a UMP CoP amongst teachers, administrators and students that can bring the whole Faculty in line with 21st century medical education.

While these recommendations are provided within the context of eMed Map and the UMP, they are also applicable to online curriculum maps used in other medical and higher education programs. A general recommendation derived from this thesis for institutions using such online systems is to identify the typology of map users that exists in their own organisations to help them improve their map use, training and support. A final general recommendation for such institutions is to explore the interrelatedness of variables affecting their curriculum map use by combining the reductionist lens of analytic thinking with the holistic lens of systems thinking, as done in this thesis. The next chapter will conclude with final observations about this Map study, and with the future directions of this research.

Chapter 9 : Conclusion and Future Directions

Conclusion

In essence, this research showed that a system that had been labour intensive and time consuming to design, develop and maintain and was widely available to all UMP staff was not being used as planners and advocates of the Map had originally hoped. While its basic goals in educational administration, curriculum indexing and content management were being realised, its advanced goals in learning and teaching and in organisational change were not. This research showed that there were many factors influencing the use of this online curriculum mapping system. These factors affected who used the system, what they used it for, when they used it and what they thought of it. A typology of UMP Map users was identified by analysing the patterns of map use over time and the staff characteristics of users, and this typology showed that in general clinical and conjoint staff members were not using the Map as much as campus, academic or general staff.

By using systems theory and thinking principles, this thesis explored the factors affecting map use not as single, un-related variables (as often reported in the literature) but as interrelated variables and events forming part of a dynamic system. This systems-based view facilitated the identification of different leverage points in the curriculum mapping system where one could intervene to improve its overall use. Staff training and support were identified as key variables in the system. The ‘shifting the burden’ system archetype helped to identify the dynamic interaction between these and other related variables, and various training and support initiatives were suggested to improve the curriculum mapping capabilities of individuals and the organisation. Ten high-level recommendations were derived from the synthesis of findings.

The lessons learnt from this research can be applied to similar curriculum mapping systems in other educational programs. Curriculum mapping should be viewed as a whole complex and dynamic system of which the technology, the educational design and the user’s needs are only some of its key variables. Curriculum mapping requires systemic change in the organisation and a paradigm shift in education. While staff training and support are essential, care should be taken in providing the right level of support to avoid the unintended consequence of weakening the system by creating a dependence on mapping experts.

Curriculum map evaluations need to go beyond the linear analysis of single variables, events and constructs, by looking at the relationships between multiple variables, and at their dynamic and complex interactions which are sometimes confusing, sometimes surprising and often counter-intuitive. Curriculum mapping should be viewed as one large closed system which includes not only the individual, the technology and the organisation but also new mental models and ways of thinking about education which are in line with the 21st century information age.

Importance of Study

This study responded to a call in the educational research literature for case-based evaluations of curriculum mapping systems used in medical and other higher education programs to improve the implementation and use of such systems (e.g. Harden, 2001a; Sumsion & Goodfellow, 2004; Willett, 2008). Even though this study is of a bespoke system used in one medical program only, it is significant since no similar comprehensive case-based evaluation of an advanced curriculum mapping system has yet been reported in the higher education literature.

Although this case-study revealed that many UMP staff members did not use the Map or used it in a very limited way, the significance of this study lies not only in its quantitative findings but also in its qualitative findings. This study uncovered a number of interrelated factors affecting map use which are generalizable and transferrable to others using similar advanced curriculum mapping systems. Since those implementing comparable curriculum mapping systems in higher education have similar reasons for using such a system as did the medical Faculty in this case-study, the barriers to map use they encounter are also likely to be similar to those identified in this study. Hence, the findings, implications and recommendations from this study could be used to either avoid or overcome the barriers to map use identified in this research.

The importance and general application of this study lies not only in its findings, but also in the research methods used to attain these findings, and in the theoretical framework adopted to triangulate and interpret the results and provide practical recommendations on how one could improve the system's use. Hence, this study's research methods and theoretical framework are also readily transferrable and applicable to others wanting to evaluate comparable advanced curriculum mapping systems.

Limitations of Research

The research methods used in this evaluation had their own strengths and weaknesses (see Table 4.1), and further limitations were noted as each study was conducted. In general Study 1 did not have any major unforseen limitations. Study 2 was complicated by Map users who had performed sessions of non-meaningful duration. Now that this pattern of behaviour has been identified and quantified, in future it could be better to analyse very short sessions separately from longer sessions by using a web log data filter in Sawmill. A different cut-off point for the total session duration could also be considered. If the proposition that senior medical students use the Map with their clinical teachers is adopted, care should be taken when interpreting the analysis of web log reports since a student log-in could indirectly also represent a clinical teacher's map use. This problem could be partly overcome by combining the web log analysis with a brief survey of clinical, conjoint and primary care teachers in particular, to establish how often they accessed the Map with their students.

Study 3 was complicated by the small sample size of Map users who responded to the survey. While 148 staff members responded in total, only 39 respondents had used the Map in the previous 12 months (i.e. 19 % of the 201 UMP Map users with meaningful session durations in 2009). Although the response rate for this survey was generally low, this problem was partly offset by the triangulation of methods in the whole evaluation. Even so, the small number of cases compared with the large number of items in each of the three main domains (between 14 to 33 items in each domain) meant that the minimum 5 to 1 case-to-item ratio needed to conduct an exploratory factor analysis was not met (Lewis & Byrd, 2005). Another problem was the manual categorisation of survey items against the SUV categories and levels, which was awkward and time consuming. In future and if available, it may be worth using the SUV software application to develop, deliver and analyse the survey, and hence use the SUV model *a priori* (Jokela et al., 2008).

Future Directions

This case-study is the finale of a specific educational technology design and development effort, and completes the first major iteration of the ADDIE instructional design cycle. This Map study has covered the qualitative phases of the ST&M methodology—namely problem structuring (phase 1) and causal loop modelling (phase 2). The next step, which is outside the scope of this thesis, would be to involve key UMP stakeholders in reviewing the findings and implications of this research. This could then be followed by further research into curriculum mapping by using the quantitative modelling phases of the same methodology—namely dynamic modelling (phase 3), scenario planning and modelling (phase 4) and implementation and organisational learning (phase 5). Since the ST&M process is not necessarily linear, it may be worth starting with phase 5 and then decide if to proceed to phases 3 and 4 (Maani & Cavana, 2007).

As part of the UMP's on-going commitment to curriculum mapping, a small evaluation of the use of eMed Map could be conducted on a regular basis (e.g. annually or bi-annually). These regular evaluations could continue tracking quantitative patterns of Map use by employing the web log analysis methods used in this thesis (either with or without data linkage). The survey instrument could be abridged, refined and re-implemented. If use of the SUV evaluation model were to continue, it would be preferable to use the model *a priori* and, if available, to use the SUV application to re-develop, deliver and analyse the survey. Further qualitative evaluations could include focus groups or key informant interviews.

Evaluating students' use of eMed Map is an important consideration which should be explored in the near future since ultimately curriculum mapping is intended to benefit the students. From its inception, the Map was open to students for their use in learning and to engender in them a sense of curriculum ownership. Hence, establishing if students use the Map and if so which students, how, when and what for is an important next step that could further help rationalised the changes proposed in this thesis. A similar triangulated evaluation of Map use by students could be conducted using modified survey items and different qualitative methods (e.g. focus groups). Involving ILP students in conducting this evaluation could foster in medical graduates an interest not only in medical education and the burgeoning area of educational informatics (Ford, 2008), but also in health informatics research which, as noted by Faxvaag, Toussaint, and Johansen (2011), is an area requiring a multidisciplinary research approach and true collaboration amongst disciplines, and can benefit through the networking generated by involving students in projects at an early stage.

Future evaluations of Map use by staff and by students could be done as part of the UMP's overall evaluation methods (Gibson et al., 2008). Other innovative evaluation methods could be tried such as the 'empowerment evaluation' method employed at Stanford Medical School, which includes staff and students and uses five mutually reinforcing tools of empowerment (Fetterman, Deitz, & Gesundheit, 2010). As well, other theories used to explore educational technology adoption could be considered such as the Technology Acceptance Model (see for example Shum, Land, Dick, & Jamieson, 2010) or the self-regulated learning theory (e.g. Sharma, Dick, Chin, & Land, 2007), and other quantitative survey-based methods and statistical analyses could be used to explore some of the multi-dimensional and complex interaction between Map use factors (e.g. Slyke, Dick, Case, & Ilie, 2010).

In relation to the educational research fraternity, this evaluation could be seen as one case-study in a wider "meta-ethnography" of studies (Patton, 2002, p. 500) on curriculum mapping in medical education and other higher education programs in Australia and overseas. As noted by others, further scholarly evaluations of curriculum mapping systems used by staff and students are sorely needed (Harden, 2001a; Naik et al., 2011; Sumsion & Goodfellow, 2004; Willett, 2008). As new digital technologies evolve (e.g. social networks and the semantic web) curriculum mapping could help educators develop more organic mental models that are better adapted to the new era of non-linear learning in the 21st century:

> The model may not be that which conjures up a cathedral, carefully crafted by wizards and experts working in quiet isolation, but that of a great babbling bazaar that, as if by magic, presents a coherent and stable system that meets the challenges of a transformational time in our understanding of learning and teaching. (Wilmarth, 2010, pp. 95-96)

In closing, it is worth returning to the top leverage point on Meadows' list—namely transcending paradigms. This leverage point requires one to stay flexible and realise that *no* paradigm is 'true' since every paradigm offers a very limited understanding of the world in which we live. In acknowledging that the interpretation of findings from this Map study and the proposed interventions, recommendations and model of staff training and support are only the researcher's 'mental model', albeit based on much triangulated data, it is now time as Meadows puts it to:

> Get your model out there where it can be viewed. Invite others to challenge your assumptions and add their own … Getting models out there into the light of day, making them as rigorous as possible, testing them against the evidence, and being willing to scuttle them if they are no longer supported is nothing more than practicing the scientific method … (Meadows & Wright, 2009, p. 172)

Hence, it is time for the researcher to transcend paradigms and offer these research findings, interpretations and potential intervention strategies to the key stakeholders of eMed Map, and to those interested in curriculum mapping in medicine and in the wider educational community for them to discuss, explore, apply, modify and/or reject. It is time for UMP staff and educators in general to take the opportunity to look at these findings, consider the intervention strategies, experiment with the technology, and extend its use beyond educational administration into learning, teaching and cognition, and into fostering communities of practice in their own educational programs and organisations. It is time for others to see where a curriculum mapping system can take them by "… strategically, profoundly, madly, letting go and dancing with the system" (Meadows & Wright, 2009, p. 165).

Appendices

This thesis includes a number of Appendices. The first three appendices relate to the research in general (Appendices A to C). The remaining appendices relate to one of the three studies as follows:

- Study 1: Appendices D to G
- Study 2: Appendices I to N and S
- Study 3: Appendices O to R.

This extra information on each study pertains to either the research methods used or the results attained. The information on methods has been provided to facilitate the replication of a study. Results that were deemed important but not essential were only cited in the thesis and then included in full in an appendix. All appendices are provided separately in Volume II.

References

Aabakken, L., & Bach-Gansmo, E. (2000). Data and metadata: development of a digital curriculum. *Medical Teacher, 22*(6), 572-575.

Ackoff, R. L. (1994). Systems thinking and thinking systems. *System Dynamics Review, 10*(2-3), 175-188. doi: 10.1002/sdr.4260100206

Akcam, B. K., Guney, S., & Cresswell, A. M. (2011, Jully 24 - 28). *Major issues in mixed use of grounded theory and system dynamics approaches in qualitative secondary data.* Paper presented at the 29th international conference of the System Dynamics Society, Washington, DC.

Alter, S. (1999). *Information systems: a management perspective* (3rd ed.). Reading, Massachusetts: Addison-Wesley.

Anonymous. (2004). Data-driven-decision making. *T.H.E. Journal, 31*(12), 32.

Anonymous. (2006). Sustaining successful school reform: An interview with Jordan Horowitz. *Curriculum Review, 45*(5), 14.

Association of American Medical Colleges. (2011). Curriculum inventory portal—a new service from the AAMC. *Fall 2011*, 1-6. https://www.aamc.org/download/249510/data/cipvendordocument.pdf

Association of American Medical Colleges. (2012a). Curriculum Management and Information Tool (CurrMIT). Retrieved December 21, 2012, from https://www.aamc.org/services/currmit/

Association of American Medical Colleges. (2012b). Medical Academic Performance Services (MedAPS). Retrieved December 21, 2012, from https://www.aamc.org/initiatives/medaps/

Avison, D. E., & Fitzgerald, G. (1995). *Information systems development : Methodologies, techniques, and tools* (2nd ed.). New York: McGraw-Hill.

Bacon, C. J., & Fitzgerald, B. (2001). A systematic framework for the field of information systems. *The Data Base for Advances in Information Systems, 32-67*(2), 46.

Baecher, L. (2012). Integrating clinical experiences in a TESOL teacher education program: Curriculum mapping as process. *TESOL Journal, 3*(4), 537-551.

Baker, S. (2012). Curriculum mapping: An essential tool for radiologic science education. *Journal of Medical Imaging and Radiation Sciences, 43*(1 Supp. 1), S6-S7.

Barkhi, R., & Sheetz, S. D. (2001). The state of theoretical diversity. *Communications of the Association for Information Systems, 7*(1), 1-18. http://aisel.aisnet.org/cais/vol7/iss1/6

Bartoo, E. (2005). Getting results with curriculum mapping. *Teachers College Record, 107*(11), 2437-2443.

Bath, D., Smith, C., Stein, S., & Swann, R. (2004). Beyond mapping and embedding graduate attributes: Bringing together quality assurance and action learning to create a validated and living curriculum. *Higher Education Research & Development, 23*(3), 313-328.

Bell, C. E., Ellaway, R. H., & Rhind, S. M. (2009). Getting started with curriculum mapping in a Veterinary degree program. *Journal of Veterinary Medical Education, 36*(1), 100-106. doi: 10.3138/jvme.36.1.100

Benjamin, S., Robbins, L. I., & Kung, S. (2006). Online resources for assessment and evaluation. *Academic Psychiatry, 30*(6), 498-504. doi: 10.1176/appi.ap.30.6.498

Bernhardt, V. L. (2004). Continuous improvement: It takes more than test scores. *Leadership, 34*(2), 16-19.

Bertalanffy, L. V. (1971). *General System Theory: Foundations, development, applications*. London, UK: Penguin Press.

Bertalanffy, L. V. (1972). The history and status of general systems theory. *Academy of Management Journal, 15*(4), 407.
Bigge, M. L. (1982). *Learning theories for teachers*. New York: Harper & Row.
Biggs, J. B., & Tang, C. S. (2007). *Teaching for quality learning at university : What the student does* (3rd ed.). Maidenhead: Society for Research into Higher Education & Open University Press.
Boardman, J., Sauser, B., John, L., & Edson, R. (2009, October). *The conceptagon: A framework for systems thinking and systems practice.* Paper presented at the IEEE International Conference on Systems, Man, and Cybernetics, San Antonio, Texas, USA.
Boling, E., & Smith, K. M. (2008). Artifacts as tools in the design process. In J. M. Spector, M. D. Merrill, J. van Merrienboer & M. P. Driscoll (Eds.), *Handbook of research on educational communications and technology* (3rd ed., pp. 685-690). New York: Taylor & Francis Group.
Branch, R. M., & Merrill, M. D. (2012). Characteristics of instructional design models. In R. Reiser & J. V. Dempsey (Eds.), *Trends and issues in instructional design and technology* (3rd ed., pp. 8-15). Boston, M.A.: Pearson Education.
Breen, B. (2005). The business of design. *Fast Company*(93), 68-69.
Britton, M., Letassy, N., Medina, M. S., & Er, N. (2008). A curriculum review and mapping process supported by an electronic database system. *American Journal of Pharmaceutical Education, 72*(5), 99. http://www.ajpe.org/doi/full/10.5688/aj720599 doi:10.5688/aj720599
Brodie, L., Bullen, F., & Jolly, L. (2011, 12-15 October). *Effective evaluation strategies to meet global accreditation requirements.* Paper presented at the 41st ASEE/IEEE Frontiers in Education Conference, Rapid City, SD.
Brody, H. (1992). Philosophic approaches. In B. F. Crabtree & W. L. Miller (Eds.), *Doing qualitative research* (pp. 174-185). Newbury Park, CA: Sage.
Brooks, S., & Simkins, M. (1999). The curriculum management creatures. *Technology & Learning, 20*(3), 10.
Browne, E. G. (2009). *Emerging teacher leadership: Collaboration, commitment, and curriculum mapping.* (Dissertation), Rowan University, USA, ProQuest Dissertations & Theses. Retrieved from http://gradworks.umi.com/33/59/3359918.html (3359918)
Buzan, T., & Buzan, B. (1993). *The mind map book*. London, UK: BBC Books.
Cabrera, D., & Colosi, L. (2008). Distinctions, systems, relationships, and perspectives (DSRP): A theory of thinking and of things. *Evaluation and Program Planning, 31*(3), 311-317. doi: 10.1016/j.evalprogplan.2008.04.001
Cabrera, D., Colosi, L., & Lobdell, C. (2008). Systems thinking. *Evaluation and Program Planning, 31*, 299-310.
Cabrera, D. A. (2007a). Distributed knowledge: ThinkBlocks and ergonomic chair. *Entrepreneurship, Business, and Leadership* [YouTube video]. USA: Cornell University.
Cabrera, D. A. (2007b). ThinkBlocks are the 21st century wooden block. *Entrepreneurship, Business, and Leadership* [YouTube video]. USA: Cornell University.
Cain, T. J., Rodman, R. L., Sanfilippo, F., & Kroll, S. M. (2005). Managing knowledge and technology to foster innovation at the Ohio State University Medical Center. *Academic Medicine, 80*(11), 1026-1031.
Callen, J. L., Braithwaite, J., & Westbrook, J. I. (2008). Contextual implementation model: a framework for assisting clinical information system implementations. *Journal of the American Medical Informatics Association, 15*(2), 255-262. doi: 10.1197/jamia.M2468
Campbell, D., Dawes, L., Beck, H., Wallace, S., Boman, M., & Reidsema, C. (2009, 6-9 December). *Graduate attribute mapping with the extended CDIO framework.* Paper presented at the 20th Australasian Association for Engineering Education conference, The University of Adelaide, Adelaide, Australia.

Carew, A. L., Lewis, D. J. H., & Letchford, C. W. (2008). *Conversational auditing of stage 1 competencies for accreditation and beyond.* Paper presented at the Australian Association for Engineering Education (AAEE) Conference, Yeppoon, Australia.
Carr, N., Olmos, J., Bushnell, M., & Bushnell, J. (2008). Delivering a pathology curriculum in an integrated medical course. *Virchows Archiv, 453*(4), 369-375.
Chapman, B. L. (2008). Tools for design and development of online instruction. In J. M. Spector, M. D. Merrill, J. van Merrienboer & M. P. Driscoll (Eds.), *Handbook of research on educational communications and technology* (3rd ed., pp. 671-684). New York: Taylor & Francis Group.
Checkland, P. (1988). Information systems and systems thinking: Time to unite? *International Journal of Information Management, 8*(4), 239-248. doi: 10.1016/0268-4012(88)90031-x
Checkland, P. (1993). *Systems thinking, systems practice*. Chichester, England: John Wiley & Sons.
Checkland, P. (1999). Systems thinking. In W. L. Currie & B. Galliers (Eds.), *Rethinking management information systems* (pp. 45-56). Oxford, UK: Oxford University Press. (Reprinted from: 2003).
Checkland, P., & Haynes, M. G. (1994). Varieties of systems thinking: The case of soft systems methodology. *System Dynamics Review, 10*(2-3), 189-197. doi: 10.1002/sdr.4260100207
Checkland, P., & Holwell, S. (1998). *Information, systems, and information systems : making sense of the field*. Chichester ; New York: Wiley.
Chen, D., & Stroup, W. (1993). General System Theory: toward a conceptual framework for science and technology education for all. *Journal of Science Education and Technology, 2*(3), 447-459.
Chen, P.-W., & Wu, Y.-H. (2009). Constructing a curriculum map to support learning navigation. *Pervasive Computing, December*, 45-50. doi: 10.1109/JCPC.2009.5420216
Clough, D. B., James, T. L., & Witcher, A. E. (1996). Curriculum mapping and instructional supervision. *NASSP Bulletin, 80*(581), 79-82.
Coffey, J. W., Carnot, M. J., Feltovich, P., Hoffman, R. R., Feltovich, J., Cañas, A. J., & Novak, J. D. (2003). A summary of literature pertaining to the use of concept mapping techniques and technologies for education and performance support: Technical report prepared by The Institute for Human and Machine Cognition (IHMC) for The Chief of Naval Education and Training, Pensacola, USA.
Cohen, J. J. (2000). CurrMIT: You've gotta use this thing! *Academic Medicine, 75*(4), 319.
Cohen, L., Manion, L., & Morrison, K. (2007). *Research methods in education* (6th ed.). London, UK: Routledge.
Cook, M. (1996). *Building enterprise information architectures: reengineering information systems*. Upper Saddle River, NJ: Prentice Hall.
Costa, A. L., & Kallick, B. (2010). It takes some getting used to: Rethinking curriculum for the 21st century. In H. H. Jacobs (Ed.), *Curriculum 21: Essential education for a changing world* (pp. 210-226). Alexandria, VA: Association for Supervision and Curriculum Development (ASCD).
Cottrell, S., Linger, B., & Shumway, J. (2004). Using information contained in the Curriculum Management Information Tool (CurrMIT) to capture opportunities for student learning and development. *Medical Teacher, 26*(5), 423-427.
Coyle, R. G. (1999). *Qualitative modelling in system dynamics or what are the wise limits to quantification?* Paper presented at the 17th international conference of the System Dynamics Society and the 5th Australian and New Zealand systems conference, Wellington, New Zealand. http://www.systemdynamics.org/conferences/1999/PAPERS/KEYNOTE1.PDF

Creswell, J. W., & Plano Clark, V. L. (2007). *Designing and conducting mixed methods research*. Thousand Oaks, CA: Sage.
Crouch, M., Richardson, G., & Reid, S. (2005). Enhancing patient-based learning: introducing STRAC and the reflective history template. *Rural and Remote Health, 5*(2), 368.
Davis, M. H., & Harden, R. M. (1999). AMEE medical education guideline No. 15: Problem-based learning: a practical guide. *Medical Teacher, 21*(2), 130-140.
De Simone, J. (2006). Reductionist inference-based medicine, i.e. EBM. *Journal of Evaluation in Clinical Practice, 12*(4), 445-449.
Dean, D. (2004, December 7). *St George's Hospital Medical School, London: What constitutes successful involvement from a student perspective?* Paper presented at the Association for the Study of Medical Education (ASME) Conference on Student Involvement in the Curriculum (Synopsis), RIBA, London.
Decker, G. S. (2003). Creating a framework to make data-driven instruction a reality. *Multimedia Schools, 10*(2), 22-25.
DeClark, T. (2002). Curriculum mapping: A how-to guide. *The Science Teacher, 69*(4), 29-31.
Denny, J. C., Irani, P. R., Wehbe, F. H., Smithers, J. D., & Spickard III, A. (2003). *The KnowledgeMap project: development of a concept-based medical school curriculum database.* Paper presented at the American Medical Informatics Association (AMIA) Symposium.
Denny, J. C., & Smithers, J. D. (2002). *A new tool to identify key biomedical concepts in text documents, with special application to curriculum content.* Paper presented at the American Medical Informatics Association (AMIA) Annual Symposium.
Denny, J. C., Smithers, J. D., Armstrong, B., & Spickard, A. (2005). "Where do we teach what?". *Journal of General Internal Medicine, 20*(10), 943-946. doi: 10.1111/j.1525-1497.2005.0203.x
Denny, J. C., Smithers, J. D., Miller, R. A., & Spickard III, A. (2003). "Understanding" medical school curriculum content using KnowledgeMap. *Journal of the American Medical Informatics Association, 10*(4), 351-362. doi: DOI 10.1197/jamia.M1176
Dornan, T., Lee, C., & Stopford, A. (2001). SkillsBase: A web-electronic learning portfolio for clinical skills. *Academic Medicine, 76*(5), 542-543.
Douglas, I. (2008). Technology-based knowledge systems. In J. M. Spector, M. D. Merrill, J. van Merrienboer & M. P. Driscoll (Eds.), *Handbook of research on educational communications and technology* (3rd ed., pp. 241-249). New York: Taylor & Francis Group.
Downey, J. P., McMurtrey, M. E., & Zeltmann, S. M. (2008). Mapping the MIS curriculum based on critical skills of new graduates: An empirical examination of IT professionals. *Journal of Information Systems Education, 19*(3), 351-364.
Dowton, S. B. (2004). Leadership in medicine: where are the leaders? *Medical Journal of Australia, 181*(11-12).
Dowton, S. B. (2005). Imperatives in medical education and training in response to demands for a sustainable workforce. *Medical Journal of Australia, 183*(11/12), 595-598.
Doyle, D. P. (2003). Data-driven decision-making. *T.H.E. Journal, 30*(10), supp19.
Draugalis, J. R., Slack, M. K., Sauer, K. A., Haber, S. L., & Vaillancourt, R. R. (2002). Creation and implementation of a learning outcomes document for a Doctor of Pharmacy curriculum. *American Journal of Pharmaceutical Education, 66*(3), 253-260.
Duffy, F. M. (2006). *Power, politics, and ethics in school districts : dynamic leadership for systemic change*. Lanham, Md.: Rowman & Littlefield Education.
Dunne, D., & Martin, R. (2006). Design thinking and how it will change management education: An interview and discussion. *Academy of Management Learning and Education, 5*(4), 512-523.

Dutta, S. (2009). *A model for dynamic curriculum development system for advanced courses through knowledge management in academic library*. Paper presented at the Asia-Pacific Conference on Library and Information Education and Practice, Tsukuba, Japan.
Earl, B. L. (2007). Concept maps for general chemistry. *Journal of Chemical Education, 84*(11), 1788-1789.
Edmondson, K. M. (1995). Concept mapping for the development of medical curricula. *Journal of Research in Science Teaching, 32*(7), 777-793. doi: 10.1002/tea.3660320709
Eisenberg, M. (1984). *Microcomputer-based curriculum mapping a data management approach*. Paper presented at the American Society for Information Science (mid-year meeting), Bloomington, USA. http://www.eric.ed.gov/contentdelivery/servlet/ERICServlet?accno=ED247901
Eisner, J. (1993, October 30-November 3). *Curriculum Analysis Tools (CATs): a cooperative approach to the design of curriculum databases.* Paper presented at the 17th annual symposium on computer applications in medical care, Sheraton Washington Hotel, Washington DC.
Eisner, J. (1995). Multi-national, multi-lingual, multi-professional CATs: (Curriculum Analysis Tools). *Medinfo, 2*, 1706.
Elliott, A. C., & Woodward, W. A. (2007). *Statistical analysis quick reference guidebook*. Thousand Oaks, CA: Sage.
English, F. W. (1978). Quality control in curriculum development (Report). Arlington, VA, USA: American Association of School Administrators.
English, F. W. (1979). Re-tooling curriculum within on-going school systems. *Educational Technology, 19*(5), 7-13.
English, F. W. (1980). Curriculum mapping. *Educational Leadership, 37*(7), 558-559.
English, F. W. (1984). *Curriculum mapping and management.* Paper presented at the Regional Exchange Workshop: Promoting school excellence through the application of effective schools research, Washington, D.C.
English, F. W. (1987). It's time to abolish conventional curriculum guides. *Educational Leadership, 44*(4), 50-52.
English, F. W. (1988). *Curriculum auditing*. Lancaster, PA: Technomic Publishing.
English, F. W. (1999, April 19-23). *Looking behind the veil: Addressing the enigma of leadership.* Paper presented at the Annual meeting of the American Educational Research Association, Montreal, Quebec, Canada.
English, F. W. (2007). *The art of educational leadership: balancing performance and accountability*. Thousand Oaks, CA: Sage.
English, F. W. (2010). *Deciding what to teach and test: Developing, aligning, and leading the curriculum* (3rd ed.). Thousand Oaks, CA: Corwin.
English, F. W., & Larson, R. L. (1996). *Curriculum management for educational and social service organizations* (2nd Ed.). Springfield, IL, USA: Charles C. Thomas Publisher.
English, F. W., & Steffy, B. E. (1982). Curriculum as a strategic management tool. *Educational Leadership, 39*(4), 276-278.
English, F. W., & Steffy, B. E. (2001). *Deep curriculum alignment: Creating a level playing field for all children on high-stakes tests of educational accountability*. Lanham, MD: Scarecrow Press.
Faxvaag, A., Toussaint, P. J., & Johansen, T. S. (2011). Research management in healthcare informatics — experiences from Norway *Studies in health technology and informatics* (Vol. 169: User centred networked health care, pp. 980-984). Amsterdam: IOS Press.
Fetterman, D. M., Deitz, J., & Gesundheit, N. (2010). Empowerment evaluation: a collaborative approach to evaluating and transforming a medical school curriculum. *Academic Medicine, 85*(5), 813-820.

Field, M. J., & Sefton, A. J. (1998). Computer-based management of content in planning a problem-based medical curriculum. *Medical Education, 32*(2), 163-171.
Fink, A., & Kosecoff, J. B. (1985). *How to conduct surveys : A step-by-step guide*. Beverly Hills, CA: Sage.
Ford, N. (2008). Educational informatics. *Annual Review of Information Science and Technology, 42*(1), 497-544. doi: 10.1002/aris.2008.1440420118
Forrester, J. W. (1994). System dynamics, systems thinking, and soft OR. *System Dynamics Review, 10*(2-3), 245-256. doi: 10.1002/sdr.4260100211
Forrester, J. W. (2007). System dynamics—a personal view of the first fifty years. *System Dynamics Review, 23*(2/3), 345-358.
Francois, C. (1999). Systemics and cybernetics in a historical perspective. *Systems Research and Behavioral Science, 16*, 203-219.
Gable, G. G., Sedera, D., & Chan, T. (2008). Re-conceptualizing information system success: The IS-Impact Measurement Model. *Journal of the Association for Information Systems, 9*(7), 1-32.
Garten, C. (2005). Assessment, communication, and intervention. *Curriculum Technology Quarterly, 15*(1), 1-4.
Gharajedaghi, J. (2007). Systems thinking: a case for second-order learning. *The Learning Organization, 14*(6), 473-479. doi: 10.1108/09696470710825088
Gibson, K. A., Boyle, P., Black, D. A., Cunningham, M., Grimm, M. C., & McNeil, H. P. (2008). Enhancing evaluation in an undergraduate medical education program. *Academic Medicine, 83*(8), 787-793. doi: 10.1097/ACM.0b013e31817eb8ab
Gjerde, C. L. (1981). 'Curriculum mapping': objectives, instruction, and evaluation. *Academic Medicine, 56*(4), 316-323.
Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory: strategies for qualitative research* (Fourth paperback printing 2009 ed.). Piscataway, NJ: Aldine Transaction Publishers.
Gluga, R. (2010, June 14-18). *Long term student learner modeling and curriculum mapping.* Paper presented at the Intelligent Tutoring Systems (ITS) 10th international conference, Pittsburgh, PA, USA.
Gluga, R., Kay, J., & Lever, T. (2010, June 14-18). *Modeling long term learning of generic skills.* Paper presented at the Intelligent Tutoring Systems (ITS) 10th international conference, Pittsburgh, PA, USA.
Goldkuhl, G. (2008). *What kind of pragmatism in information systems research?* Paper presented at the AIS SIG Prag Inaugural meeting, Paris. http://www.vits.org/publikationer/dokument/663.pdf
Goulston, K. J., & Oates, R. K. (2012). The Sydney University medical program: Highlights and lessons. *Medical Journal of Australia, 196*(2), 106-107.
Gravetter, F. J., & Wallnau, L. B. (2004). *Statistics for the behavioural sciences* (6th ed.). Belmont, CA: Wadsworth/Thomson Learning.
Greene, J. C. (1994). Qualitative program evaluation: practice and promise. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 530-544). Thousand Oaks, CA: Sage.
Gregor, S. (2006). The nature of theory in information systems. *MIS Quarterly, 30*(3), 611-642.
Guba, E. G., & Lincoln, Y. S. (1989). *Fourth generation evaluation*. Newbury Park, CA: Sage.
Gustafson, K. L., & Branch, R. M. (2002). What is instructional design. In R. A. Reiser & J. V. Dempsey (Eds.), *Trends and issues in instructional design and technology* (pp. 16-25). Upper Saddle River, NJ: Merrill/Prentice Hall.
Hale, J. A. (2008). *A guide to curriculum mapping: planning, implementing, and sustaining the process*. Thousand Oaks, CA: Corwin.

Hale, J. A., & Dunlap, R. F., Jr. (2010). *An educational leader's guide to curriculum mapping: Creating and sustaining collaborative cultures*. Thousand Oaks, CA: Corwin.

Harden, R. M. (2000). The integration ladder: a tool for curriculum planning and evaluation. *Medical Education, 34*(7), 551-557.

Harden, R. M. (2001a). AMEE Guide No. 21: Curriculum mapping: A tool for transparent and authentic teaching and learning. *Medical Teacher, 23*(2), 123.

Harden, R. M. (2001b). The learning environment and the curriculum. *Medical Teacher, 23*(4), 335-336.

Harden, R. M., Crosby, J., Davis, M. H., Howie, P. W., & Struthers, A. D. (2000). Task-based learning: the answer to integration and problem-based learning in the clinical years. *Medical Education, 34*(5), 391-397. doi: 10.1046/j.1365-2923.2000.00698.x

Harden, R. M., Davis, M. H., & Crosby, J. R. (1997). The new Dundee medical curriculum: a whole that is greater than the sum of the parts. *Medical Education, 31*(4), 264-271.

Harden, R. M., & Stamper, N. (1999). What is a spiral curriculum? *Medical Teacher, 21*(2), 141-143.

Hatfield, A. J., & Bangert, M. P. (2005). Implementation of the clinical encounters tracking system at the Indiana University School of Medicine. *Medical Reference Services Quarterly, 24*(4), 41-58.

Hausman, J. J. (1974). Mapping as an approach to curriculum planning. *Curriculum in Art, 4*(3), 192-198.

Hege, I., Nowak, D., Kolb, S., Fischer, M. R., & Radon, K. (2010). Developing and analysing a curriculum map in Occupational- and Environmental Medicine. *BMC Medical Education, 10*. http://www.biomedcentral.com/1472-6920/10/60 doi:10.1186/1472-6920-10-60

Hege, I., Siebeck, M., & Fischer, M. R. (2007). An online learning objectives database to map a curriculum. *Medical education, 41*(11), 1095-1096.

Herbold, J. (2012). Curriculum mapping and research-based practice: Helping students find the path to full potential. *Odyssey: New directions in deaf education, 13*.

Herr, P. (2000). The changing role of the teacher: How management systems help facilitate teaching. *T.H.E. Journal, 28*(4), 28-34.

Herrington, J., McKenney, S., Reeves, T. C., & Oliver, R. (2007). *Design-base research and doctoral students: guidelines for preparing a dissertation proposal.* Paper presented at the World Conference on Educational Multimedia, Hypermedia and Telecommunication, Chesapeake, Virginia, USA.

Herrington, J., & Oliver, R. (2000). An instructional design framework for authentic learning envirnoments. *Educational Technology, Research and Development, 48*(3), 23-48.

Hevner, A. R. (2007). A three cycle view of Design Science Research. *Scandinavian Journal of Information Systems, 19*(2).

Hevner, A. R., & Chatterjee, S. (2010). *Design research in information systems: Theory and practice*. New York, NY: Springer.

Hevner, A. R., March, S. T., Park, J., & Ram, S. (2004). Design science in information systems research. *MIS Quarterly, 28*(1), 75-105.

Hoffman, S. (1997). Elaboration Theory and hypermedia: Is there a link? *Educational Technology, 37*(1), 57-64.

Homer, J., & Oliva, R. (2001). Maps and models in system dynamics: A response to Coyle. *System Dynamics Review, 17*(4), 347-355.

Horton, P. B., McConney, A. A., Gallo, M., Woods, A. L., Senn, G. J., & Hamelin, D. (1993). An investigation of the effectiveness of concept mapping as an instructional tool. *Science Education, 77*(1), 95-111.

Housego, S., & Parker, N. (2009). Positioning ePortfolios in an integrated curriculum. *Education + Training, 51*(5), 408-421. doi: 10.1108/00400910910987219

Howard, J. K. (2010). Information specialist and leader—Taking on collection and curriculum mapping. *School Library Monthly, 27*(1), 35.
Hoyle, J. R., English, F. W., & Steffy, B. E. (1998). *Skills for successful 21st century school leaders: Standards for peak performers*. Arlington, VA: American Association of School Administrators.
Hughes, C., & Barrie, S. (2010). Influences on the assessment of graduate attributes in higher education. *Assessment & Evaluation in Higher Education, 35*(3), 325-334. doi: 10.1080/02602930903221485
Hughes, C., Toohey, S., & Velan, G. (2008). eMed Teamwork: A self-moderating system to gather peer feedback for developing and assessing teamwork skills. *Medical Teacher, 30*(1), 5-9. doi: 10.1080/01421590701758632
Hummelbrunner, R. (2011). Systems thinking and evaluation. *Evaluation, 17*(4), 395-403. doi: 10.1177/1356389011421935
Hunter, D. P., & Ciotti, V. (2006). IT disasters: The worst debacles and lessons learned from them. *Healthcare Executive, 21*(5), 9-12.
Ingleby, E., & Hedges, C. (2012). Exploring the continuing professional development needs of pedagogical practitioners in early years in England. *Professional Development in Education, 38*(4), 533-549. doi: 10.1080/19415257.2011.651777
Jacobs, H. H. (1997). *Mapping the big picture: Integrating curriculum and assessment K-12*. Alexandria, VA: Association for Supervision and Curriculum Development (ASCD).
Jacobs, H. H. (2000). Upgrading the K-12 journey through curriculum mapping: A technology tool for classroom teachers, media specialists, and administrators. *Knowledge Quest, 29*(2), 25-29.
Jacobs, H. H. (2004a). Curriculum mapping as a hub: Integrating new forms of data, decision-making structures, and staff development. In H. H. Jacobs (Ed.), *Getting results with curriculum mapping* (pp. 126-137). Alexandria, VA: Association for Supervision and Curriculum Development (ASCD).
Jacobs, H. H. (Ed.). (2004b). *Getting results with curriculum mapping*. Alexandria, VA: Association for Supervision and Curriculum Development (ASCD).
Jacobs, H. H. (Ed.). (2010). *Curriculum 21: Essential education for a changing world*. Alexandria, VA: Association for Supervision and Curriculum Development (ASCD).
Jacobs, J., Salas, A. A., Cameron, T., Naguwa, G., & Kasuya, R. (2005). Implementing an online curriculum management database in a problem-based learning curriculum. *Academic Medicine, 80*(9), 840.
Jairam, D., & Kiewra, K. A. (2010). Helping students soar to success on computers: An investigation of the SOAR study method for computer-based learning. *Journal of educational psychology, 102*(3), 601.
Janesick, V. J. (1994). The dance of qualitative research design: Metaphor, methodolatry and meaning. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 209-219). Thousand Oaks, CA: Sage.
Jaye, C., & Egan, T. (2006). Communities of clinical practice: Implications for health professional education. *Focus on Health Professional Education, 8*(2), 1-10.
JISC The Design Studio. (2010, 22 May 2012). Dynamic Learning Maps Project. Retrieved December 22, 2012, from http://jiscdesignstudio.pbworks.com/w/page/24179142/Dynamic+Learning+Maps+Project
Jokela, P., & Karlsudd, P. (2009). Net-based training for physicians. *E-Learning and Digital Media, 6*(4), 325-335.
Jokela, P., Karlsudd, P., & Östlund, M. (2008). Theory, methods and tools for evaluation using a systems-based approach. *The Electronic Journal of Information Systems Evaluation, 11*(3), 197-121.

Kali, Y., & Linn, M. C. (2008). Technology-enhanced support strategies for inquiry learning. In J. M. Spector, M. D. Merrill, J. van Merrienboer & M. P. Driscoll (Eds.), *Handbook of resarch on educational communications and technology* (3rd ed., pp. 145-161). New York: Taylor & Francis Group.

Kallick, B., & Wilson, J. M. (2004). Curriculum mapping and software: Creating an information system for a learning community. In H. H. Jacobs (Ed.), *Getting results with curriculum mapping* (pp. 126-137). Alexandria, VA: Association for Supervision and Curriculum Development (ASCD).

Kassab, S. E., & Hussain, S. (2010). Concept mapping assessment in a problem-based medical curriculum. *Medical Teacher, 32*(11), 926-931.

Kast, F. E., & Rosenzweig, J. E. (1972). General Systems Theory: Applications for organization and management. *Academy of Management Journal, 15*(4), 447.

Kelley, K. A., McAuley, J. W., Wallace, L. J., & Frank, S. G. (2008). Curricular mapping: Process and product. *American Journal of Pharmaceutical Education., 72*(5).

Kelly, M. J. (2004). Qualitative evaluation research. In C. Seale, G. Gobo, J. F. Gubrium & D. Silverman (Eds.), *Qualitative research practice* (pp. 521-535). London: Sage.

Kennedy, E. (2003). *Raising test scores for all students: an administrator's guide to improving standardized test performance*. Thousand Oaks, CA: Corwin.

Kies, S. M. (2010). Curriculum mapping: Knowing where you are going and how you are going to get there. *Medical Science Educator (previously JIAMSE), 20*(2). http://www.iamse.org/artman/publish/printer_537.shtml

Kiewra, K. A. (2002). How classroom teachers can help students learn and teach them how to learn. *Theory into Practice, 41*(2), 71-80.

Kim, D. H. (1993). *Systems archetypes I: Diagnosing systemic issues and designing high-leverage interventions*. Waltham, MA: Pegasus Communications.

Kim, D. H. (1994). *Systems archetypes II: Using systems archetypes to take effective action*. Waltham, MA: Pegasus Communications.

Kim, D. H. (2000). *Systems thinking tools: A user's reference guide*. Waltham, MA: Pegasus Communications.

Kim, D. H., & Anderson, V. (1998). *System archetypes basics*. Waltham, MA: Pegasus Communications.

Kopera-Frye, K., Mahaffy, J., & Messick Svare, G. (2008). The map to curriculum alignment and improvement. *Collected Essays on Learning and Teaching, 1*, 8-14. http://apps.medialab.uwindsor.ca/ctl/CELT/celtvol1.html

Koppang, A. (2004). Curriculum mapping: building collaboration and communication. *Intervention in School and Clinic, 39*(3), 154-161.

Lai, J., Wood, L., & Marrone, M. (2012). Implementation of a curriculum management tool: Challenges faced by a large Australian university. *Asian Social Science, 8*(14), 28.

Lane, D. C. (1994). With a little help from our friends: How system dynamics and soft OR can learn from each other. *System Dynamics Review, 10*(2-3), 101-134. doi: 10.1002/sdr.4260100203

Latimer, D. G., & Thornlow, D. K. (2006). Incorporating geriatrics into baccalaureate nursing curricula: Laying the rroundwork with faculty development. *Journal of Professional Nursing, 22*(2), 79-83.

Lave, J., & Wenger, E. (1991). *Situated learning : Legitimate peripheral participation*. Cambridge, England: Cambridge University Press.

Learning-Theories.com. (2008, December 2012). Learning theories knowledge base and webliography.   Retrieved December 22, 2012, from http://www.learning-theories.com

Lee, A. S. (1991). Integrating positivist and interpretive approaches to organizational research. *Organization Science, 2*(4), 342-365.

Lee, M. Y., Albright, S. A., Alkasab, T., Damassa, D. A., Wang, P. J., & Eaton, E. K. (2003). Tufts Health Sciences database: Lessons, issues and opportunities. *Academic Medicine, 78*(3), 254-264.

Lee, Y., Lee, Z., & Gosain, S. (2004). The evolving intellectual diversity of the IS discipline: Evidence from the referent disciplines. *Communications of the Association for Information Systems, 13*. http://aisel.aisnet.org/cais/vol13/iss1/33

Lewis, B. R., & Byrd, T. A. (2005). A methodology for construct development in MIS research. *European Journal of Information Systems, 14*(4), 388-400.

Liu, M., Wrobbel, D., & Blankson, I. (2010). Rethinking program assessment through the use of program alignment mapping technique. *Communication Teacher, 24*(4), 238-246.

Lucas, R. M. (2005). *Teachers' perceptions on the efficacy of curriculum mapping as a tool for planning and curriculum alignment.* (Dissertation), Seton Hall University, New Jersey, USA, ProQuest Dissertations & Theses. (3190194)

Lyle, V. (2010). *Teacher and administrator perceptions of administrative responsibilities for implementing the Jacobs model of curriculum mapping.* (Doctoral dissertation), Walden University, USA, ProQuest Dissertations & Theses. (2206340851)

Maani, K. E., & Cavana, R. Y. (2007). *Systems thinking, system dynamics : Managing change and complexity* (2nd ed.). Auckland, NZ: Pearson.

Marshall, B., Chen, H., Shen, R., & Fox, E. A. (2006). Moving digital libraries into the student learning space:The GetSmart experience. *ACM Journal on Educational Resources in Computing, 6*.

Marshall, B., Yiwen, Z., Hsinchun, C., Lally, A., Rao, S., Fox, E., & Cassel, L. N. (2003). *Convergence of knowledge management and e-learning: The GetSmart experience.* Paper presented at the 2003 Joint Conference on Digital Libraries (JCDL'03), Piscataway, NJ, USA.

Mathiesen, J. A. (2008). *Teacher perceptions related to technology tools for curriculum alignment: A survey of teachers' response to a curriculum mapping tool.* (Doctoral dissertation), Pepperdine University Malibu, CA, USA, Association for Computing Machinery (ACM) Digital Library. Retrieved from http://dl.acm.org/citation.cfm?id=1571007

Mattern, W. D., Anderson, M. B., Aune, K. C., Carter, D. E., Friedman, C. P., Kappelman, M. D., & O'Connell, M. T. (1992). Computer databases of medical school curricula. *Academic Medicine, 67*(1), 12-16.

Matveev, A. G., Veltri, N. F., Zapatero, E. G., & Cuevas, N. M. (2010). *Curriculum mapping: A conceptual framework and practical illustration.* Paper presented at the American Conference on Information Systems (AMCIS).

Maxwell, E. (1997). Extended uses for curriculum mapping : Keeping track of text types and technology use in units of work at Cherrybrook Technology High School. *Scan, 16*(1), 20-21.

Mayer, R. E. (Ed.). (2005). *The Cambridge handbook of multimedia learning*. New York, NY: Cambridge University Press.

Mazurat, R., & Schonwetter, D. J. (2008). Electronic curriculum mapping: supporting competency-based dental education. *Journal Canadian Dental Association, 74*(10), 886-889.

McGill, L. (2011, 17 November). Curriculum delivery: Dynamic Learning Maps. Retrieved from http://blogs.cetis.ac.uk/othervoices/2011/11/17/curriculum-delivery-dynamic-learning-maps/

McGrath, C., Comfort, M. B., Luo, Y., Samaranayake, L. P., & Clark, C. D. (2006). Application of an interactive computer program to manage a problem-based dental curriculum. *Journal of Dental Education, 7*(4), 387-397.

McIntire, T. (2006). Share and share alike. *Technology & Learning, 26*(6), 26-27.

McKenney, S., Nieveen, N., & Strijker, A. (2008). Information technology tools for curriculum development. In J. Voogt & G. Knezek (Eds.), *International handbook of information technology in primary and secondary education* (pp. 195-210). New York, NY: Springer.

McNeil, H. P., Hughes, C. S., Toohey, S. M., & Dowton, S. B. (2006). An innovative outcomes-based medical education program built on adult learning principles. *Medical Teacher, 28*(6), 527-534.

McNeil, H. P., Scicluna, H. A., Boyle, P., Grimm, M. C., Gibson, K. A., & Jones, P. D. (2011). Successful development of generic capabilities in an undergraduate medical education program. *Higher Education Research & Development*, 1-15. doi:10.1080/07294360.2011.559194

McNutt, L.-A., Furner, S. E., Moser, M., & Weist, E. M. (2008). Applied epidemiology competencies for governmental public health agencies: Mapping current curriculum and the development of new curriculum. *Public Health Reports, 123*(Suppl 1), 13-18.

Meadows, D. H. (2005). Places to intervene in a system. *Developer.*, *(August). http://www.developerdotstar.com/mag/articles/places_intervene_system.html

Meadows, D. H., & Wright, D. (2009). *Thinking in systems : A primer*. London, UK: Earthscan.

Mehta, C. R., & Patel, N. R. (2010). IBM SPSS Exact Tests. 1-226. ftp://public.dhe.ibm.com/software/analytics/spss/documentation/statistics/20.0/en/client/Manuals/IBM_SPSS_Exact_Tests.pdf

Metz, B. A., Lee, M. Y., Albright, S., & Alkasab, T. (2001). Transforming medical and health science education at Tufts University. *Educause Quarterly, 24*(4), 46-50.

Mills, M. S. (2001). Ensuring the viability of curriculum mapping in a school improvement plan. Little Rock, USA: University of Arkansas.

Mills, M. S. (2003). Curriculum mapping as professional development. *Curriculum Technology Quarterly, 12*(3), 1-4.

Molenda, M. (1997). Historical and philosophical foundations of intructional design: A North Americal view. In R. D. Tennyson, F. Schott, N. M. Seel & S. Dijkstra (Eds.), *Instructional design : International perspectives. Volume 1: Theory, research and models* (Vol. 1, pp. 41-53). Mahwah, NJ: Lawrence Erlbaum Associates.

Moody, D., Iacob, M. E., & Amrit, C. (2010). *In search of paradigms: Identifying the theoretical foundations of the IS field.* Paper presented at the 18th European Conference on Information Systems (ECIS 2010 Proceedings. Paper 43).

Mora, M., Gelman, O., Forgionne, G., Petkov, D., & Cano, J. (2007a). Information systems research and systems approach (Special issue guest editoral preface). *Information Resource Management Journal, 20*(2), i-iv.

Mora, M., Gelman, O., Forgionne, G., Petkov, D., & Cano, J. (2007b). Integrating the fragmented pieces of IS research paradigms and frameworks: A systems approach. *Information Resources Management Journal, 20*(2), 1-22.

Morse, J. M., & Richards, L. (2002). *Readme first for a user's guide to qualitative methods*. Thousand Oaks, CA: Sage.

Morsi, R., Ibrahim, W., & Williams, F. (2007, October 10-13). *Concept maps: Development and validation of engineering curricula.* Paper presented at the 37th ASEE/IEEE frontiers in education conference. Global engineering: Knowledge without borders, opportunities without passports, Milwaukee, WI.

Moss Curtis, D., & Moss, D. M. (2010). Curriculum mapping: Bringing evidence-based frameworks to legal education. *Nova Law Review, 34*(2), 473-513.

Myers, M. D. (1997, November 5, 2012). Qualitative research in information systems. *MISQ Discovery.* Retrieved December 22, 2012, from http://www.qual.auckland.ac.nz/

Naik, V., Wong, N., Hamstra, A., Hamstra, K., Hamstra, S., & Hamstra, J. (2011). Review article: Leading the future: Guiding two predominant paradigm shifts in medical education through scholarship. *Canadian Journal of Anesthesia, 59*(2), 213-223. doi: 10.1007/s12630-011-9640-1

Nandhakumar, J., & Jones, M. (1997). Too close for comfort? Distance and engagement in interpretive information systems research. *Information Systems Journal, 7*(2), 109-131.

Newcastle University UK. (2010). Dynamic Learning Maps. Retrieved December 21, 2012, from https://learning-maps.ncl.ac.uk/

Noble, C., O'Brien, M., Coombes, I., Shaw, P. N., & Nissen, L. (2011). Concept mapping to evaluate an undergraduate pharmacy curriculum. *American Journal of Pharmaceutical Education, 75*(3). http://www.ajpe.org/doi/full/10.5688/ajpe75355

Novak, J. D. (1990). Concept mapping: A useful tool for science education. *Journal of Research in Science Teaching, 27*(10), 937-949.

Novak, J. D., & Cañas, A. J. (2008). The theory underlying concept maps and how to construct and use them. *Florida Institute for Human and Machine Cognition, 2008*.

Novak, J. D., & Gowin, D. B. (1984). *Learning how to learn*. Cambridge: Cambridge University Press.

Nowacek, G., & Friedman, C. P. (1995). Issues and challenges in the design of curriculum information systems. *Academic Medicine, 70*(12), 1096-1100.

O'Connor, J., & McDermott, I. (1997). *The art of systems thinking: Essential skills for creativity and problem solving*. Hammersmith, London, England: Thompsons.

O'Sullivan, A. J., Harris, P., Hughes, C. S., Toohey, S. M., Balasooriya, C., Velan, G., Kumar, R. K., & McNeil, H. P. (2012). Linking assessment to undergraduate student capabilities through portfolio examination. *Assessment & Evaluation in Higher Education, 37*(3), 379.

Oates, K. (2012). The new clinical leader. *Journal of Paediatrics and Child Health, 48*(6), 472-475. doi: 10.1111/j.1440-1754.2012.02478.x

Oliver, B. (2011). Assuring graduate outcomes. Strawberry Hills, NSW, Australia: Australian Learning and Teaching Council.

Oliver, B., Ferns, S., Whelan, B., & Lilly, L. (2010, June 30 - July 2). *Mapping the curriculum for quality enhancement : Refining a tool and processes for the purpose of curriculum renewal.* Paper presented at the Australian Universities Quality Forum (AuQF): Quality in uncertain times Gold Coast, Australia.

Olsson, M. O. (2005). Schools of systems thinking – development trends in systems methodology. In M. O. Olsson & G. Sjostedt (Eds.), *Systems approaches and their application: Examples from Sweden* (pp. 31-74). New York, NY: Kluwer Academic Publishers.

Øvretveit, J. (1998). *Evaluating health interventions: An introduction to evaluation of health treatments, services, policies and organizational interventions*. Buckingham, Philadelphia: Open University Press.

Øvretveit, J. (2002). *Action evaluation of health programmes and changes: A handbook for a user-focussed approach*. Abingdon, Oxon, UK: Radcliffe Medical Press Ltd.

Pallant, J. (2011). *SPSS survival manual* (4th ed.). Crows Nest, NSW, Australia: Allen & Unwin.

Paquette, G., Rosca, I., Mihaila, S., & Masmoudi, A. (2007). TELOS: A service-oriented framework to support learning and knowledge management. In S. Pierre (Ed.), *E-learning networked environments and architectures - a knowledge-processing perspective* (pp. 79-109). London, UK: Springer.

Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks, CA: Sage.

Perlin, M. S. (2011). Curriculum mapping for program evaluation and CAHME accreditation. *Journal of Health Administration Education, 28*(1), 33-53.

Phelps, V. (2005). Beyond scissors and glue. *Journal of Staff Development, 26*(1), 31-32.

Plaza, C. M., Draugalis, J. R., Slack, M. K., Skrepnek, G. H., & Sauer, K. A. (2007). Curriculum mapping in program assessment and evaluation. *American Journal of Pharmaceutical Education, 71*(2), 1-8. http://www.ajpe.org/doi/full/10.5688/aj710220

Prideaux, D. (2003). ABC of learning and teaching in medicine: Curriculum design. *British Medical Journal (BMJ), 326*(7383), 268-270.

Prince, N. J., Ross, J. G., Fertleman, C. R., & Watson, M. (2011). 'Signpost' - An innovative online solution to mapping resources to curriculum competences. *Archives of Disease in Childhood, 96*(Supplement 1), A24. doi: 10.1136/adc.2011.212563.48

Pugh, D. S. (Ed.). (1997). *Organization theory: Selected readings* (4th ed.). London, England: Penguin Books.

Ramage, M., & Shipp, K. (2009). *Systems thinkers*

Ramagli, H. J. (1982). *Curriculum management systems: Analysis and definition*. Paper presented at the Annual meeting of the American Educational Research Association, New York.

Ramnarine, S. (2004). Impacting student achievement through data-driven decision-making. *MultiMedia & Internet @ Schools, 11*(4), 33-35.

Ranmuthugala, G., Plumb, J. J., Cunningham, F. C., Georgiou, A., Westbrook, J. I., & Braithwaite, J. (2011). How and why are communities of practice established in the healthcare sector? A systematic review of the literature. *BMC Health Services Research, 11*, 1-16. http://www.biomedcentral.com/1472-6963/11/273

Rapoport, A. (1976). General Systems Theory: A bridge between two cultures. Third annual Ludwig von Bertalanffy memorial lecture. *Behavioral Science, 21*(4), 228.

Read, D. (2005). Places to intervene in a system—Editor's note. *Developer.**. http://www.developerdotstar.com/mag/articles/places_intervene_system.html

Reeves, T. C., Herrington, J., & Oliver, R. (2004). A development research agenda for online collaborative learning. *Educational Technology, Research and Development, 52*(4), 53-65.

Reeves, T. C., Herrington, J., & Oliver, R. (2005). Design research: A socially responsible approacht to instructional technology research in higher education. *Journal of Computing in Higher Education, 16*(2), 97-116.

Reigeluth, C. M. (1997). Instructional theory, practitioner needs, and new directions: Some reflections. *Educational Technology, 37*(1), 42-46.

Reigeluth, C. M. (1999a). The elaboration theory: Guidance of scope and sequence decisions. In C. M. Reigeluth (Ed.), *Instructional-design theories and models: A new paradigm of instructional theory* (Vol. 2, pp. 425-453). New Jersey, NJ: Lawrence Erlbaum.

Reigeluth, C. M. (1999b). What is instructional-design theory and how is it changing? In C. M. Reigeluth (Ed.), *Instructional-design theories and models: A new paradigm of instructional theory* (Vol. 2, pp. 5-29). New Jersey, NJ: Lawrence Erlbaum.

Reigeluth, C. M. (2005). New instructional theories and strategies for a knowledge-based society. In J. M. Spector, C. Ohrazda, A. Van Schaack & D. A. Wiley (Eds.), *Innovations in instructional technology: Essays in honor of M. David Merrill* (pp. 207-217). New Jersey, NJ: Lawrence Erlbaum.

Reigeluth, C. M. (Ed.). (1983). *Instructional-design theories and models: An overview of their current status* (Vol. 1). New Jersey, NJ: Lawrence Erlbaum.

Reigeluth, C. M. (Ed.). (1999c). *Instructional-design theories and models: A new paradigm of instructional theory* (Vol. 2). New Jersey, NJ: Lawrence Erlbaum.

Reigeluth, C. M., & Carr-Chellman, A. A. (Eds.). (2009). *Instructional-design theories and models: Building a common knowledge base* (Vol. 3). New York, NY: Taylor and Francis.

Renzulli, P. (2005). Testing the limits of one-stop data access. *T.H.E. Journal, 32*(12), 45-46.

Richardson, G. P. (1994). Introduction: Systems thinkers, systems thinking. *System Dynamics Review, 10*(2-3), 95-99. doi: 10.1002/sdr.4260100202

Richardson, G. P. (1996). Problems for the future of system dynamics. *System Dynamics Review, 12*(2), 141-157.

Richmond, B. (1994). Systems thinking/system dynamics: Let's just get on with it. *System Dynamics Review, 10*(2-3), 135-157. doi: 10.1002/sdr.4260100204

Robinson, D. H., & Kiewra, K. A. (1995). Visual argument: Graphic organizers are superior to outlines in improving learning from text. *Journal of Educational Psychology, 87*(3), 455.

Robley, W., Whittle, S., & Murdoch-Eaton, D. (2005). Mapping generic skills curricula: A recommended methodology. *Journal of Further and Higher Education, 29*(3), 221-231. doi: 10.1080/03098770500166801

Ross, N., & Davies, D. (1999). AMEE Guide No. 14. Outcome-based education: Part 4—Outcome-based learning and the electronic curriculum at Birmingham Medical School. *Medical Teacher, 21*(1), 26-31.

Ross, S. M., Morrison, G. R., Hannafin, R. D., Young, M., van den Akken, J., Kuiper, W., Richey, R. C., & Klein, J. D. (2008). Research design. In J. M. Spector, M. D. Merrill, J. van Merrienboer & M. P. Driscoll (Eds.), *Handbook of research on educational communications and technology* (3rd ed., pp. 715-761). New York, NY: Taylor & Francis.

Rouet, J.-F., & Potelle, H. (2005). Navigational principles in multimedia learning. In R. E. Mayer (Ed.), *The Cambridge handbook of multimedia learning* (pp. 297-312). New York, NY: Cambridge University Press.

Ruddlesdin, J., Wentworth, L., Bhat, S., & Baker, P. (2010). Competency mapping in quality management of foundation training. *Clinical Medicine, 10*(6), 568-572.

Rudzajs, P., Kirikova, M., Strazdina, R., & Sukovskis, U. (2011, February 17–18). *Towards managing learning outcomes in the jungle of qualification standards.* Paper presented at the EQANIE conference: Learning outcomes and quality management in informatics education—training and exchange of good practice, Vienna, Austria.

Russell, C., & Lee, A. (2005). *The innovative teaching and educational technology (ITET) fellowship: Cultivating communities of practice in learning and teaching*. Paper presented at the ALT-C 2005: Exploring the frontiers of e-learning – borders, outposts and migrations, Manchester, UK. http://www.unsworks.unsw.edu.au/primo_library/libweb/action/dlDisplay.do?docId=unsworks_4221&vid=UNSWORKS

Ryan, A. J. (2008). What is a systems approach? *arXiv:0809.1698v1 [nlin.AO],* (September 10). http://arxiv.org/abs/0809.1698v1

Salas, A. A., & Anderson, M. B. (1997). Introducing information technologies into medical education: Activities of the AAMC. *Academic Medicine, 72*(3), 191-193.

Salas, A. A., Anderson, M. B., LaCourse, L., Allen, R., Candler, C. S., T, C., & D, L. (2003). CurrMIT: A tool for managing medical school curricula. *Academic Medicine, 78*(3), 275-279.

Salisbury, D. F. (1989). What should instructional designers know about general systems theory? *Educational Technology, 29*, 42-45.

Salisbury, D. F. (1996). *Five technologies for educational change : Systems thinking, systems design, quality science, change managament, instructional technology*. Englewood Cliffs, NJ: Educational Technology Publications.

Salpeter, J. (2004). Data: mining with a mission. *Technology & Learning, 24*(8), 30-36.

Sapone, C. V. (1972). *CURMIS. Curriculum Management Information System*. Paper presented at the Supervisors conference annual meeting National Council for the Social Studies, Boston, Massachusetts, USA.

Schafheutle, E. I., Hassell, K., Ashcroft, D. M., Hall, J., & Harrison, S. (2012). How do pharmacy students learn professionalism? *International Journal of Pharmacy Practice, 20*, 118-128. doi: 10.1111/j.2042-7174.2011.00166.x

Schultze, U. (2000). A confessional account of an ethnography about knowledge work. *MIS Quarterly, 24*(1), 3-41.
Senge, P. (1996). Rethinking leadership in the learning organization. *The Systems Thinker, 7*(1), 1-5 and 7.
Senge, P. M. (1995). System dynamics and the learning organization [DVD]. USA: Pegasus Communications.
Senge, P. M. (2006). *The fifth discipline: The art and practice of the learning organization* (Rev. ed.). New York, NY: Currency Doubleday.
Senge, P. M., Kleiner, A., Roberts, C., Ross, R. B., & Smith, B. J. (1994). *The fifth discipline fieldbook: Strategies and tools for building a learning organization*. London, England: Nicholas Brealey Publishing.
Senge, P. M., & Scharmer, C. O. (2006). Community action research: Learning as a community of practitioners, consultants and researchers. In P. Reason & H. Bradbury (Eds.), *Handbook of action research* (2nd ed., pp. 195-206). London, UK: Sage.
Shapiro, A. M. (2005). The site map principle in multimedia learning. In R. E. Mayer (Ed.), *The Cambridge handbook of multimedia learning* (pp. 313-324). New York, NY: Cambridge University Press.
Sharma, S., Dick, G., Chin, W., & Land, L. P. W. (2007). *Self-regulation and e-learning. ECIS Proceedings. Paper 45.* Paper presented at the European Conference on Information Systems (ECIS), St. Gallen.
Sharma, S., Paul, A., Raghavan, M., Advent, J., Northcott, C. A., Martin, B., Nesbitt, S., Ripstein, I., Simon, I., & Mcconnell, K. (2011a, August 23-25). *Comparing medical students' learning via paper-based versus electronic curriculum.* Paper presented at the Proceedings of the 11th WSEAS international conference on Applied informatics and communications, and Proceedings of the 4th WSEAS International conference on Biomedical electronics and biomedical informatics, and Proceedings of the international conference on Computational engineering in systems applications, Florence, Italy.
Sharma, S., Paul, A., Raghavan, M., Advent, J., Northcott, C. A., Martin, B., Nesbitt, S., Ripstein, I., Simon, I., & McConnell, K. (2011b, August 23-25). *Learning/Curriculum Management Systems (LCMS): Emergence of a new wave in medical education.* Paper presented at the 11th WSEAS International Conference on Applied Informatics and Communications (AIC'11), 4th WSEAS International Conference on Biomedical Electronics and Biomedical Informatics (BEBI'11), and International Conference on Environment, Economics, Energy, Devices, Systems, Communications, Computers, Pure and Applied Mathematics, Florence, Italy.
Sherborne, T. (2008). Mapping the curriculum: How concept maps can improve the effectiveness of course development. In T. Sherborne, S. J. Buckingham Shum & A. Okada (Eds.), *Knowledge cartography: Software tools and mapping techniques* (pp. 183-198). London, UK: Springer.
Shum, P. S., Land, L., Dick, G., & Jamieson, R. (2010). *40P. Online Lecturing: Students want it, but what about the lecturers? CONF_IRM 2010 Proceedings. Paper 25.* Paper presented at the International Conference on Information Resources Management (CONF-IRM).
Skyttner, L. (1996). *General systems theory : An introduction*. Basingstoke: Macmillan Press.
Slyke, C. V., Dick, G., Case, T., & Ilie, V. (2010). The importance of compatibility and pressure on intentions to engage in distance learning. *Communications of the Association for Information Systems, 27*(1), 395-414.
Souza, K., & Lawrence, T. (2004). *Illios: UCSF School of Medicine's curriculum management tool*. Application for 2004 University of California Larry L. Sautter Award for Innovation in Information Technology. University of California, San Francisco (UCSF). San Francisco,

CA, USA. Retrieved from http://www.ucop.edu/information-technology-services/award-winners-and-applications/ucsf_ilios.pdf
Spector, J. M. (2002). Knowledge management tools for instructional design. *Educational Technology Research and Development, 50*(4), 37-46.
Spector, J. M., & Edmonds, G. S. (2002). Knowledge management in instructional design. *ERIC Digest*(September), 1-2.
Spencer, D., Riddle, M., & Knewstubb, B. (2011). Curriculum mapping to embed graduate capabilities. *Higher Education Research & Development, 31*(2), 217-231. doi: 10.1080/07294360.2011.554387
Starr, M. L., & Krajcik, J. S. (1990). Concept maps as a heuristic for science curriculum development: Toward improvement in process and product. *Journal of Research in Science Teaching, 27*(10), 987-1000. doi: 10.1002/tea.3660271007
Steinbeck, R. (2011). Building creative competence in globally distributed courses through design thinking. *Comunicar, Scientific Journal of Media Literacy, 37*(19), 27-34.
Sterman, J. D. (1994). Learning in and about complex systems. *System Dynamics Review, 10*(2-3), 291-330. doi: 10.1002/sdr.4260100214
Sterman, J. D. (2000). *Business dynamics: Systems thinking and modeling for a complex world*. Boston: McGraw-Hill Higher Education.
Stivers, B., & Phillips, J. (2009). Assessment of student learning: A fast-track experience. *The Journal of Education for Business, 84*(5), 258-262.
Streifer, P. A. (2002). *Using data to make better educational decisions*. Lanham, Md.: Scarecrow Press.
Stufflebeam, D. L., & Shinkfield, A. J. (2007). *Evaluation theory, models, and applications*. San Francisco, CA: Jossey-Bass.
Sumsion, J., & Goodfellow, J. (2004). Identifying generic skills through curriculum mapping: A critical evaluation. *Higher Education Research & Development, 23*(3), 329.
Talbot, L., James, E. L., Verrinder, G., & Jackson, P. (2007). Curriculum development, accreditation and quality assurance in university environmental health education. *Environmental Health, 7*(1), 35-46.
Tariq, V. N., Scott, E. M., Cochrane, A. C., Lee, M., & Ryles, L. (2004). Auditing and mapping key skills within university curricula. *Quality Assurance in Education, 12*(2), 70-81.
Tennyson, R. D., & Elmore, R. L. (1997). Learning theory foundations for instructional design. In R. D. Tennyson, F. Schott, N. M. Seel & S. Dijkstra (Eds.), *Instructional design : International perspectives: Theory, research and models* (Vol. 1, pp. 55-78). Mahwah, NJ: Lawrence Erlbaum.
Tennyson, R. D., & Schott, F. (1997). Instructional design theory, research, and models. In R. D. Tennyson, F. Schott, N. M. Seel & S. Dijkstra (Eds.), *Instructional design : International perspectives: Theory, research and models* (Vol. 1, pp. 1-16). Mahwah, NJ: Lawrence Erlbaum.
Tennyson, R. D., Schott, F., Seel, N. M., & Dijkstra, S. (Eds.). (1997). *Instructional design : International perspectives: Theory, research and models* (Vol. 1). Mahwah, NJ: Lawrence Erlbaum.
Tertiary Education Quality and Standards Agency, T. E. Q. S. A. (2012). Retrieved December 22, 2012, from http://www.teqsa.gov.au/
The University of New South Wales Teaching Gateway. (2012). Mapping program learning outcomes. Retrieved December 22, 2012, from http://teaching.unsw.edu.au/mapping-program-learning-outcomes
The University of Sydney Institute for Teaching and Learning. (2012a, 17 January 2012). Curriculum mapping. Retrieved December 22, 2012, from http://www.itl.usyd.edu.au/graduateAttributes/curriculum_mapping.htm

The University of Sydney Institute for Teaching and Learning. (2012b, 17 May 2011). The National Graduate Attributes Project (GAP). Retrieved December 22, 2012, from http://www.itl.usyd.edu.au/projects/nationalgap/introduction.htm
Thompson, D. (2009). Successful engagement in graduate attribute assessment using software. *Campus-Wide Information Systems, 26*(5), 400-412.
Tohyama, S., & Miyake, N. (2011). *The evaluation of ReCoNote summaries for learner-centered integration*. Paper presented at the 3rd international conference on Intelligent Networking and Collaborative Systems (INCoS) http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6132921
Tramaglini, T. W. (2005). Transforming curriculum: Establishing curricular democracy. Educational Resources Information Center (ERIC): Plumsted Township Schools, New Egypt, New Jersey, USA.
Trochim, W. M. K. (2006). Research methods knowledge base. Retrieved December 22, 2012, from http://www.socialresearchmethods.net/kb/index.php
Tufts University. (2008). Visual Understanding Environment (VUE). Retrieved December 22, 2012, from http://vue.tufts.edu/
Tuning. (2012). Tuning Educational Structures in Europe. Retrieved December 22, 2012, from http://www.unideusto.org/tuningeu/home.html
Uchiyama, K. P., & Radin, J. L. (2009). Curriculum mapping in higher education: A vehicle for collaboration. *Innovative Higher Education, 33*(4), 271-280.
University of California San Francisco. (2011). Ilios 2.0: Curriculum management from UCSF. Retrieved December 22, 2012, from http://www.iliosproject.org/
Value Based Management net. (2011, 5 July 2012). Management methods, management models, management theories. Retrieved December 22, 2012, from http://www.valuebasedmanagement.net/
van Boxtel, C., van der Linden, J., Roelofs, E., & Erkens, G. (2002). Collaborative concept mapping: Provoking and supporting meaningful discourse. *Theory into Practice, 41*(1), 40-46.
Van Patten, J., Chao, C. I., & Reigeluth, C. M. (1986). A review of strategies for sequencing and synthesizing instruction. *Review of Educational Research, 56*(4), 437-471.
Veltri, N. F., Webb, H. W., Matveev, A. G., & Zapatero, E. G. (2011). Curriculum mapping as a tool for continuous improvement of IS curriculum. *Journal of Information Systems Education, 22*(1), 31.
Villano, M. (2007). The other data. *T.H.E. Journal, 34*(9), 46-52.
Wachtler, C., & Troein, M. (2003). A hidden curriculum: Mapping cultural competency in a medical programme. *Medical Education, 37*(10), 861-868.
Wade, M. (2010, 20 November 2012). Theories used in IS research Wiki. Retrieved December 22, 2012, from http://istheory.byu.edu/wiki/Main_Page
Wager, W. (1976). *Instructional curriculum mapping*. Paper presented at the Annual Spring conference of the American Educational Research Association, San Francisco, California, USA.
Wandersee, J. H. (1990). Concept mapping and the cartography of cognition. *Journal of Research in Science Teaching, 27*(10), 923-936.
Wardle, K., Ruddlesdin, J., Wentworth, L., Bhat, S., Baker, P., & Roberts, N. (2011). The use of curriculum mapping in evaluating a regional geriatric training programme. *CME Geriatric Medicine, 13*(3), 85-91.
Watson, E. G. S., Moloney, P. J., Toohey, S. M., Hughes, C. S., Mobbs, S. L., Leeper, J. B., & McNeil, H. P. (2007). Development of eMed: A comprehensive, modular curriculum-management system. *Academic Medicine, 82*(4), 351-360.
Watson, S. L., Reigeluth, C. M., & Watson, W. R. (2008). Systems design for change in education and training. In J. M. Spector, M. D. Merrill, J. Van Merrienboer & M. P.

Driscoll (Eds.), *Handbook of research on educational communications and technology* (pp. 691-701).
Weave. (2010). WEAVEOnline. Retrieved December 22, 2012, from http://www.weaveonline.com/
Weinstock, J. (2009). Data-driven decision-making: Mission accomplished. *T.H.E. Journal, 36*(2), 28-32.
Weiss, C. H. (1998). *Evaluation: Methods for studying programs and policies* (2nd ed.). Upper Saddle River, NJ: Prentice Hall.
Wendt, A. (2003). Mapping geriatric nursing competencies to the 2001 NCLEX-RN test plan. *Nursing Outlook, 51*(4), 152-157.
Wenger, E. (1998). *Communities of practice : Learning, meaning, and identity*. Cambridge, England: Cambridge University Press.
Wenger, E. (2006). Communities of practice: A brief introduction. Retrieved December 22, 2012, from http://www.ewenger.com/theory/
Wenger, E. (2009). Communities of practice. *Communities, 22*, 57.
Wenger, E. (2010). Communities of practice and social learning systems: The career of a concept. In C. Blackmore (Ed.), *Social learning systems and communities of practice* (pp. 179-198). London, UK: Springer/The Open University.
Wenger, E., McDermott, R. A., & Snyder, W. (2002). *Cultivating communities of practice: A guide to managing knowledge*. Boston, Mass.: Harvard Business School Press.
Wenger, E., White, N., & Smith, J. D. (2010). *Digital habitats: Stewarding technology for communities*. Portland, OR: CPsquare.
Wenrich, M., Jackson, M. B., Scherpbier, A. J., Wolfhagen, I. H., Ramsey, P. G., & Goldstein, E. A. (2010). Ready or not? Expectations of faculty and medical students for clinical skills preparation for clerkships. *Medical Education Online, 15*. doi:10.3402/meo.v15i0.5295
White, H. D. (2001). Computing a curriculum: Descriptor-based domain analysis for educators. *Information Processing & Management, 37*(1), 91-117.
WIDS. (2012). Worldwide Instructional Design System. Retrieved December 22, 2012, from http://www.wids.org/Home.aspx
Wigal, C. M. (2005, October 19–22). *Managing and aligning assessment knowledge.* Paper presented at the 35th annual conference ASEE/IEEE frontiers in education, Indianapolis, IN, USA.
Wilansky, J. A. (2006). *The effects of curriculum mapping on the instructional practices of professional collaboration, standards alignment, and assessment.* (Dissertation), Dowling College, USA, ProQuest Dissertations & Theses. (3205824)
Willcoxon, W. O. (2001). Collection evaluation in a Georgia elementary school: A look at the process and resulting change in teachers' perceptions of its quality and usefulness. *Knowledge Quest, 29*(5), 23-29.
Willett, T. G. (2008). Current status of curriculum mapping in Canada and the UK. *Medical Education, 42*(8), 786-793.
Willett, T. G., Marshall, K. C., Broudo, M., & Clarke, M. (2007). TIME as a generic index for outcome-based medical education. *Medical Teacher, 29*(7), 655-659.
Willett, T. G., Marshall, K. C., Broudo, M., & Clarke, M. (2008). It's about TIME: A general-purpose taxonomy of subjects in medical education. *Medical Education, 42*(4), 432-438.
Wilmarth, S. (2010). Five socio-technology trends that change everything in learning and teaching. In H. H. Jacobs (Ed.), *Curriculum 21: Essential education for a changing world* (pp. 80-96). Alexandria, VA: Association for Supervision and Curriculum Development (ASCD).

Wolstenholme, E. F. (2003). The use of system dynamics as a tool for intermediate level technology evaluation: Three case studies. *Journal of Engineering and Technology Management, 20*(3), 193-204. doi: 10.1016/s0923-4748(03)00018-3

Wolstenholme, E. F., & Coyle, R. G. (1983). Development of system dynamics as a methodology for system description and qualitative analysis. *The Journal of the Operational Research Society, 34*(7), 569-581.

Wolstenholme, E. F., Henderson, S., & Gavine, A. (1993). *The evaluation of management information systems: A dynamic and holistic approach*. Chichester, England: John Wiley & Sons.

Wong, R. Y., & Roberts, J. M. (2007). Real time curriculum map for internal medicine residency. *BMC Medical Education, 7*. doi:10.1186/1472-6920-7-42

Woodell, J. (2001). Knowledge networks in the education enterprise. *MultiMedia Schools, 8*(2), 48-51.

Zylinski, J., Allan, G. L., Jamieson, P., Maher, K. P., Green, R., & Hislop, J. (1998). The implementation of an integrated on-line health education system at RMIT. *International Journal of Medical Informatics, 50*(1-3), 261-265. doi: 10.1016/s1386-5056(98)00078-1

A triangulated, mixed-method investigation of an online curriculum mapping system in medical education

Volume II: Appendices

Eilean Genevieve Sinclair Watson

A thesis in fulfilment of the requirements for the degree of

Doctor of Philosophy

Australian Institute of Health Innovation

Faculty of Medicine

January 2013

Appendices

Table of Contents

Appendix A: Chronology of Key Events

Table 1: Chronological chart of key events associated with eMed Map and this research project.

Key Event	Before 2007	2007	2008	2009	2010–2011
eMed Map research project		February: qualitative data collection period started	Jan-Dec: qualitative data collection continued November: qualitative data analysis started	August: qualitative data collection period ended May: web log and data linkage study started October 12 to Nov 23: Map survey period	eMed web log reports collected from January 2004 to December 2010 December: completed all data collection for this research
UMP	1999: conceptualisation started March 2004: UMP started	January: Phase 3 started		December: first UMP students graduate	
eMed Map	2001: conceptualisation started Late 2003: Version 1 released	March: funding application unsuccessful (L&T)** November: Version 3 released	February: funding application unsuccessful (IT)** September: Version 4 released	April: minor version release (V4.5)	February 2011: submitted data visualisation proposal using VUE application (eMed Ref Grp)
eMed AIB	2005: conceptualisation and design started	March: funding application unsuccessful (L&T) December: Faculty presentation (Med Ed group)	April: funding application unsuccessful (L&T) July: design restarted	February: funding approved (IT) March: conceptualisation and design completed May: development started	June 2011: version 1 released
eMed Placements		September: development started	Early 2008: Version 1 released	System updated	System in use
Workload system and eMed Metrics	2006: school workload system conceptualised and started	Workload system discontinued but replaced by workload formula	eMed Metrics: development of system was funded	eMed Metrics: development started early 2009	System in use
PDTM system*				February: Version 1 released	System in use
eMed Reference Group		May: formed and started meeting every one to two months	Group continued meeting regularly	Continued meeting regularly	Continued meeting regularly
P2 Course DIG (Participant obs.)	April 2003: group formed	February: researcher joined group		Participant observations completed by August	
Faculty & University	January 2006: new A/Dean Education & eMed business owner started	2007: UNSW IT centralisation started		October: use of WebCT Vista in the UMP was replaced with Blackboard version 9	

*PDTM: Professional Development and Talent Management system developed by the Medical Faculty.

**L&T: Learning and Teaching funds; IT: Information Technology funds.

Appendix B: Potential Uses of a Curriculum Map

Table 1 was adapted from work done by the researcher during the UNSW ITET 1 Fellowship (2001) in which she conceptualised what a curriculum map could be used for in the UMP.

Table 1: Potential uses of a curriculum map categorised by type, level and manifestation of use.

Type of use	Level of use	Manifestation of use	Potential use of a curriculum map
Educational [1]	Basic	Explicit	To design and develop the curriculum for the six years of a medical program
			To develop the curriculum around pre-defined educational principles and a structural framework
			To develop a horizontally and vertically integrated curriculum
			To avoid gaps, overlaps and redundancies in the curriculum
			A web-based tool to explore the whole curriculum and its components (e.g. phases, domains, graduate capabilities) as well as individual learning and assessment activities within each course
			To provide staff with both a wide-angle and narrow-angle view of the curriculum (to see both forest and trees as per Reigeluth's elaboration theory)
			To make graduate capabilities explicit in learning and assessment activities
			To ensure students have opportunities to develop each graduate capability
			To align learning and assessment activities with graduate capabilities
			For course designers and principal teachers to develop learning and assessment activities collaboratively
			For course designers to guide principal teachers on what to teach in relation to the graduate capabilities, learning context, content streams and topics.
			For principal teachers to provide an overview of their activity by identifying its aims, key concepts, key references and key words
			For assessment developers to align assessment items (e.g. topics for assignments, projects or

[1] **Educational use:** includes use in learning and teaching, program evaluation and improvement, and research.

Type of use	Level of use	Manifestation of use	Potential use of a curriculum map
			exam questions) with learning activities
Educational	Intermediate	Explicit	For teachers to keep the curriculum up-to-date with the expanding body of knowledge, and with industry and community expectations of medical graduates.
			For teachers to know what students have covered and will cover in the 6-year program
			For teachers to identify those teaching similar topics to their own
			To use in curriculum evaluation and improvement (educational quality control)
		Implicit	To provide inconspicuous staff development on the structure, content and educational foundations of the curriculum (staff development by stealth)
			For teachers to explore what they teach in relation to the whole curriculum.
			To encourage teachers to share what they teach with other teachers.
	Advanced	Explicit	For teachers to use in class activities (in Phase 1 scenario group sessions when exploring the learning needs in a scenario).
			A curriculum research and development tool to facilitate and encourage educational research into what is being taught, as well as when and how it is being taught (teaching/research nexus)
		Implicit	As a professional development tool to assist teachers identify teaching skills required in the medicine program, and to reflect on their teaching (self-directed staff development)
			To provide inconspicuous staff development by promoting reflection on one’s teaching practices
			To encourage collaborative teaching
			To explore novel ways of using the Map in learning and teaching activities
			To use as a meta-cognitive tool to explore the process of learning, teaching and knowledge development
			For teachers to explore their own abilities to meet the personal attributes and interactional abilities being asked of students, and attempt to model desired behaviours for students to learn from

Type of use	Level of use	Manifestation of use	Potential use of a curriculum map
Administrative[2]	Basic	Explicit	To provide a central repository of curriculum information
			To standardise the language of the curriculum by creating a controlled vocabulary
			To index and catalogue learning and assessment activities using predefined indexing tags
			To be able to browse information through defined views, and search for information using simple and advanced search strategies
			To be able to export data to other applications (e.g. word processing, statistical analysis)
			To optimise the use of information systems (e.g. by integrating Map with WebCT)
			To provide a mapping system that forms part of a comprehensive and modular curriculum management system
			To keep track of the number of course convenors and principal teachers per school
	Intermediate	Explicit	To answer enquiries from medical specialties, and other healthcare and community groups on the coverage/ teaching of specific content or skills in the curriculum
			To produce curriculum reports for use in program accreditation (e.g. by AMC, University, government departments)
Organisational [3]	Basic	Explicit	To provide an open and transparent curriculum
			To provide a simple system to resolve the complex problem of keeping a medical curriculum up-to-date
			To support the organisation to deliver an integrated and complex curriculum
	Intermediate	Implicit	To return to teachers the lost sense of 'authority' brought about by the integrated nature of the curriculum
			To engender in staff a sense of 'curriculum ownership'
	Advanced	Explicit	To improve the curriculum in small, incremental changes so as to avoid large and organisationally disruptive changes
			To use in educational and administrative data-mining and decision-making processes
		Implicit	To promote a knowledge network culture and

[2] **Administrative use:** includes use in the management of information, information systems and resources.
[3] . **Organisational use:** includes use in curricular governance, and organisational and cultural change.

Type of use	Level of use	Manifestation of use	Potential use of a curriculum map
			community of practice
			To promote communication, collaboration, knowledge sharing and team-teaching
			To break the barriers of 'silo' teaching (discipline or topic silos)
			To encourage and support evidence-based education
			To provide a tool that has the potential to be an agent of change in teaching and learning

Appendix C: eMed Map Screen Captures

Screen captures of eMed Map v 5.9 (29/12/2012) showing the user interface and navigation menus, a Learning Activity Form (LAF) and the search function.

Figure 1: Homepage of eMed Map v 5.9 (left image) showing the selection menu (left panel), main window (middle panel) and eMed tools menu (top bar); and the 'Learning Activities by Context' browsing view (boxed) showing a hyperlinked list of UMP courses (right image).

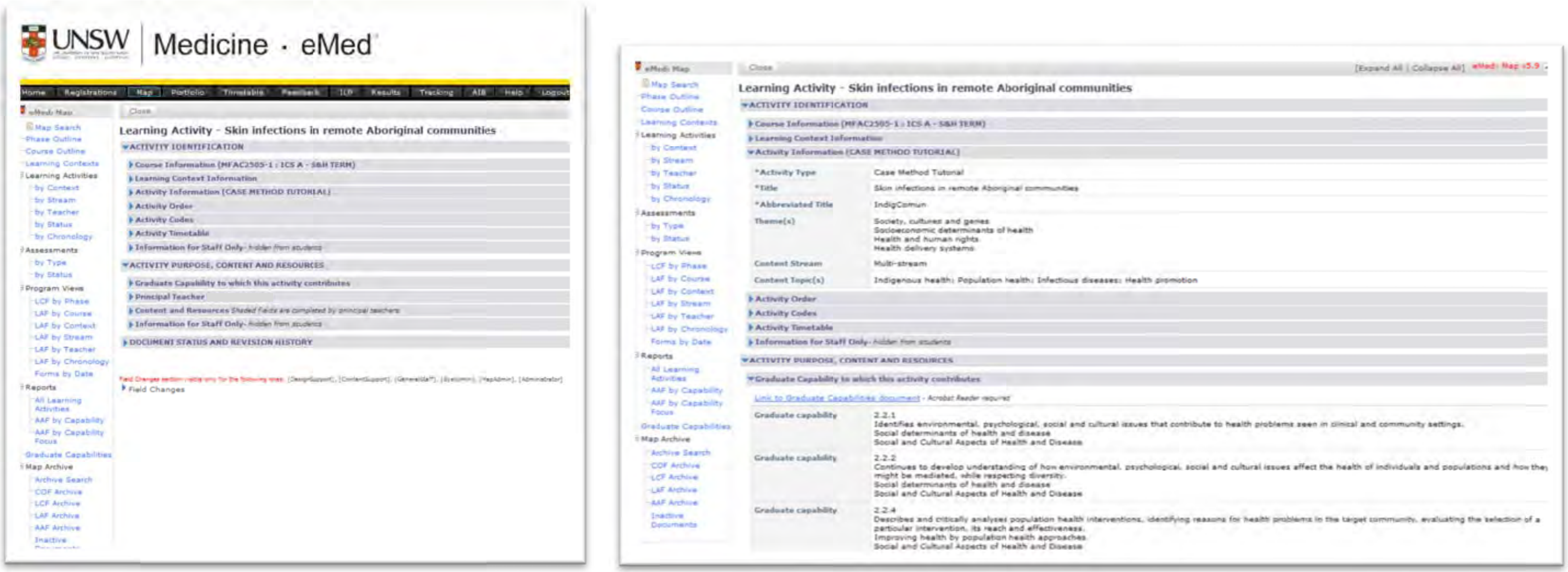

Figure 2: Learning Activity Form (LAF) showing all sections in a collapsed view (left image), and with top sections in an expanded view (right image).

Figure 3: Same Learning Activity Form as above showing the middle and bottom sections in an expanded view.

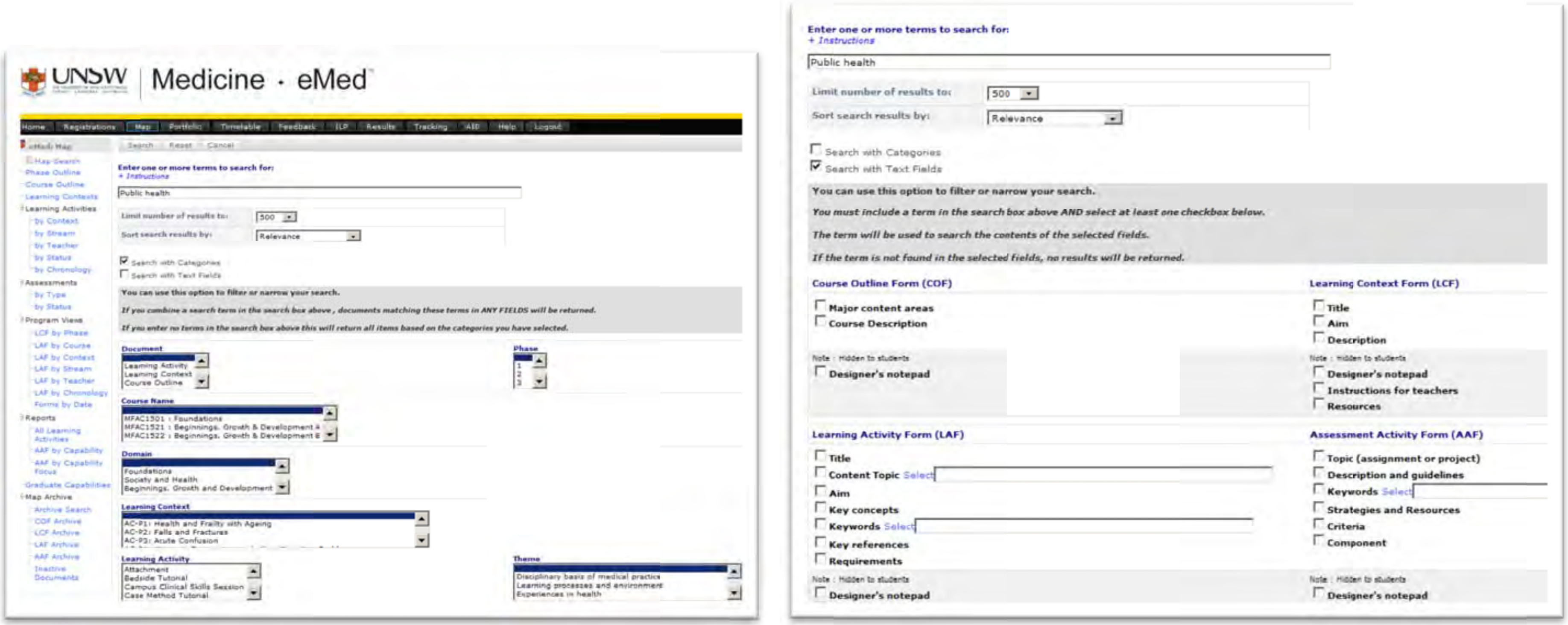

Figure 4: Map Search fuction showing the simple search function (text entry box) and the two advances search functions—'search with categories' and 'search with text fields'.

Appendix D: Study 1—Data Collection and Analysis Procedures

This appendix provides a detailed description of the data collection and content analysis procedures used in the observations and textual documentation study (Study 1).

Data Collection Procedures

Most of the data collected in Study 1 originated between 20th April 2007 and 7th August 2009. Some observations (e.g. passive observations, self-observations/reflections) dated back to February 2007, and some textual documentation dated back to late 2003 (e.g. IT Issue Log entries, Map version release documents) and mid-2001 (e.g. documents developed during the researcher's UNSW ITET 1 Fellowship).

In 2007, the researcher recorded her participant observations after attending DIG meetings or after working with DIG members on the course in general or on the Map in particular. General observations were recorded after helping with, working on or simply discussing Map issues with others in the Faculty (e.g. during school meetings, informal conversations, preparing to teach etc.). Observations were generally recorded in a Microsoft Word (MS Word or Word) document immediately after or within a week of the event. Extracts from key emails and from minutes of meetings were often included alongside the participant or general observations. Reflections were either included at the end of the week, after a critical incident, or alongside participant or general observations.

In 2008 the researcher's method of recording field-notes changed. Instead of recording observations at the end of each meetings or interaction with DIG members or other staff members in the Faculty, only key events were recorded. The date, time and brief description of these events were also recorded in the researcher's personal time-log in Excel which she routinely kept as part of her own time management practices. These field-notes and time-log entries were later substantiated with extracts from relevant emails, minutes of meetings, other documents and reflections as time allowed which was usually no more than 3 months from the original event. While this new method was born out of necessity due to the time constraints, this 'retrospective documentation and reflection' method worked in her favour by allowing a 'cooling-off' period between the experience of the original incident and the documentation of it, which helped to analyse the incident from the distance of a participant-as-observer as opposed to the proximity of a complete participant, as had occurred in 2007.

In 2009 the researcher used a similar process for recording her field-notes as she had done in 2008, except that between April and August the researcher was on sabbatical and hence found time to write her field-notes within a week or so of key events. Much of her field-notes during this period were her own reflections on the past 2 years of events, on the issues and themes being uncovered from the analysis of existing field-notes, and on the relationship between these issues and the relevant literature on curriculum mapping, educational technology and information systems evaluation. All field-note entries in these electronic documents were first coded in Word and then in the application NVivo 8 by QSR.

In mid-2009, the researcher searched her archived email files from 2006 to 2009 (she used the application Lotus Notes 7 for emailing). Selected emails were moved to a Notes folder and exported as a compiled PDF file. The Notes view of this folder was exported as an MS Excel file, which contained the author, date and time, and subject of the each email selected. These email references were further selected and coded in Excel, copied into the respective Word table of field-notes, and further coded in NVivo 8. Similarly, the researcher conducted a keyword search of her Excel time-log files from 2007 to 2009 which contained brief descriptions of her daily work activities by date and time. Selected time-log entries were coded and then copied into the respective Word table of field-notes. The combined content in these Word tables was then sorted by date and time, thereby organising the observations, email references and time-log entries in chronological order. This proved useful in providing further information on the content and context of the events observed between February 2007 and August 2009.

The researcher also conducted a similar keyword search of all her archived work documents dating back to the 2001 ITET fellowship where her conceptual design of the Map had originated. Selected documents were grouped under suitably named folders. Files within these folders were renamed chronologically, compiled as PDF files and later printed. Selected extracts from these documents were coded by hand due to the limitations of NVivo 8 in handling compiled PDF files.

No further observations or textual documentation data were collected after 7th August 2009, since by then data saturation had been reached for this qualitative study. The participant observation group members were informed of this on August 7th, and the researcher's participation in this group continued solely as a staff member and no longer as an evaluator of the Map.

The number of qualitative data collected and analysed in this study was as follows:

- Field note entries: 158
- Email entries: 285
- Time-log entries: 975
- eMed Issue Log entries: 355
- Map version release notes (from eMed Help site): 7
- Other textual documentation:
    - Meetings: monthly eMed meetings (20), DIG meetings (30), Phase committee meetings (3), school meetings (3), and DIG workshops for clinical teachers (3). The agendas, minutes and other documents from many of these meetings and workshops were analysed.
    - Audits conducted by the researcher: audit of Phase 2 data (early 2007); audit of the Map's controlled vocabulary (2006).
    - Documents prepared by the researcher: a proposal regarding the tasks and staff roles required to manage the Map (2004), archival documents of Map evaluations conducted in 2003-2004, a document on the potential use of a curriculum map (ITET fellowship mid-2001).
    - Other documents: citation documents prepared in 2007 for a national educational award, the Australian Medical Council (AMC) accreditation report of November 2004, various educational and IT grant applications submitted in 2006-2007 to fund the final development of the Map, and various abstracts and proceedings from conferences, forums or workshops on the Map presented between 2004 and 2008.
- Cases: a total of 100 cases. All cases were staff members of the Faculty of Medicine or of one particular school in the Faculty of Science, except for eight staff members who were from other Faculties and sectors within the University.

Content Analysis and Data Coding Procedures

Qualitative content analysis was used to analyse and code the data collected. While some coding of field-notes was done as events were recorded in MS Word, the major coding of field-notes began in November 2008. The analysis and coding of qualitative data were done by using a combination of Microsoft Word 2007, Microsoft Excel 2007 and NVivo 8 by QSR.

The first attempt at content analysis and coding involved the following process:

1. Carefully reading the field-notes
2. Noting recurring issues related to the Map and to eMed
3. Capturing these issues as short-phrased topics (e.g. unable to use, unable to access, eMed as amorphous system, lack of procedures, lack of training)
4. Grouping similar topics under common themes (e.g. user training, support, workload, access, data quality etc.)
5. Grouping similar themes under categories (e.g. information system, education and training, organisation and management)
6. Using the evolving topics, themes and categories to create a preliminary coding tree in MS Word
7. Entering the coding tree in NVivo 8 with the intention of coding the field-notes.

Inadvertently, the three major categories which evolved from this preliminary data analysis and coding coincided with the three original research domains. This gave credence to some of the anecdotal evidence on problems relating to the Map's use, and was an indication of the inductive process that took place during the analysis of qualitative data.

The preliminary content analysis coding tree was redeveloped because many coding nodes were not mutually exclusive, therefore making it difficult to code the field-notes with accuracy. The coding tree was re-developed using the following radically different approach:

1. The original research question of 'how is the Map used' was broken down into the 'who, what, why, when, where and how' of Map use.
2. A research framework was developed to align each of these basic research questions with the study's research methods and with a more suitable coding structure (see Appendix F).
3. Map users (i.e. cases) and their attributes were coded under a separate category.

4. Previously identified topics were retained, but re-grouped under 2 major categories (i.e. the type of Map use, and the factors affecting Map use) and three minor categories (i.e. frequency and location of Map use, and Map features used).
5. Themes were re-developed and grouped under the above categories.
6. The type of events observed or documented, the context of the observation or documentation, and the research methods used were also coded.
7. The level of coding was purposefully limited to three deep—namely category, theme and topic. This level of granularity suited this study's analysis requirements.

This new coding tree was progressively refined as it was used to code the field-notes, emails and time-log entries for 2007, 2008 and 2009. This process was highly iterative, and the coding tree became progressively more stable as data were coded. The coding in MS Word was accomplished by consistently using the same format to enter the relevant code (i.e. category, theme and topic) at the end of each section being coded. Sections were often coded with a number of mutually exclusive codes. Once the Word version of the coding tree was relatively stable, the tree was re-created in NVivo 8. The coded Word files were then imported into NVivo, and the coding of these files was achieved by running NVivo's 'Text Search Queries' function combined with the 'Broad Spread' search function of the codes that existed in the imported Word files. In this way, the paragraph surrounding the Word code was also coded, which then allowed for the use of other NVivo analytic functions such as the inclusion and exclusion of intersecting codes.

Appendix E: Study 1—Quantifying Qualitative Data

This appendix provides information on the type and amount of qualitative data collected in the observations and textual documentation study (Study 1).

Field-Notes, Emails and Time-Log Entries

Table 1 shows the type and amount of data recorded in the combined Word tables for 2007, 2008 and 2009. The 'coding query' function in NVivo 8 was used to determine the number of entries by type (i.e. field-note, email-reference or time-log entry). The average number of words per entry type and the range were calculated by establishing the word-count of 20 randomly selected entries of each type. Since all three combined Word tables used the same format (single-space, Arial, 11pt font) it was possible to compare the number of pages per table per year.

Table 1: Type and number of entries recorded in combined Word documents for 2007, 2008 and 2009 (NVivo 8 was used to determine the number of entries by type).

Type of entry in combined Word tables	Number of entries, and average number of words and range of words per type			
	2007	**2008**	**2009**	**Total**
Field-note entries	55	52	51	158
Words per field-note entry	660 (50–1450)	564 (120–1000)	735 (11 –2200)	-
Email-reference entries	163	73	49	285
Words per email-reference entry	15 (12–20)	10 (8–12)	10 (8–12)	-
Time-log entries	638	254	83	975
Words per time-log entry	50 (15–140)	40 (12–74)	45 (15–93)	-
Total number of pages	**84**	**74**	**62**	**220**

Table 1 shows that the number of field-note entries was evenly distributed across the three years, and that the average number of words per entry type did not vary substantially across these years. However, the number of selected email references and time-log entries was considerably larger in 2007 than it was in 2008 and 2009. This was because the 2007 emails and time-log entries were selected and coded first, and a certain amount of data saturation had been reached at the end of this coding. Hence, emails and time-log entries for 2008 and 2009 were selected more judiciously. Further information on field-notes, email references and time-log entries that were selected and analysed is presented below.

Field-note entries

Field-note entries were coded according to the type of research method used (i.e. participant observation, general observation, reflections, textual extracts mostly from key email threads), and according to the type of event observer or experienced (i.e. routine academic work involving teaching, research or service; formal meetings; critical incidents not part of routine work; Map training sessions involving one-to-one, small group or workshop sessions; PhD-related events). See Appendix F for further information on the coding system used. Table 2 quantifies the type of research methods and the type of events recorded in the field-notes. While most entries were coded with only one type of method and one type of event, some were coded with two (e.g. general observation and reflection) in which case only the first code (i.e. the main code) was counted.

Table 2: Type of methods used and of events recorded in the field-notes between February 2007 and August 2009.

Type of Method	Numbers recorded between February 2007 and August 2009	Type of Event	Numbers recorded between February 2007 and August 2009
Participant observations	24	Work	98
General observations	54	Meetings	27
Reflections	39	Critical incidents	12
Textual extracts (mostly email extracts)	41	Training sessions	6
		PhD	15
Total	**158**	**Total**	**158**

Participant observations were collected mostly in 2007, while textual extracts were collected mostly in 2008. The collection of general observations and reflections was evenly distributed across the three years. While events associated with routine work and meetings were also evenly distributed across the three years, only one critical incident was recorded in 2007 and training sessions occurred mostly in 2009.

Email-reference entries

The search function in Lotus Notes 7 was used to find emails created after 1/01/2007 which contained the keywords ‘Map’ or ‘eMed’. These searches retrieved 1473 emails from the researcher’s 2006-07 email archive file, and these emails were then further selected by hand in Lotus Notes. A different approach was used with the 2008–2009 email archives whereby the Notes ‘Mail Threads’ view was used to select relevant emails by hand. This method retrieved

313 emails which were then further selected. Table 3 shows the number of archived emails selected and coded.

Table 3: Number of archived emails selected and coded in NVivo 8.

Time-period of Lotus Notes email archive file	Number of work-related emails	Number of emails selected in Notes	Number of email references coded	Percentage of archived emails coded
Jan 06 - Nov 07	8363	184	163	1.95%
Dec 07 - May 09	9024	313	122	1.35%
Total	**17387**	**497**	**285**	**1.65%**

Time-log entries

Selected time-log entries were first coded in Excel 2007 and then in NVivo 8 according to the context of the work activity (i.e. OME work, DIG work, School work, PhD work). As noted previously, much fewer time-log entries were selected for 2008 and 2009 since a certain amount of data saturation had been reached after coding the 2007 entries. As shown in Table 4, almost two-thirds of selected entries related to work activities associated with the eMed Reference Group or the DIG, which was as expected since the researcher had done most of her Map-related work with these two groups.

Table 4: Number of time-log entries selected and coded in NVivo 8 categorised by work context.

Time-log entries and their work context	Number of time-log entries for each context type			
	2007 (start: 1/2/07)	**2008**	**2009 (end: 6/6/09)**	**Total**
Total number of time-log entries	1865	1942	635	4442
Selected number of time-log entries	638	254	83	975
% of entries selected	34%	13%	13%	22%
Work context of selected entries				
OME (eMed Reference Group)	180	119	43	342
DIG	254	43	16	313
School	67	41	4	112
PhD	137	51	20	209
Total	**638**	**254**	**83**	**975**

eMed Issue Log and Map version release notes

The web-based eMed Issue Log, which was developed in late 2003, contained all of the Map's design and development items from 31 October 2003 onwards. Items included system requirements (outstanding or new design features) and reported IT glitches. New items were classified as 'Open' and then progressively reclassified as the item was developed, tested and released, at which stage it was classified as 'Closed'. Table 5 shows the number of Map items that were open (i.e. created) and subsequently closed (i.e. resolved) between late October 2003 and early June 2009. As well, there were 74 items that were created but subsequently rejected but these were not included in the table.

Table 5: Number of Map items created, resolved, or open in the eMed Issue Log from 31 October 2003 to 5 June 2009.

Year	Number of Items Created	Number of Items Resolved	Number of Items Open
2003	52	25	27
2004	148	86	89
2005	40	76	53
2006	8	1	60
2007	12	44	28
2008	75	93	10
2009	20	26	4
Total	**355**	**351**	**4**

Other Textual Documentation

The researcher attended a number of meetings between February 2007 and August 2009 which either directly or indirectly related to the Map. These included monthly eMed Reference Group meetings which commenced in May 2007 (20), DIG meetings (30), Phase committee meetings (3), school meetings (3), and DIG workshops for clinical teachers (3). The agenda, minutes and other documents from many of these meetings and workshops formed part of the textual documentation data analysis.

Other textual documentation used in the data analysis included an audit of Phase 2 data conducted by the researcher in early 2007, an audit of the Map's controlled vocabulary conducted by the researcher in 2006, a proposal of tasks and staff roles to manage the Map written by the researcher in 2004, archival documents of Map evaluations conducted in 2003-2004, and a document on the potential use of a curriculum map written by the researcher in mid-2001 during her ITET Fellowship. Other textual documentation was also used such as citation documents prepared in 2007 for a national educational award by The Carrick Institute for Learning and Teaching in Higher Education (unsuccessful application), the Australian Medical Council (AMC) accreditation report of November 2004, various educational and IT grant applications submitted in 2006–2007 to fund the continuing development of the Map, and various abstracts and proceedings from conferences, forums or workshops on the Map presented between 2004 and 2008.

Cases and Their Attributes

A total of 100 individuals (i.e. cases) formed part of Study 1, including the researcher since she was also involved as a teacher in the UMP. All individuals were staff members of the Faculty of Medicine or of the School of Biotechnology and Biomolecular Sciences (Faculty of Science), except for 8 individuals who were staff members of other Faculties or sectors within the University. All individuals formed part of the study through their interactions with the researcher between February 2007 and August 2009 (e.g. through informal discussions, meetings, email communications). A total of 10 staff members who were originally part of the study left the Faculty before August 2009. Table 6 provides information on the attributes of these cases, such as their position in the Faculty (information obtained from the Faculty's staff database) and their involvement in the UMP (information obtained from these staff members or from the researcher's own organisational knowledge).

Table 6: Attributes of cases that formed part of Study 1 between February 2007 and August 2009.

Attributes of Cases	Number of Cases
Staff Type	
Academic	53
Conjoint	5
Casual or Contract	6
General	31
Non-Faculty staff member	5
Faculty Position	
Lecturer (included associate lecturer, lecturer, senior lecturer, course tutor)	34
Professor (included associate professor, professor, director)	17
Dean, Associate Dean, Head of School, Deputy Head of School	7
Information Technology staff (included IT manager, IS manager, programmer, technical officer, computer systems officer, web coordinator)	8
Administrator or manager (included administrative assistant, executive assistant, senior administrator, senior librarian, administrative officer, project officer, administration manager, manager)	12
Faculty School or Unit	
School of Public Health and Community Medicine	39
Medical Administration	28
Medicine Education and Student Office	13
Medicine Computing Support Unit	8
Office of the Dean	7
South Western Sydney Clinical School	2
School of Medical Sciences	6
St George Clinical School	3
School of Women's and Children's Health	2
Rural Clinical School	1
School of Biotechnology and Biomolecular Sciences (Faculty of Science)	2
St Vincent's Clinical School	4
School of Psychiatry	2
University Units or Services	
Central IT Services	2
Learning and Teaching Unit	4
Type of UMP teacher	
Campus-based	40
Clinical school-based	15
GP/Community-based	2
Other involvement in UMP	
UMP Convenor (of a course, element or phase)	11
UMP Curriculum group member	17
UMP Administrator	11
No involvement in UMP	19
Gender	
Female	51
Male	49

Appendix F: Study 1—Research Framework

The research framework in Table 1 was developed during the analysis of data in Study 1. This framework aligns specific research questions with the research methods used to answer the questions and with the categories, themes and topics which formed the final coding tree used to code the qualitative data.

Table 1: Research framework developed during the analysis of data in Study 1.

Research Questions (based on the 'who, what, why, when, where and how' of Map use)	**Research Methods** (used to answer questions)	**Coding Tree** (used to code and analyse qualitative data)
Who was using the Map and who was not using it? Who were these staff members (cases and their attributes)?	Users (cases) and their characteristics (attributes) Used NVivo Casebook (cases and attributes) Explored further through Web log reports and data linkage Explored further through survey	**Users and their attributes** User: • Code number Attributes: • Name • Gender • Age • Staff type • Position • School • Department • Role in UMP
What was the Map used for? How was it used? Was it used as intended? At what level of complexity was it being used?	'Types of use' relates to the researcher's original ideas when designing the system regarding the potential uses of a curriculum map (see Appendix B) Some information gathered from observations and textual documentation data. Explored further through the Map survey	**Types of Map Use** Levels: 1 basic, 2 intermediate, 3 advanced **Educational use:** • 1 Develop course activities • 1 Provide content (online, course guides) • 1 Prepare to teach or to assess/examine • 1 Review/revise activities (course, phase, program) • 2 Check for gaps & redundancies • 2 Align outcomes, activities & assessments • 2 Explore whole program • 3 Evidence-based education (data-mining) • 3 Research • 2 Staff development (e.g. help teachers to understand the UMP, to teach etc.) • 3 Learning and Teaching (L&T) tool for students (e.g. help students to integrate content covered)

Research Questions (based on the 'who, what, why, when, where and how' of Map use)	**Research Methods** (used to answer questions)	**Coding Tree** (used to code and analyse qualitative data)
		• 3 Meta-cognitive tool (to learn about L&T) **Information Management use:** • 1 Centralise information • 1 Keep information up-to-date • 1 Standardise language • 1 Index and catalogue (tag) • 1 Search & retrieve information • 2 Export data (to produce course guide) • 2 Audit data (for data quality control) • 2 Integrate with other systems • 3 Answer professional enquiries • 3 Accreditation reports **Organisational use:** • 1 Provide transparent curriculum • 1 Support delivery of integrated curriculum • 2 Break down discipline barriers/silos • 2 Promote self-responsibility (of staff & students) • 3 Shared ownership of curriculum • 3 Knowledge management and networks (community of practice) **Other uses:** • Workload calculations (to capture staff or activity workload/time) • Other educational programs **No uses:** • Map not being used

What individual-user (personal) factors affected the use of the Map?
 	
What were the causes of these factors or issues?
	Socio-technical factors organised by category, theme and topic
	
	Mainly explored through observations and textual documentation data.
	
	Explored further through survey
		Individual-user (personal) factors affecting Map use:
		• Attitudes, beliefs, behaviours, assumptions and perceptions towards:
		  o Map/mapping
		  o eMed (for good or evil)
		  o UMP curriculum
		  o IT in general
		  o Paper (course guides, timetables)
		  o Memory, brain-power (versus database)
		  o Others (staff or students)
		  o From others (national/international)
		• Knowledge, understanding, skills & training:
		  o Map

Research Questions (based on the ‘who, what, why, when, where and how’ of Map use)	**Research Methods** (used to answer questions)	**Coding Tree** (used to code and analyse qualitative data)
		o eMed o Curriculum (structure, L&T principled, organisational principles) o Online resources and IT info o Training needs (reader to trainer) • Map meets user needs according to: o user’s Tasks (teaching or administration) o user’s Setting (campus, clinical, community) o Phase of UMP (P1-3) • Effect of map/mapping on: o Work (workload & time; time-savers/wasters; work processes & workflow) o Document management (data duplication and manipulation—Map, course guide, server & WebCT docs) • Rewards, recognition & compelling reasons (intrinsic/extrinsic): o Access to useful data (for L&T, revising courses, research and publications) o Personal reputation/kudos & recognition (providing quality data in forms, having name in Map) o Work points (for workload calculations in annual reviews, promotion) • Map in perspective: o Mapping vs. teaching vs. course coordination o Prioritising work (Pareto principle, teaching vs. research) • Map & eMed advocates (system champions or promoters)
What organisational factors affected the use of the Map? What were the causes of these factors or issues?	Socio-technical factors organised by category, theme and topic Mainly explored through observations and textual documentation data.	**Organisational factors affecting Map use:** • Communication, consultation, coordination, shared perspectives: o Amongst users—academic & general (share ideas, discuss system strengths, limits and improvements) o Between UMP staff (users) &

Research Questions (based on the 'who, what, why, when, where and how' of Map use)	**Research Methods** (used to answer questions)	**Coding Tree** (used to code and analyse qualitative data)
	Explored further through survey	IT staff (non-users) (reach common understanding of user needs & of each other's perspectives) o Keeping staff informed (via email, broadcasts, newsletters, conversation etc.) o Conversation versus computation • Culture and mindset within Faculty: o Campus versus clinical o Collaboration, sharing, trust, teamwork, respect or lack of (CoP) o Teaching versus research o Teaching & research versus administration & IT o DIFM versus DIY o 20th century (technology age) versus 21st century (information age) o Male versus female • Management (UMP & eMed governance): o Groups & committees (DIG, eMed, P2, UMP, Faculty) o Management style, leadership, changes o Attitude towards Map, eMed o Attitude towards UMP & L&T o Task allocation, accountability, ownership and politics o Workforce, workload & time management (staff types—paid vs. non-paid vs. conjoint, UMP vs. non-UMP work, staff numbers, lack of time) o Finances (grants, funding, hidden costs) • Administration (Map governance framework): o Mapping policies, procedures, guidelines, timelines, support, (forward/proactive planning,

Research Questions (based on the 'who, what, why, when, where and how' of Map use)	**Research Methods** (used to answer questions)	**Coding Tree** (used to code and analyse qualitative data)
		simple, clever and time-saving solutions, building a CoP) o Course guide production (includes formatting, simple solutions) o Help information (maintaining the Map help sites and websites, information as 'perishable commodity') o Map access (procedures, user-roles, data quality) o IT project management (includes Map develop & testing, Issue Log training) o Overall eMed administration (organise meetings, coordinate eMed owners, task allocation) • Central services/unit (Central IT, Library, Learning and Teaching Unit)
What technical factors affected the use of the Map? What were the causes of these factors or issues?	Socio-technical factors organised by category, theme and topic Mainly explored through observations and textual documentation data. Explored further through survey Some IT factors explored further through Web log reports and data linkage	**Technical factors affecting Map use:** • Map data and data structure: o Controlled vocabulary o Data quality o Data security o Data limitations • Map IT features and functions o Design, development & maintenance (including Issue Log, Lotus, system improvement, problematic features) o IT glitches, tests and releases • Other IT systems (eMed, WebCT or other IT): o Integration, data sharing, design o Glitches
Which parts of the Map were used?	Some information gathered from observations data. Explore further through survey Explore further through Web log reports and data linkage.	**Map features used:** • Forms • Views • Search tool • Export tool • Archive tool • Content files • Help sites (in eMed and webpages) • Map links in WebCT

Research Questions (based on the ‘who, what, why, when, where and how’ of Map use)	**Research Methods** (used to answer questions)	**Coding Tree** (used to code and analyse qualitative data)
When was it used? How often was it used?	Some information gathered from observations data. Explore further through survey Explored further through Web log reports and data linkage	**Frequency of use:** • Daily • Weekly • Fortnightly • Monthly • Once per course teaching period • Only at course revision time • Never
Who was it used with? (Where was it used?)	Some information gathered from observations data. Explore further through survey	**Used with:** • Oneself • With other staff • With students
What was the effect of a single factor on the use of the Map? What was the effect of related factors on the use of the Map?	Started using systems thinking and systems theory principles to bring together single and related factors, noting their effect on Map use as follows: • Positive effects: factors enabling, promoting or encouraging Map use (enablers) • Negative effects: factors blocking, preventing or impeding Map use (barriers) • Neutral effects: no obvious effect.	**Effect of a factor on the use of the Map:** • Enabling effect • Hindering effect • Neutral effect
What events were observed during this qualitative study?	Used to standardise terminology in the **Observations log,** for coding purposes.	**Event:** • Work (Wk) (routine teaching/ research/ service work done alone, in pairs or in a group) • Meeting (Mt) (work-related meetings) • Critical incident (CI) • Training session (Tr) (one-to-one, small-group, workshop) • PhD (PhD) (this research project)
In which work-context did the events occur?	Used to classify the **Time log data.** SPHCM was the broadest context, and covered all non-SH3 work involving other undergraduate and postgraduate courses, and other School work or	**Context:** • OME (eMed-specific work) (ome) • SH3 (includes P2 committee) (sh3) • SPHCM (other UG/PG work) (sphcm) • PhD (research-specific work) (phd)

Research Questions (based on the ‘who, what, why, when, where and how’ of Map use)	**Research Methods** (used to answer questions)	**Coding Tree** (used to code and analyse qualitative data)
	service work.	

Which types of qualitative research methods were used?	Used to standardise the terminology used in the **Combined Observations + Timelog + Emails** documents for 2007–2009 (for coding purposes).	**Method:**
		• Participant observation (PO)
		• General observation (GO)
		• Reflection (R)
		• Textual documentation (Tx):
		    o Email (MyEmail)
		    o Time log (as per ‘Context’)
		    o Meetings docs
		    o Issue log

Appendix G: Study 1—Summary of Factors Enabling or Hindering Map Use

Tables 1 to 3 of this appendix summarise the findings from Study 1 (the qualitative study). These summarised findings include the key individual, organisational and technical factors that enabled or hindered staff members' use of the Map, and are based on the research framework in Appendix F.

Table 1: Summary of individual-user factors (personal factors) observed to either enable or hinder Map use by staff.

Individual-user factors (arranged by themes & topics)	**Factors observed to enable or potentially enable Map use**	**Factors observed to hinder or potentially hinder Map use**
Attitudes, beliefs, behaviours, assumptions and perceptions of: • Map • eMed • UMP • IT • Paper-based resources • Memory versus database • Other staff • From others	✓ Being given the opportunity to use the Map ✓ Being invited to complete one's Map forms ✓ Receiving a personalised invitation to complete one's forms ✓ Being made aware of other LAFs when invited to review own forms	× Assuming that clinical teachers did not use or want to use the Map × The negative reputation of eMed × Viewing eMed as one single, amorphous system × Perceiving Map forms as being 'too inflexible' to capture learning activities × Aversion towards or lack of patience with IT in general × Preference for information on paper, in own memory or through other staff members × Considering one's LAF only
Knowledge, understanding, skills & training in: • Map • eMed • Curriculum • Online resources • Training needs	✓ Being shown briefly how to use the Map ✓ Being left to use the Map alone ✓ Providing different levels of training based on user's needs ✓ Being willing to explore the Map's content and its various features ✓ Being willing to invest own time into learning how to use the Map (self-directed learning) ✓ Being willing to follow the course convenor's suggested learning activity focus (i.e. top half of LAF) ✓ Being willing to explore how to extend the Map's use in learning and teaching (critical	× Having someone else complete one's own Map forms × Having someone else search the Map for a user × Not using Map Help or eMed website to build own skills × Limited understanding or conflicting interpretation of the curriculum (e.g. transparent, integrated) or its requirements (e.g. learning aims, key concepts, assessments etc.) × Conflicting interpretation of educational alignment and what to align × Limited knowledge of the Map's controlled vocabulary × Limited understanding of an

Individual-user factors (arranged by themes & topics)	**Factors observed to enable or potentially enable Map use**	**Factors observed to hinder or potentially hinder Map use**
	evaluation and reflection) ✓ Being provided with information on how to access the Map and other online resources for teachers	activity's content to be able to index its Map form
Meeting user's Map needs according to the: • Task (teaching, administration) • Setting (campus, clinical, primary care) • UMP Phase (1, 2 or 3)	✓ Meeting Map needs of on-campus teachers and administrators ✓ Meeting Map needs of Phase 1 activities ✓ Partly meeting Map needs of Phase 2 activities ✓ Meeting Map needs for Phase 3 assessments and on-campus activities ✓ Providing alternatives for meeting needs of clinical and primary care teachers	✗ Not meeting Map needs of clinical course convenors or clinical activities ✗ Experiencing Map forms as being "too inflexible" to capture clinical activities or primary care placements ✗ Map had too much information for GP/primary care clinical teachers ✗ Password protected sites were less appealing to GP/primary care clinical teachers
Effect of the Map on: • Workload, workflow & time • Document management	✓ Following recommended workflow for Map data entry ✓ Workflow and support accommodating special requirements of courses and phases (e.g. short time period between P2 course iterations) ✓ Using teacher-only fields to manage Map changes for next course iteration while current course still running ✓ Reducing need for course guides and data duplication by referring to Map data instead ✓ Dividing the Map work amongst DIG members ✓ Adopting good file management practices for course-related documents held in the Map or otherwise	✗ Entering Map data in Word documents instead of online increased workload and decreased data quality ✗ Duplication of data in the Map, course guides and WebCT Vista increased workload and decreased overall data quality ✗ Erroneous data in the Map, course guide or WebCT Vista increased class preparation time for teachers ✗ Over-reliance on paper-based documents such as course-guides
Map in perspective: • Mapping versus teaching versus course coordination • Prioritising work	✓ Acknowledging that Map work is intermittent ✓ Acknowledging that teaching and other course work comes first	✗ Prioritising Map work as last on list ✗ Prioritising research before teaching
Rewards, recognition & compelling reasons for using the Map: • Useful data • Personal reputation & recognition	✓ Using data for course guided, course improvement, research, publications ✓ Gaining kudos from having one's name in the Map ✓ Gaining workload points from	✗ Finding that poor data quality rendered the Map useless ✗ Losing kudos by having one's name against incomplete or out-of-date Map forms ✗ Not having one's Map work

Individual-user factors (arranged by themes & topics)	**Factors observed to enable or potentially enable Map use**	**Factors observed to hinder or potentially hinder Map use**
• Workload points	having one's name in the Map	rewarded or acknowledged
Map advocates	✓ Helping with Map work and training, and with reviewing and improving its use and the IT system ✓ Understanding Map use from the perspective of a course convenor, teacher and administrator ✓ Opportunistically promoting its use	× Overbearing advocacy

Table 2: Summary of organisational factors observed to either enable or hinder Map use by staff.

Organisational factors (arranged by themes and topics)	**Factors observed to enable or potentially enable Map use**	**Factors observed to hinder or potentially hinder Map use**
Communication, consultation, coordination, shared perspectives: • Amongst users • Between users & IT non-users • Keeping staff informed • Conversation versus computation	✓ Using various modes of communication ✓ Timely and proactive communication ✓ Users sharing problems and solutions about the Map ✓ Good communication with Map administrators ✓ Good communication with IT programmers	× Overuse of IT-driven solutions in place of conversation-driven solutions × Overuse of automated eMed notifications via email
Culture and mindset: • Campus versus clinical • Collaboration, sharing, trust, teamwork, CoP • Teaching versus research • DIY versus DIFM • 20th versus 21st century • Male versus female	✓ Providing access to Map and other online resources to promote sense of belonging amongst GP / primary care teachers ✓ Collaborative teaching and teamwork ✓ Do IT Yourself (DIY) approach to Map use ✓ Focussing on the needs of Map users as opposed to the technical features of the Map ✓ 21st century approach to information systems, education and organisations (open, sharing, student-focussed, information driven)	× Clinical teachers viewing the mapping of clinical activities as an unnecessary task × Introduction of teaching workload formulae × Swing towards research and away from teaching × Do It For Me (DIFM) approach to Map use × 20th century approach to information systems, education and organisations (closed, protective, teacher-focussed, technology driven)
Management and governance of UMP and eMed: • Groups & committees	✓ Having a reference group of academic, administrative and IT staff to develop and improve the Map and other	× Focussing more on research than on teaching × Mixed messages about senior managements' support for the

Organisational factors (arranged by themes and topics)	**Factors observed to enable or potentially enable Map use**	**Factors observed to hinder or potentially hinder Map use**
• Management style, leadership, change • Attitude towards Map and eMed • Attitude towards UMP and L&T • Task allocation, accountability, ownership and organisational politics • Workforce and workload • Finances	eMed tools ✓ Informing new senior academic managers about the UMP, eMed and the Map ✓ Encouraging senior academic managers to use the Map so as to lead by example (behaviour modelling) ✓ Allocating Map tasks to specific staff members and regularly reminding them of their Map responsibilities ✓ Ensuring equitable distribution of teaching workload ✓ Having proactive and tenacious Map advocates	UMP × Mixed messages about the usefulness of eMed × No financial support through educational or IT grants to finalise the Map's development × Users being affect by Map tasks which had not been done
Map administration and governance framework: • Mapping policies, procedures, guidelines, timelines, support • Course-guide production • Map help maintenance • Map access • IT project management • eMed administration	✓ Map administrators implementing Map policies, procedures, guidelines and timelines ✓ Map administrators driving the revision of Map forms (e.g. on an annual basis) and preparation of course guides ✓ Map administrators monitoring data quality and the controlled vocabulary ✓ Map administrators maintaining helps sites ✓ Map administrators monitoring, resolving user problems and sharing solutions and tips with users	× Leaving the revision of Map forms up to the individual course convenors. × Map administrators entering data on behalf of course convenors or of principal teachers with access × Users unable to access the Map × Problems with clinical teachers attaining a University staff number and password × Problems with the maintenance of data in eMed Access Manager × Administration and management of the whole eMed system at an organisational level
University Central Services	✓ Moving the UMP content and archiving functions from WebCT Vista to the Map ✓ Continued support for the Lotus Domino platform	× Problems with accessing the Map relating to central servers × Potential Map log-in problems due to staff number changes from 's' to 'z' prefix

Table 3: Summary of technical factors observed to either enable or hinder Map use by staff.

Technical factors (arranged by themes and topics)	**Factors observed to enable or potentially enable Map use**	**Factors observed to hinder or potentially hinder Map use**
Map data and data structure: • Controlled vocabulary • Data quality • Data retrieval • Data security • Data limitations	✓ Maintaining and managing the Map's controlled vocabulary ✓ Sharing Map's controlled vocabulary with related eMed systems ✓ Refreshing old staff details in the Map with latest data from the Faculty's Staff directory ✓ Including a spell-checker in the Map ✓ Ensuring data security by providing the correct access level to users and by blocking access when no longer appropriate ✓ Understanding the function of the database	× Limited data entry or quality affected Map search results × Limited use of controlled vocabulary affected Map search results × Controlled vocabulary not meeting users' needs × Using the Map data in ways it was not originally designed to × Data security affected by limited management of eMed Access Manager × Simple text formatting in the Map's fields × Screen-readable capacity of the Map's data × Expecting the Map database to be something more than what it is
Map IT features and functions: • Design, development & maintenance • IT glitches, tests and releases	✓ Keeping the Map's design simple for users ✓ Designing around the Map user's needs as oppose to the technology ✓ Using the eMed Issue Log to record potential IT improvements and fixes and to follow through on the development, testing and release of these ✓ Documenting the fixes and features of new Map versions ✓ Continued Map development to meet curricular needs ✓ Reviewing the continued use of Lotus Domino ✓ Appreciating the dichotomous experiences of Map users and IT programmers (non-user)	× Development stalling × Delays in fixing glitches and in developing new required features and functions × Map glitches occurring due to limited testing × Map glitches re-appearing after being fixed × Workload of testing on non-IT staff members × Hidden cost of non-IT staff involved in the design, development and testing × Not appreciating the effects of not testing the system × Not appreciating the effects of IT glitches on Map users × Those requesting IT changes or fixes not knowing why or how to use the Issue Log.
Other IT systems: • Integration, data sharing, design • Glitches	✓ Appreciating the integrated nature of the eMed system ✓ Appreciating the centrality of the Map in the eMed system from an IT perspective ✓ Appreciating the parts and the whole of eMed as an IT system	× Expecting general users to find and report eMed glitches × Not appreciating the effect of IT glitches on eMed users × Broken IT links between eMed tools or between its other integrated systems

Appendix H: Study 2—Details of Data Collected

This appendix provides detailed information on the data collected and analysed in Study 2 (the web log and data linkage study).

Overview

Two major datasets formed part of Study 2: (a) data on Map use from the eMed access web logs and (b) data on staff member from the Faculty's staff database and other data sources. The major source of data on staff members involved in the UMP came from the eMed Timetable database, a system used to schedule all campus activities and many clinical activities in all three Phases of the UMP. Other sources included data from the Map, eMed Access Manager, eMed Placement, Faculty and School websites, and documentation on UMP courses and phases.

Table 1 provides detailed information on all data collected and analysed in this study. As noted in the third column, while some of the data analysed were available for continuous periods of time (e.g. eMed web log data, eMed Timetable data) other data were only available for specific points in time (e.g. Faculty staff data). Other sections in this appendix provide further information on each data source used.

Table 1: Details of data used in the web log and data linkage study, including data source, type and purpose, and time period captured (all data were exported to MS Excel 2007).

Data source	Data type and purpose	Time period captured and collection details
Lotus Domino 7 eMed access web logs	**Type:** web access logs of eMed Map use **Purpose:** to identify staff members who had used the Map	Continuous data from January 2004 to December 2010
Faculty of Medicine staff database and UNSW Human Resources database (NSS-HR)	**Type:** general data on Faculty staff members including name and surname, staff number, staff type, position, School (or equivalent), contact details, gender, age, employment commencement and termination dates (if applicable). **Purpose:** to identify all staff members who had access to the Map at least at the level of Map 'Reader'.	Data for the following dates: • 1 January 2004 • 27 June 2006 • 4 September 2009 • 14 & 15 September 2009 • 16 June 2010 • 15 & 17 December 2010
eMed Timetable database	**Type:** data on timetabled activities in the UMP, including type of activity, location and name of teacher. **Purpose:** to identify all staff members who had taught learning activities in the	Continuous data from 1 March 2004 to 12 November 2010 (i.e. all teaching periods in that time).

Data source	Data type and purpose	Time period captured and collection details
	UMP that had been scheduled in eMed Timetable.	
eMed Access Manager database	**Type:** general data on select staff members and affiliated teachers including name and surname, staff number, School, and access level to the Map. **Purpose:** to identify those with access to the Map who were not in the Faculty database (e.g. casual Faculty teachers, non-Faculty teachers) and those with elevated access to the Map (i.e. beyond Reader access).	Data for the following dates: • 1 May 2009 • 17 September 2009 • 21 March 2011
UMP Course Guides and Program Guides	**Type:** name of phase convenors and administrators, course convenors, administrators and contributors, principal teachers of learning activities and P1 scenario facilitators. **Purpose:** to identify staff members with specific roles in the UMP.	Continuous data from March 2004 to December 2010 (data copied from the Word or PDF version of the guides in electronic format)
eMed Map and Map Archive databases	**Type:** name of course convenors and principal teachers in the UMP (from data in the Map's course outline forms and learning activity forms). **Purpose:** to identify staff members with specific roles in the UMP.	From Map: continuous data from January 2010 to December 2010 (data exported from search results conducted on 25 and 26 November 2010). From Map Archive: continuous data from January 2008 to December 2009 (data exported from search results conducted on 25 and 26 November 2010).
Faculty of Medicine's 'Governance' webpage	**Type:** name of staff members in various committees and groups involved in the governance of the UMP. **Purpose:** to identify staff members with specific roles in the UMP.	Data as available on the Faculty website in November 2010.
eMed Placements database (Primary Care course) and Clinical Placement database (Society and Health 3 course)	**Type:** name of staff members and affiliated clinical teachers in the UMP courses 'Society and Health 3' and 'Primary Care'. **Purpose:** to identify affiliated clinical teachers in these two course who were not in the Faculty staff database.	For Primary Care: continuous data from January 2008 (start of course) to November 2010 (data exported on 2 November 2010) For Society and Health 3: continuous data from January 2007 to November 2010 (data exported on 30 October 2010)
Rural Clinical School (RCS) website and RCS database on conjoint appointments	**Type:** name of staff members and affiliated clinical teachers involved in the rural health component of the UMP. **Purpose:** to identify any RCS teachers or administrators involved in the UMP who were not in the Faculty staff database.	From RCS website: data available on the website on 23 November 2010 From RCS database: data current as of 30 September 2010.

eMed Access Web Log Data

The eMed access web log reports were automatically captured by the Lotus Domino eMed server on a daily basis from 20 January 2004 onward. To balance the server's workload, there were two mirror serves working in unison, known respectively as the 'emed1' and 'emed2' servers. Since an eMed user can be sent to the emed1 or emed2 server depending on each server's workload, web logs captured from both servers were analysed. The captured eMed access web log files were routinely downloaded and saved onto CD or DVD every few months by staff members of the Medical Faculty's Medicine Computing Support Unit (MCSU). A total of 7042 eMed web log files containing a total of 159GB of data captured between January 2004 and December 2010 were saved from CDs and DVDs onto an external hard drive and analysed using Sawmill 8 (see Table 2). Due to an oversight with the disk-saving routine, the eMed access web logs for May 2008 and April 2009 were missing from the data-set, therefore reducing the total number of access web logs available for analysis for these 2 years.

Table 2: Number of eMed access web log files captured by the Lotus Domino 7 mirror-servers emed1 and emed2, and saved onto disk between 20 January 2004 and 31 December 2010.

Year	Date range of saved eMed access web log files		Date range of missing eMed access web log files			Number of eMed access web log files saved and analysed		
	First day	Last day	First day	Last day	Days missing	emed1 server	emed2 server	Total
2004	20/01/2004	31/12/2004	NA*	NA		319	345	664
2005	1/01/2005	31/12/2005	NA	NA		362	365	727
2006	1/01/2006	31/12/2006	NA	NA		364	365	729
2007	1/01/2007	31/12/2007	NA	NA		363	363	726
2008	1/01/2008	31/12/2008	1/05/2008	31/05/2008	31	320	317	637
2009	1/01/2009	31/12/2009	1/04/2009	30/04/2009	30	335	334	669
2010	1/01/2010	31/12/2010	NA	NA		365	364	729

(*NA: Not Applicable)

These raw eMed access web log files contained large amounts of detailed and varied web log traffic information on all users who had logged onto the eMed website between January 2004 and December 2010. Raw data included the following relevant information on each authenticated eMed user/visitor:

- Authenticated user ID number (staff or student number/username)
- Type of user (staff or student)
- Hostname/client IP
- Date and time of logging in and logging out
- eMed directories/tools visited (e.g. Map, Timetable, Portfolio, Help etc.)
- Pages viewed
- File types viewed
- Session information (session pages, entry pages, exit pages and session users).
- Geographical location of access (countries, regions and cities)
- Technical information (screen dimensions, screen depth, web browsers, operating systems, referrers and server responses).

Between 2004 and 2007, the Lotus Domino eMed web log files only captured the authenticated user's ID number as their 'uid' (i.e. staff or student ID). In 2008 a cookie was added to the Lotus Domino server so that web log files also captured the user's name and surname. This extra information facilitated the data linkage conducted in this study.

Data from Staff Database

Table 3 provides detailed information about the data collected on staff members from the Faculty of Medicine's Lotus Domino 7 staff database and the UNSW Human Resources database (NSS-HR). As noted in the first column, data were collected at specific points in time. The fourth column shows that the number of Faculty staff members increased substantially between 2004 and 2010. The NSS-HR database only included names of staff members employed in the Faculty of Medicine, while the Faculty's staff database also included names of Faculty affiliates (e.g. UNSW outreach librarians), and staff members involved in the UMP such as session teaching staff and staff from the School of Biotechnology and Biomolecular Sciences (Faculty of Science). Therefore the total number of staff listed in the Faculty database was always larger than in the NSS-HR database. Terminated staff included those who had resigned and left the Faculty, as well as those who had resigned from one Faculty position and changed to another position within the Faculty. All data were exported to Excel 2007, cleaned and standardised, and used in the data linkage component of this study.

Table 3: Information on data exported from the Faculty of Medicine's staff database (public and private versions) and from the University's Human Resources database (NSS HR).

Time period captured	Staff member data collected	Export database, date and other details	Total number of staff members at the time
1 January 2004	Abridged general data (e.g. no School information). Date of birth and gender.	NSS-HR on 15/12/2010 using pre-dated report (exported by Information Coordinator)	1792
27 June 2006	General data	Faculty staff (public) on 27/6/2006 using current date export (exported by author)	2242
4 September 2009	General data; date of birth and gender; employment commencement and end dates.	NSS-HR on 4/9/2009 using the pre-dated report (exported by Information Coordinator)	2688
14 September 2009	General data on terminated staff	Faculty staff (restricted) on 14/9/2009 using current date export (exported by Information Coordinator)	1538 (terminated)
14 September 2009	Abridged general data. Date of birth and gender	Faculty staff (restricted) on 14/9/2009 using current date export (exported by Information Coordinator)	2865
15 September 2009	General data	Faculty staff (public) on 15/9/2009 using current date export (exported by author)	2869
16 June 2010	General data	Faculty staff (public) on 16/6/2010 using current date export (exported by author)	3037
15 December 2010	General data; date of birth and gender; employment commencement and end dates.	NSS-HR on 15/12/2010 using current date report (exported by Information Coordinator)	3024
17 December 2010	General data	Faculty staff (public) on 17/12/2010 using current date export (exported by author)	3218

Data from eMed Timetable

While the Faculty's staff database provided general information about staff members, it did not provide information about a staff member's involvement in the UMP. One major source of information on the teachers involved in the UMP was the eMed Timetable database (see Table 1 above). Table 4 provides detailed information about the data exported from eMed Timetable to Excel 2007, and consequently used in the data linkage component of the study. As noted in the first column, the data collected was continuous from January 2004 to November 2010 (i.e. to the end of the last teaching period in 2010). All data were exported to Excel 2007, cleaned and standardised and used in the data linkage component of this study.

Table 4: Information on data exported from the eMed Timetable database.

Time period captured	Learning activity data collected	Export database, export date and other details
1 January 2004 to 12 March 2010	• Course details • Learning activity type, title, time and location • Teacher name and Teacher ID number (if available)	eMed Timetable on 1/7/2010 from archived data (by eMed IT Developer). Processed data captured all teaching periods from March 2004 to November 2009.
17 March 2009 to 7 September 2010	• Course details • Learning activity type, title, time and location • Teacher name and Teacher ID number (if available)	eMed Timetable on 1/7/2010 from current data (by eMed IT Developer). Processed data captured the teaching periods from 18 January to 9 July 2010 (i.e. STP of Phases 2 and 3, and TP1 to TP2 of Phases 1 to 3).
1 June 2010 to 12 November 2010	• Course details • Learning activity type, title, time and location • Teacher name and Teacher ID number (if available)	eMed Timetable on 6/12/2010 from current data (by eMed IT Developer). Processed data captured teaching periods from 19 July to 12 November 2010 (i.e. TP3 and TP4 of Phases 1 to 3).

Data from eMed Access Manager

Another source of information was the eMed Access Manager database, a system used to allow Map access to those not in the Faculty database (e.g. casual or affiliated UMP teachers). Table 5 provides detailed information on data exported from eMed Access Manager. As noted in the first column, data were not continuous but instead were collected at specific points in time. All data were exported to Excel 2007, cleaned and standardised and used in the data linkage analysis.

Table 5: Information on data exported from the eMed Access Manager database.

Time period captured	Staff member data collected	Export database, date and other details (exported by Map Administrator)
1 May 2009	Staff name and ID number, Map access level, School and email	eMed Access Manager on 1/5/2009 using current date export
17 September 2009	Staff name and ID number, Map access level, School and email	eMed Access Manager on 17/9/2009 using current date export
21 March 2011	Staff name and ID number, Map access level, School and email	eMed Access Manager on 21/3/2011 using current date export

Data from Other Sources

On 13 May 2009, along with the Faculty-wide email announcement about the eMed Map research study, staff members were invited to complete a short questionnaire on their UMP involvement. This questionnaire could be completed in hardcopy (Figure 1) or online through the eMed Map homepage.

Your Role(s) in the Undergraduate Medicine Program (UMP)

Note:

- If you have **never** accessed eMed Map **and** you do not intend to access it within the next 18 months, you do **not** need to answer this question.
- If you prefer, you can complete the online version of this question which is available on the eMed Map homepage at http://emed.med.unsw.edu.au (login required).

Your name:

Your staff number:

Please indicate the role(s) you have in the Undergraduate Medicine Program (UMP).
If you are not involved in the UMP but you have accessed eMed Map (e.g. out of interest), please select "Not applicable".

Role(s) in UMP	**You can select more than one role** (Use an **X** to indicate your selection)
Teacher—campus-based	
Teacher—clinical school-based	
Convenor	
Curriculum design, overview or evaluation group or committee	
Administrator	
Other (please specify >>>)	
Not Applicable	

Thank you for completing this question.

Please return your completed form to Ms Eilean Watson by email (e.watson@unsw.edu.au) or by mail (Room 238 Samuels Building, School of Public Health and Community Medicine, Faculty of Medicine, The University of New South Wales, Sydney 2052).

Figure 1: Staff questionnaire on UMP involvement.

Other data sources used to identify the involvement and roles of staff members in the UMP included the following:

- UMP course guides and program guides
- eMed Map and Map Archive databases
- Faculty of Medicine's 'Governance' webpage
- eMed Placements database for Primary Care
- MS Access Clinical Placement database for Society and Health 3
- Rural Clinical School (RCS) website and RCS database on conjoint staff appointments.

Since some Clinical Schools often used their own timetable systems to schedule their clinical activities and teachers, not all learning activities were captured in eMed Timetable. Also, since access to the Clinical Schools' UMP timetables proved difficult and since many Clinical School websites containing their timetable for students were password protected, only those clinical teachers found in eMed Timetable or in one of the other sources listed above were included in this study. Therefore, the number of clinical teachers from metropolitan Clinical Schools reported in this study may under-represent the true number (also see Appendix K).

Type of UMP Roles

Staff members involved in the UMP had specific roles relating to teaching and/or administration. While some staff members had only one UMP role (e.g. course administrator or facilitator), others had many roles (e.g. course convenor, group member, principal teacher and facilitator), with some roles ranging across courses and phases (e.g. Phase 1 facilitator and Phase 2 course convenor). Table 6 outlines the type of UMP roles, the categories included under each role and the data sources used to identify the staff members in each role. Note that while the Independent Learning Project (ILP) committee group members were included in this study, individual ILP supervisors were not included.

Table 6: Type of roles held by UMP staff including categories under each role and data sources.

Type of UMP role	Categories included under the UMP role	Data source and time period
Convenor	Included the following convenors: *Course convenor and Co-convenor *Element convenor *Phase convenor *Clinical School Coordinator *Phase 1 Portfolio Advisor *Portfolio Examination Convenor *A/Deans and Dean	*Program Guides 2004-2010 *Phase 1 to 3 Guides 2007-2010 *Course Guides 2004-2010 *UMP Faculty webpages 2010, including the Faculty webpage on 'Governance'
Group member	Included the following groups/committees: *Design and Implementation Group or contributor *Phase Committees (excluding student representative) *Clinical Learning and Assessment Committee *ILP & Honours Committee *Curriculum Development Committee (excluding invited members & students) *Assessment Review Group Undergrad *Education Committee (excluding invited members & students) *Program Evaluation and Improvement Group	*Program Guides 2004-2010 *Phase 1 to 3 Guides 2007-2010 *Course Guides 2004-2010 *UMP Faculty webpages in 2010 only, including the Faculty webpage on 'Governance'
Administrator	Included the following administrators: *MESO/OME administrator *Office of the Dean (OoD) administrator *eMed administrator *SOMS administrator *SPHCM administrator *Rural School administrator *Clinical Schools administrator *Student Affairs Coordinator *Grievance Resolution Officer	*Program Guides 2004-2010 *Phase 1 to 3 Guides 2007-2010 *Course Guides 2004-2010 *UMP Faculty webpages 2010, including the Faculty webpage on 'Governance' *Rural School website and database 2010
eMed Timetable teacher	Included all teachers in all activities scheduled in eMed Timetable (excluding students)	eMed Timetable 2004-2010
Phase 1 Facilitator	Included all Phase 1 Facilitators	Course Guides 2004-2010
Principal Teacher	Included all Principal Teachers	*Course Guides 2004-2010 *eMed Map (2010) *eMed Map Archive (2008-2010)
Primary Care clinical teacher	Included all clinical teachers in the courses 'Society and Health 3' (Phase 2) and 'Primary Care' (Phase 3)	*Clinical placements database (for SH3) from 2007-2010 *eMed Placements database (for Primary Care) from 2008 to 2010
Rural Clinical School staff	Included all Rural Clinical School staff	*Rural Clinical School database (30/10/2010). *Rural Clinical School website (23/11/2010)
Metropolitan Clinical Schools teacher	Included academic, conjoint, adjunct, visiting or external staff members located in Clinical Schools (excluding the Rural Clinical School).	Derived from Faculty staff database and eMed Timetable (e.g. by filtering data on 'Involvement in UMP', 'Staff Type' and 'Location of School/Centre')

Appendix I: Study 2—Sawmill Metrics

This appendix provides an overview of the software application Sawmill 8 and its metrics. Sawmill 8 is a fully programmable and customisable, GUI-based web log analysis tool which can be used to analyse many web log data formats including the Lotus Domino Access log data format of the eMed Access web logs used in this study. Further information is available from the Sawmill website at http://www.sawmill.net/.

Sawmill 8 can count web log traffic in several ways. Each way is counted independently of the others, and each has its own advantages in analysing the web traffic. What follows is a description of each Sawmill measurement, and of how and why it was used in this study.

- **Hits:** hits are events on a website. It could be that a webpage was downloaded, or several images or documents were downloaded from a webpage. A single webpage can be made up of many elements (images, documents, movies etc.). So if there are 5000 events for a single day, then Sawmill will report 5000 hits. Hits were not explored in this study.
- **Page views:** page views correspond to hits on pages. In the example above only the hit on the webpage (not the elements within the page) will count as a page view. Page views were not explored in this study.
- **Visitors:** visitors correspond to the total number of people who visited the site. If a single person visits the site and looks at 100 pages, this will count as 100 page views, but only one visitor. By default, Sawmill defines visitors to be 'unique hosts' - a hit is assumed to come from a different visitor if it comes from a different hostname/client IP. However, in this study since the eMed website was password protected, the Lotus Domino eMed server tracked not only a visitor's hostname/client IP but also the visitor's authenticated user data which was the staff ID number entered at log-in. Hence, in this study, the 'visitor' fields in Sawmill were re-set to measure the authenticated user data (uid) which was much more accurate than the hostname/client IP data (the default 'visitor' measurement in Sawmill). For further details see Appendix J.
- **Bandwidth:** bandwidth is the total number of bytes transferred. Bandwidth is tracked for every event that occurs, whether it is a 'hit' or a 'page view'. Bandwidth was not explored in this study.
- **Referrers:** referrers are 'where visitors came from'. For instance, if a visitor entered the Map through Blackboard (or WebCT Vista), the referrer was Blackboard (or Vista) for that

session, and Sawmill reported Blackboard (or Vista) as the referring website in the Referrers view. Referrers were explored in this study.

- **Sessions:** several of the Sawmill reports deal with 'session' information, including the 'sessions overview' report and the 'paths' report. Sessions are similar to visitors, except that they can 'time out'. When a visitor visits the site, and then leaves, and comes back later, it will count as two sessions, even though it is only one visitor. To reduce the effect of caches that look like very long sessions, Sawmill also discards sessions longer than a specified time; the default setting of 30 minutes was used in this study. Sawmill computes session information by tracking the page, date/time, and visitor ID for each page view. When a session view is requested, it processes all of these page views at the time of the request. The visitor ID used by Sawmill is usually the hostname (client IP). However, in this study the 'session' fields were re-set to measure the visitor ID as the authenticated user data (uid) which was much more accurate than the hostname/client IP data (for further details see Appendix J). Sessions were extensively explored in this study.
- **Session events:** a page view which occurs during a session is a session event. For web server logs, this number is similar to page views but may be smaller because it does not include page views which are not in any session. That can occur if the page view is a reload (two consecutive hits on the same page), or if the page view is a part of a session which has been discarded because it is too long. Session events were explored in this study.
- **Session duration:** Sawmill computes session information by tracking the page, date/time, and visitor id for each page view in the log data. Sawmill decides that a new session has begun if a visitor has been idle for 30 minutes. The Lotus Domino web logs captured the entry and exit time for Map sessions in 'seconds' and therefore Sawmill also reported session duration in seconds. In this study, the session duration time was converted to decimal minutes in Excel 2007 to accommodate for the wide range of session durations.

Appendix J: Study 2—Sawmill Fields and Filters

This appendix provides detailed information on the Sawmill 8 fields, filters and settings that were used in Study 2. Since a number of these fields and filters were either modified or created exclusively for this study, this detailed information allows for the replication of the analysis of the Lotus Domino 7 eMed Access web log files conducted in this study using Sawmill v8.1.5.

Overview of Fields and Filters

Sawmill 8 is a fully programmable and customisable, web log analysis tool which can analyse many web log data formats including the Lotus Domino Access log data format of the eMed Access web logs. It uses its own programming language known as ‘Salang’, which is similar to Perl and borrows syntactic elements from Perl, C and other computer languages and makes use of regular expressions. Further information is available from the Sawmill website at http://www.sawmill.net/.

Sawmill 8 contains a variety of configurable fields which are grouped as follows:

- Log fields
- Database fields
- Session fields
- Report fields

The following extract from the Sawmill online Technical Manual briefly explains what log fields are, and their relation to log filters:

> Log fields are containers which hold particular values in the log data, or which act as variables to hold other values. In general, each log entry contains multiple fields, and Sawmill extracts those field values from the log data and populates it into the log fields. The log fields are then processed by log filters, and if the entry is accepted by the filter, they are then copied to database fields to be included into the database. The database fields are then used to generate reports. For instance, if a log file contains three comma-separated fields per line: date, time, and page, then the log fields would be date, time, and page and any derived fields, like hour_of_day; see below. Log fields

can have any names, and the log fields in a profile depend on the log format. A log field may be either an actual field or a derived field, which is present in each log entry of the file. For instance, the ‘page’ field or the ‘hostname’ fields are actual fields, and a derived field which is not present in log entries, but is derived from the entries which are present, and from other information. Derived fields include fields like ‘domain description’ which is a textual description of the host domain (e.g. ‘France’ for .fr), and is derived from the hostname field, or the ‘day of week’ field, which is derived from the date/time field, or the ‘operating system’ field, which is derived from the user-agent field. Derived fields are present when the fields they get their value from are present; they are created automatically when their source fields are created (extract from Sawmill 8 online Technical Manual at http://www.sawmill.net/cgi-bin/sawmill7/docs/sawmill.cgi?dp+docs.technical_manual.toc — password protected site).

Sawmill Fields and Settings

Table 1 contains a complete list of the Sawmill 8 log fields, database fields and report fields used in this study, and Table 2 contains a list of the session fields used. Most of the Sawmill 8 fields and field settings used were the default fields and settings for a Lotus Domino Access Log data format. However, some field settings were modified to make better use of the ‘authenticated user’ data (‘uid’) captured in the Lotus Domino eMed access web logs. As well, the ‘person’ field used was a customised field created to analyse the cookie header data (‘ckUser...’) in the Lotus Domino eMed access web log files from 2008 onward.

Table 1: Sawmill 8 log fields, database fields and report fields used to analyse the Lotus Domino eMed access web log files in this study.

Log field name	Database field name	Report field name
Agent	*Authenticated user	*Authenticated user
*Authenticated user	Date/time	City
city	Day of week	Country
Cookie header	Domain description	Date/time
country	Duration	Date/time timestamp
Date/time	File type	Day
day of week	Geographic location	Day of week
day of year	Hits	Domain description
domain	Hostname	Duration
domain description	Hour of day	File type
Duration	Operation system	Geographic location

file type	Page	Hits
geographic location	Page views	Hostname
Hits	*PERSON	Hour of day
Hostname	Referrer	Month
hours of day	Referrer description	Operating system
ISP	Screen depth	Page
operation system	Screen dimensions	Page views
Operation	Search engine	Pages/directories
organization	Search phrase	*Person
Page	Server domain	Referrer
Page views	Server response	Referrer description
*Person	Session begin	Region
Protocol	Session date/time	Screen depth
Referrer	Session duration	Screen dimensions
referrer description	Session end	Search engine
region	Session entrances	Search phase
screen depth	Session events	Server domain
screen dimensions	Session exits	Server response
search engine	Session ID	Session begin
search phrase	Session page	Session date/time
Server domain	*Session user	Session duration
Server response	*Session users	Session end
Size	Sessions	Session entrances
spider	Size	Session events
Translated URI	Spider	Session exits
web browser	Translated URI	Session ID
week of year	*Visitors	Session page
worm	Web browser	*Session user
	Worm	*Session users
		Sessions
		Size
		Spider
		Translated URI
		*Visitors
		Web browser
		Worm
		Year

*An asterisk indicates that a field was customised or its settings changed. Field names are arranged in alphabetical order (not in the configuration order of Sawmill). Log fields with lower case names are derived fields (as opposed to actual fields).

Table 2: Sawmill 8 Session Fields and the settings used, and information about each field option (information extracted from information in pop-up windows of Sawmill 8 application).

Session Field Name and Setting Used *(in italics)*	Option Information
Sessions ID field: *None*	The field that is used to distinguish sessions. This field is used to distinguish one session from another. When this field is not specified, sessions are distinguished from each other by comparing the Sessions User field, together with the session timeout. When this field is specified, it directly determines the session ID of each event, so events are grouped into the same session if and only if their session ID field value matches.
Sessions user field: *Authenticated user**	The field that is used to distinguish session users. This field is used, when computing session reports and other session information, to distinguish one session user from another. This refers to a log field; if the value of that log field is the same for two events, they are considered to be events from the same user. This is often an IP, hostname, cookie, or device ID field. *Note: in this study this session field was set to the 'Authenticated user' database field, which itself was derived from the 'Authenticated user' log field which captured the 'uid' information (i.e. the user's unique staff number) in the Lotus Domino eMed access web log files (e.g. 'uid=s9400000')
Sessions event field: *Page views*	The field that is used to determine when an event is a session event. This field is used, when computing session reports and other session information, to determine when an event is a session event. An event is a session event if the value of this field is 1; it is not a session event if the value of the field is 0 (or if it is not a number). For instance, in a web log, this might be the 'page views' field, which is 1 for session events, and 0 for non-session events (non-page-view hits).
Sessions page field: *Page*	The field that is used to determine which 'page' was hit in a session event. This field is used, when computing session reports and other session information, to determine which 'page' was hit. In web logs, this is typically the 'page' field, or the 'URL' field. In other logs, it can be any field which somehow answers the question, "what was accessed?" or "what happened?"

*An asterisk indicates that a field was customised or its settings changed.

What follows are the details of those fields which had their field settings modified or that were customised to make better use of the data in the Lotus Domino log files (i.e. the asterisked fields in Tables 1 and 2 above).

‘Authenticated User’ Field

The ‘authenticated user’ Log field contained the eMed user’s unique ID number (‘uid’ code). This ‘uid’ data in the web log code was the seven digit staff (or student) ID number preceded by the letter ‘s’ or ‘z’ which eMed users enter as their ‘username’ when they log into the eMed website (e.g. uid=s1234567). Although the ‘authenticated user’ Log field in Sawmill was not actually modified, it replaced the default ‘hostname’ log field as the field against which a number of other fields were derived in this study. By using the ‘authenticated user’ data instead of the ‘hostname’ data in the Lotus Domino web logs, the results of the web log analysis were much more accurate. As shown in Table 3, the Index option of the ‘authenticated user’ field in the log data was set at position ‘3’, meaning that it was the third field in line in the Lotus Domino web log data. An example of this web log code and its line positions is provided at the end of this Appendix.

Table 3: Sawmill 8 ‘authenticated user’ field settings used in this study.

Log Field Setting	Database Field Setting	Report Field Setting
Field name: Authenticated user Identifier: authenticated_user Type: Flat Index: 3 Subindex: 0 Case sensitive: box not ticked	Field name: Authenticated user Derivation method: Log field Log field: Authenticated user Type: String Aggregation method: None Category: None Field length: 200 Integer bits: Auto Index: box ticked Suppress levels Above: 0 Below: 2 Itemnums hash function: rand_sum_shift (greyed)	Name: Authenticated user Source: Authenticated user Type: String General Tab Column label: (blank field) Sort Type: Auto Override database field category (None)—box not ticked Category: None Display format: String Alignment: Auto Column Info Tab Colum info text: (blank text box)

‘Visitor’ and ‘Session User(s)’ Fields

As shown in Table 4, the settings of the ‘visitor’, ‘session user’ and ‘session users’ fields in the Report and Database fields were changed so that the data were derived from the ‘authenticated user’ Log field instead of the ‘hostname’ Log field (the default setting in Sawmill 8). There were no Log Fields for ‘visitor’, ‘session user’ or ‘session users’.

Table 4: Sawmill 8 'visitor', 'session user' and 'session users' field settings used in this study. Note that there were no Log Fields with these field names.

Field Name	Database Field Setting	Report Field Setting
Visitors	Field name: Visitors Derivation method: Log field Log field: Authenticated user Type: Unique Aggregation method: None Category: None Field length: 200 Integer bits: Auto Index: box ticked	Name: Visitors Source: Visitors Type: Integer General Tab Column label: (blank) Sort Type: Auto Override database field category (None)—box not ticked Category: None Display format: Integer Alignment: Auto Column Info Tab Colum info text: (blank text box)
Session user	Field name: Session user Derivation method: Session field Session field: Session user Type: String Aggregation method: None Category: None Field length: 200 Integer bits: Auto Index: box ticked Suppress levels Above: 0 Below: 2 Itemnums hash function: rand_sum_shift (greyed)	Name: Session user Source: Session user Type: String General Tab Column label: (blank) Sort Type: Auto Override database field category (None)—box not ticked Category: None Display format: String Alignment: Auto Column Info Tab Colum info text: (blank text box)
Session users	Field name: Session users Derivation method: Session field Session field: Session users Type: Integer Aggregation method: Unique Category: None Integer bits: Auto Index: box ticked	Name: Session users Source: Session users Type: Integer General Tab Column label: (blank) Sort Type: Auto Override database field category (None)—box not ticked Category: None Display format: Integer Alignment: Auto Column Info Tab Colum info text: (blank text box) Numeric Options Tab *Default settings not changed*

'Person' Field

The 'Person' field was the only customised field used in this study. It was created to analyse the cookie header data (i.e. data within the 'ckUser...' string) in the Lotus Domino eMed web log files from 2008 onward. An example of this web log code and its line positions is provided at the end of this appendix. Table 5 shows the 'person' field settings used in this study.

Table 5: Sawmill 8 customised 'Person' field settings used in this study.

Log Field Setting	Database Field Setting	Report Field Setting
Field name: Person Identifier: person Type: Flat Index: 11 Subindex: 0 Case sensitive: box not ticked	Field name: PERSON Derivation method: Log field Log field: Person Type: String Aggregation method: None Category: None Field length: 200 Integer bits: Auto Index: box ticked Suppress levels Above: 0 Below: 2	Name: Person Source: PERSON Type: String General Tab Column label: Person Sort Type: Auto Override database field category (None)—box not ticked Category: None Display format: String Alignment: Auto Column Info Tab Colum info text: (blank text box)

Sawmill Filters

Sawmill 8 uses regular expressions in many places including in its log filters and report filters. A regular expression (or a regex) is a powerful method for defining a class of strings (strings are sequences of characters; for instance, a filename is a string, and so is a log entry). A regular expression is a pattern, which is essentially the string to match, plus special characters which match classes of string, plus operators to combine them.

The Lotus Domino access web log data captured in the log files varied from 2004 to 2010. Between 2004 and November 2007 the web log files did not capture cookies. From 8 November 2007 onward the web logs captured the 'UserTypeList' and the 'FirstLastName' cookie strings. The 'FirstLastName' string later became the 'FLName' string, and finally by 29 February 2008 it became the '&FLName=' string (see a sample of the cookie's code in Figures 1 and 2 at the end). Hence, the regular expressions used in the log filters in this study had to change according to the year when the eMed web log files had been captured.

Table 6 contains a complete list of the customised and default Sawmill 8 log filters used in this study to analyse the Lotus Domino eMed access web log files and to filter data on eMed Map users and eMed Help users. All customised Sawmill 8 log filters used in this study were of the ‘Expression’ type (as opposed to of the ‘Structured (Conditions and/or Actions)’ type) and therefore included regular expressions in their programming code.

Table 6: Customised and default Sawmill 8 log filters used in this study. (For confidentiality reasons, all regular expressions show mock staff ID numbers and names.)

Log Filter Name	Regular Expression	Comment
Map directory only (customised filter)	if (!starts_with(page, "/Map.nsf/")) then "reject"	
eMed Help directory only (customised filter)	if (!starts_with(page, "/eMedHELP.NSF/")) then "reject"	
Staff filter Person 2008–2010 (customised filter)	if(!matches_regular_expression(person,'UserTypeList=Staff')) then "reject";	This filter uses the ‘Person' log field (index=11) which was set up to use the cookie header information. Note that the eMed access we logs captured different information across the years, so that the coding used in the log filters needed to change accordingly. For example, only from Nov 8th 2007 onward did the access logs capture the "UserTypeList" and the "FirstLastName" and later the "FLName" strings. By Feb 29th 2008, the cookie strings used settled for "&FLName=". The "ckUser..." information did not appear in the 2008 raw logs or anything before 2008.
Exclude staff who opted-out of study or research project (customised filter)	if (matches_regular_expression(authenticated_user,'uid=s1234567|uid=s223458')) then "reject";	(Regular expression shows mock staff numbers only)
Exclude MCSU staff (customised filter)	if (matches_regular_expression(authenticated_user,'uid=s9876543|uid=s8765432')) then "reject";	Excluded MCSU staff present between 2006 and mid-2010. (Regular expression shows mock staff numbers only)
Exclude dummy accounts (customised filter)	if (matches_regular_expression(authenticated_user,'uid=z1234567|uid=m1234567')) then "reject";	Excluded dummy Map user accounts for designer, teacher, reader. Excluded users appearing as 'CN=....' in the authenticated user log field. Excluded dummy user accounts.
Remove non-authenticated user (customised filter)	if (authenticated_user eq '-') then "reject";	This filter removes the 'non-authenticated' users who are actual "uid", "person" users like staff and

Log Filter Name	Regular Expression	Comment
		students. These 'non-authenticated' users could have been those who made a mistake in entering their username or password so that their session "hit" was recorded even thought they were not actually authenticated into eMed.
FLName for 2009-10 (customised filter)	if (matches_regular_expression(person, "&FLName=([^&]*)&")) then person = $1	This filter captures the first and last name (FLName) from the cookie information (ckHeader) in the access log. The "Person" column in the reports shows the full name for the person. The code in this log filter is working as a modifier, whereby ([^&]*)&") acts like a "placer" for the person's name in the raw log, which is coded by the $1. The capture of cookie information in the eMed access logs started on Nov 8th 2007, and changed slightly until Feb 29th 2008. Therefore the code used in this log filter is different for 2007 and 2008.

FLName for 2008 only (customised filter)	if (matches_regular_expression(person, "&FLName=([^&]*)&")) then person = $1
	else
	if (matches_regular_expression(person, "FLName=([^;]*);")) then person = $1
		This filter captures the first and last name (FLName) from the cookie information (ckHeader) in the access log. The "Person" column in the reports shows the full name for the person. The code in this log filter is working as a modifier, whereby ([^&]*)&") acts like a "placer" for the person's name in the raw log, which is coded by the $1. The capture of cookie information in the eMed access logs started on Nov 8th 2007, and changed slightly until Feb 29th 2008. Therefore the code used in this log filter is different for 2007 and 2008.
		Solution from Sawmill Support for capturing information from the 2008 eMed access logs:
		else
		if (matches_regular_expression(person, "FLName=([^;]*);")) then person = $1

Simplify referrer (default filter)	if (referrer eq '-') then referrer = '(no referrer)' else if (matches_regular_expression(referrer, '^([^:]+://[^/]+/)')) then referrer = $1 . '(omitted)'	This filter strips off the pathname portion of the referrer, leaving only the scheme and hostname, to simplify the referrer hierarchy
Set page for worm	if (starts_with(worm, '(')) then ''	This filter sets the page field to

Log Filter Name	Regular Expression	Comment
(default filter)	else page = '(worm)';	'(worm)' if this is a worm hit
Remove page query (default filter)	if (contains(page, '?')) then page = substr(page, 0, index(page, '?') + 1) . '(parameters)';	This filter replaces page parameters (page.html?param1+param2+...) with ?(parameters), to simplify the page hierarchy
Detect page views (default filter)	if ((file_type eq 'JPEG') or (file_type eq 'JPG') or (file_type eq 'GIF') or (file_type eq 'ICO') or (file_type eq 'PNG') or (file_type eq 'CSS') or (file_type eq 'SWF') or (file_type eq 'JS')) then page_views = 0; else page_views = 1;	Determine whether this event is a page view, based on the file type
Strip non-page views (default filter)	if (page_views == 0) then page = substr(page, 0, last_index(page, '/') + 1) . '(nonpage)';	This strips off the filename of non-page-views, to improve performance
Mark as event (default filter)	hits = 1;	Mark this entry as an event
Staff filter with uid=s/m 2004-07 (customised filter)	if ((!matches_regular_expression(authenticated_user,'uid=s')) and (!matches_regular_expression(authenticated_user,'uid=m'))) then "reject";	This filter is used for web logs between 2004 and 2007 included, since the cookie string "UserTypeList=Staff" information only started to be captured in the logs on Nov 11th 2007, so that log filters based on information in the 'Person' log field do not work in this case.

As well as the Sawmill 8 Log filters described above, three Report filters were created to filter specific data from the eMed Help Reports. Table 7 provides information about each of these report filters.

Table 7: Sawmill 8 Report filters used to analyse eMed Help reports generated from the analysis of eMed access log files. All three report files made use of regular expressions.

Report Filter Name	Filter Setting	Comment
Authenticated user not matches regular expression '...'	Field Type: Standard Field: Authenticated user Operator: is NOT regular expression Value: s1234567|s2345678 etc. …	This Sawmill report filter made use of a regular expression to filter out the four main eMed Help page authors. (Regular expression shows mock staff numbers only for reasons of confidentiality.)
Page matches regular expression '...'	Field Type: Standard Field: Page Operator: is regular expression Value: 1836FD6A373EEDF2CA256DDB001B1CDE|1CC01612BEF859C6CA256DD7002E2B02| etc. …	This Sawmill report filter made use of a regular expression to filter in the Map Help pages, which had been previously identified by their unique Lotus Notes alphanumeric code in UPPER CASE.
Page matches regular expression '...'	Filter Type: Standard Field: Page	This Sawmill report filter made use of a regular expression to filter in the

	Operator: is regular expression Value: 1836fd6a373eedf2ca256ddb001b1cde|1cc01612bef859c6ca256dd7002e2b02|etc. …	Map Help pages, which had been previously identified by their unique Lotus Notes alphanumeric code in lower case.

eMed Access Web Log Sample

Figure 1 shows an example of the type of web log data analysed in Sawmill 8. This small sample of data from an eMed access web log file shows the researcher's own access of the eMed Map and eMed Help sites, as indicated by the highlighted data (e.g. staff number, name, surname, Map.nsf and eMedHELP.nsf directories, cookie/ckUser data).

Date: 28 January 2010
149.171.105.32 emed.med.unsw.edu.au "uid=s9400000/ou=People/dc=unsw/dc=edu/dc=au" [29/Jan/2010:09:16:11 +1100] "GET /Map.nsf/Homepage?ReadForm&AutoFramed HTTP/1.1" 200 6421 "http://emed.med.unsw.edu.au/Map.nsf/Homepage?readForm" "Mozilla/5.0 (Windows; U; Windows NT 5.1; en-US; rv:1.9.0.10) Gecko/2009042316 Firefox/3.0.10" 16 "__utma=233763905.3632855196086502000.1251952857.1264666442.1264715746.231; __utmz=233763905.1263539923.197.6.utmcsr=emed.med.unsw.edu.au|utmccn=(referral)|utmcmd=referral|utmcct=/eMedHELP.NSF/0/8DEFD6BFE75CE005CA256DCB00265E81; CFID=1959770; CFTOKEN=96990653; __utma=247997912.2215324987575970600.1251959463.1263896301.1264122086.15; __utmz=247997912.1263539923.13.4.utmcsr=emed.med.unsw.edu.au|utmccn=(referral)|utmcmd=referral|utmcct=/eMedHELP.NSF/0/8DEFD6BFE75CE005CA256DCB00265E81; __utma=80167171.2836461778949749000.1251963179.1264664769.1264716966.34; __utmz=80167171.1251963179.1.1.utmcsr=(direct)|utmccn=(direct)|utmcmd=(none); Map.nsfwLAFByCourse=:10::10.2::10.2.6:; __utmb=233763905.2.10.1264715746; __utmc=233763905; LtpaToken=AAECAzRCNjIwQzlFNEI2Mjk5M0V1aWQ9czk0OTAwNDYvb3U9UGVvcGxlL2RjPXVuc3cvZGM9ZWR1L2RjPWF1TcN/bFHQLGQefleVdmuKJgYzVIo=; ckUser=IDType=Unipass&UserTypeList=Staff&FullID=s9400000&NumberID=9400000&FirstName=Eilean&LastName=Watson&FLName=Eilean Watson&Year=&Phase=&FMSRepID=CA256FBA001848F0&SDRepID=CA256D2B000038E1&FMSName=pubFacultyD.nsf&SDName=StudentD.NSF&DataSource=pubFacultyD&SchoolHead=&; ckDesign=Theme=blue&; __utmb=80167171.1.10.1264716966; __utmc=80167171; nohistory=no" "d:/notesdata/Map.nsf"

Figure 1: A sample of data from an eMed access web log. Data on the researcher's own access of the eMed Map and eMed Help sites is highlighted.

Figure 2 shows a sample of code that has been broken into separate Index lines (from 1 to 12) to show the position of each piece of code. Any code that is surrounded by double inverted commas "…" or brackets […] is counted as ONE position (spaces within inverted commas or brackets are not counted). However, if the code is not surrounded by inverted commas or brackets and there is a SPACE in between the code, then this space indicates a separate position or index line, which can be used as the Index number in a Sawmill log field. Hence, these index lines show how the setting of a Sawmill field's "Index" option controlled how the raw web log data were analysed. For example, the field indexed at position 11 in the sample shown below was used to extract the cookie information (ckUser) for "UserTypeList=Staff" which is within the code surrounded by the double inverted commas. Note that the "Person" log field created in Sawmill to analyse the cookie information in this study had its Index position set at "11".

1.	149.171.105.32
2.	emed.med.unsw.edu.au
3.	"uid=s9400000/ou=People/dc=unsw/dc=edu/dc=au"
4.	[29/Jan/2010:09:16:11 +1100]
5.	"GET /Map.nsf/WebJSCommon?OpenJavascriptLibrary HTTP/1.1"
6.	200
7.	30830
8.	"http://emed.med.unsw.edu.au/Map.nsf/Homepage?ReadForm&AutoFramed"
9.	"Mozilla/5.0 (Windows; U; Windows NT 5.1; en-US; rv:1.9.0.10) Gecko/2009042316 Firefox/3.0.10"
10.	16
11.	"__utma=233763905.3632855196086502000.1251952857.1264666442.1264715746.231; __utmz=233763905.1263539923.197.6.utmcsr=emed.med.unsw.edu.au|utmccn=(referral)|utmcmd=referral|utmcct=/eMedHELP.NSF/0/8DEFD6BFE75CE005CA256DCB00265E81; CFID=1959770; CFTOKEN=96990653; __utma=247997912.2215324987575970600.1251959463.1263896301.1264122086.15; __utmz=247997912.1263539923.13.4.utmcsr=emed.med.unsw.edu.au|utmccn=(referral)|utmcmd=referral|utmcct=/eMedHELP.NSF/0/8DEFD6BFE75CE005CA256DCB00265E81; __utma=80167171.2836461778949749000.1251963179.1264664769.1264716966.34; __utmz=80167171.1251963179.1.1.utmcsr=(direct)|utmccn=(direct)|utmcmd=(none); Map.nsfwLAFByCourse=:10::10.2::10.2.6:; __utmb=233763905.2.10.1264715746; __utmc=233763905; LtpaToken=AAECAzRCNjIwQzlFNEI2Mjk5M0V1aWQ9czk0OTAwNDYvb3U9UGVvcGxlL2RjPXVuc3cvZGM9ZWR1L2RjPWF1TcN/bFHQLGQefIeVdmuKJgYzVIo=; ckUser=IDType=Unipass&UserTypeList=Staff&FullID=s9400000&NumberID=9400000&FirstName=Eilean&LastName=Watson&FLName=Eilean Watson&Year=&Phase=&FMSRepID=CA256FBA001848F0&SDRepID=CA256D2B000038E1&FMSName=pubFacultyD.nsf&SDName=StudentD.NSF&DataSource=pubFacultyD&SchoolHead=&; ckDesign=Theme=blue&; __utmb=80167171.1.10.1264716966; __utmc=80167171; nohistory=no"
12.	"d:/notesdata/Map.nsf"

Figure 2: A sample of code broken into separate Index lines (from 1 to 12) to show the position of each piece of code (cookie code highlighted).

Appendix K: Study 2—Map Users and Non-Users

This appendix provides supplementary information on the results of Map users and non-users presented in Part 2A of Chapter 6 on the web log and data linkage study (Study 2).

In keeping with the APA 6th ed. Style (American Psychological Association, 2010), percentage values in the tables of this appendix have been rounded as much as possible and are presented with no decimal places for ease of reading and comprehension.

Part 2A: Analysis of Map Users and Non-Users

Staff Demographics

Table 1 shows the count and percentage of Faculty staff and of UMP staff who either used or did not use the Map between January 2004 and December 2010, categorised according to their staff type, gender, age and currency of appointment. These results show that 12% (632 of 5196) of all staff in the Faculty database had used the Map, and that 46% (581 of 1263) of all UMP staff in the Faculty data base had used the Map.

The Pearson's chi-square exact test for independence (with Monte Carlo p-value and confidence interval) was used to test the association between the Map use status of UMP staff in the Faculty database and their staff characteristics. Results of these tests were as follows (for statistically significant cross-tabulations see Tables 1 to 7 of Appendix L):

- Staff type: there was a significant association between staff type and Map use status (χ^2 (5, n = 1263) = 310.50, p < 0.001, 99% CI [0.00, 0.00], *Cramer's V* = 0.50), and the cross-tabulation showed that significantly more academic staff (72% or 272 out of 377, AR = 12.2) and general staff (77% or 106 of 137, AR = 7.8) were Map users, and fewer conjoint staff (23% or 150 of 658, AR = -17.3) were Map users.
- Gender: there was a significant association between gender and Map use status (χ^2 (2, n = 1263) = 39.72, p < 0.001, 99% CI [0.00, 0.00], *Cramer's V* = 0.177), and the cross-tabulation showed that significantly more females were Map users (56% or 299 of 531, AR = 6.3) than males (38% or 266 of 696, AR = -6.1).

- Age: there was a significant association between age and Map use status (χ^2 (6, *n* = 1263) = 22.39, *p* = .001, 99% CI [0.000, 0.002], *Cramer's V* = 0.133), and the cross-tabulation showed there were significantly fewer staff in the 20-29 age group (25% or 11 of 44, AR = -2.8) who were Map users and significantly more in the 50-59 age group (53% or 159 of 299, AR = 2.8).
- Currency of appointment: there was no significant association between currency of appointment and Map use status (χ^2 (2, *n* = 1263) = 2.96, *p* = .242, 99% CI [0.23-0.25], *Cramer's V* = 0.05).

Table 1: Number and demographics of Faculty staff, and of Map users and non-users from January 2004 to December 2010.

Characteristic	Category	All staff in Faculty database (*N* = 5196)		UMP staff in Faculty database (*N* = 1263)		
		Total	Map users	Total	Map users	Map non-user
Staff Type	Academic	907	291 (32%)	377	272 (72%)	105 (28%)
	Adjunct	14	1 (7%)	3	1 (33%)	2 (66%)
	Casual	46	19 (41%)	30	18 (60%)	12 (40%)
	Conjoint	2428	149 (6%)	655	149 (23%)	506 (77%)
	External	67	4 (6%)	7	3 (43%)	4 (57%)
	External (science)	94	18 (19%)	36	18 (50%)	18 (50%)
	General	1394	134 (10%)	137	106 (77%)	31 (23%)
	Visiting	234	16 (7%)	18	14 (78%)	4 (22%)
	Unknown	12	0 (0%)	0	0	0
Gender	Female	2524	335 (13%)	531	299 (56%)	232 (44%)
	Male	2483	280 (11%)	696	266 (38%)	430 (62%)
	NA	189	17 (9%)	36	16 (44%)	20 (56%)
Age range (on 31/12/2010)	20-29	301	11 (4%)	44	11 (25%)	33 (75%)
	30-39	1083	98 (9%)	202	86 (43%)	116 (57%)
	40-49	1160	168 (15%)	317	157 (49%)	160 (51%)
	50-59	895	171 (19%)	299	159 (53%)	140 (47%)
	60-69	442	71 (16%)	153	67 (44%)	86 (56%)
	70+	101	16 (16%)	29	16 (55%)	13 (45%)
	NA	1214	97 (8%)	219	85 (39%)	134 (61%)
Currency of appointments (on 31/12/2010)	Active	3232	507 (16%)	997	471 (47%)	526 (53%)
	Terminated	1487	107 (7%)	226	93 (41%)	133 (59%)
	NA	477	18 (4%)	40	17 (42%)	23 (57%)
Total number of staff		**5196**	**632 (12%)**	**1263**	**581 (46%)**	**682 (54%)**

All UMP staff members (1292—this includes those who were not in the Faculty staff database) were also categorised according to the location of their school (based on data from the Faculty staff database and other sources), and grouped as either teaching staff (Table 2) or general staff (Table 3). The small number of general staff who taught were categorised as general staff only. Table 2 shows that 43% of all UMP teaching staff had used the Map and 57% had not used it. The 27 cases (2%) of Map users who were not in the Faculty staff database were probably casual or affiliated UMP teachers. The chi-square test showed a significant association between the school location of teaching staff and their Map use status (χ^2 (2, n = 1153) = 164.17, $p < 0.001$, CI= [0.00-0.00], *Cramer's V* = 0.38), and the cross-tabulation showed there were significantly more campus teaching staff (65% or 234 of 360, AR = 9.9) who were Map users and significantly fewer rural teaching staff (17% or 50 of 292, AR = -10.5) who were Map users.

Table 2: UMP teaching staff who used or did not use the Map (based on Faculty staff database).

Location of School (teaching staff)	**Total of UMP teaching staff (*N*=1153)**	**Map users**			**Map non-users in Faculty database**
		In Faculty staff database	Not in Faculty staff database	**Total**	
Campus	360	228	6	234 (65%)	126 (35%)
Metropolitan Clinical	434	174	2	176 (40%)	258 (59%)
Rural Clinical	292	50	0	50 (17%)	242 (83%)
Not in Faculty	46	21	5	26 (56%)	20 (44%)
Not available	21	2	14	16 (76%)	5 (24%)
Total	**1153**	475 (41%)	27 (2%)	**502 (43%)**	**651 (57%)**

Table 3 shows that 78% of all UMP general staff used the Map, and that two of these cases (1%) were not in the Faculty staff database. The chi-square test showed a significant association between the school location of general staff and Map use status (χ^2 (3, n = 138) = 12.81, p = .002, CI= [0.001-0.003], *Cramer's V* = 0.30) (the one case with non-available school information was excluded), and the cross-tabulation showed that there were significantly more campus general staff (90% or 46 of 51, AR = 2.6) who were Map users and significantly fewer rural general staff (58% or 21 of 36, AR = -3.4) who were Map users.

Table 3: UMP general staff who used or did not use the Map (based on Faculty staff database).

Location of School (general staff)	Total of UMP general staff (*N*=139)	Map users			Map non-users in Faculty database
		In Faculty database	Not in Faculty database	**Total**	
Campus	51	46	0	46 (90%)	5 (10%)
Metropolitan Clinical	51	40	1	41 (80%)	10 (20%)
Rural Clinical	36	20	1	21 (58%)	15 (42%)
Not available	1	0	0	0 (0%)	1 (100%)
Total	**139**	106 (76%)	2 (1%)	**108 (78%)**	**31 (22%)**

Table 4 shows that there were 1292 UMP teaching staff and general staff in total, and that 47% had used the Map and 53% had not, with 2% of the Map users not in the Faculty staff database. The chi-square test between UMP teaching or general staff and their Map use status showed a significant association (χ^2 (1, *n* = 1292) = 58.08, *p* <= .001, CI= [0.000-0.000], *Cramer's V* = 0.21), and the cross-tabulation showed that there were significantly more general staff (78% or 108 of 139, AR = 7.6) who were Map users, and significantly fewer teaching staff (44% or 502 of 1153, AR = -7.6) who were Map users.

Table 4: UMP general staff and teaching staff who used or did not use the Map (based on Faculty staff database).

Number of UMP teaching and general staff	Map users			Map non-users in Faculty staff database
	In Faculty staff database	Not in Faculty staff database	**Total**	
Teaching = 1153*	475	27	502 (43%)	651 (57%)
General = 139	106	2	108 (78%)	31 (22%)
Total = 1292	581 (45%)	29 (2%)	**610 (47%)**	**682 (53%)**

*Count excludes a small number of general staff who taught.

Finally, the chi-square test between the school location of all 1292 UMP staff in total (teaching plus general) and Map use status was also statistically significant (χ^2 (4, *n* = 1292) = 168.89, *p* <= .001, CI= [0.000-0.000], *Cramer's V* = 0.362), and the cross-tabulation showed that there were significantly more campus staff (68% or 280 of 411, AR = 10.2) who were Map users, and significantly fewer rural staff (22% or 71 of 328, AR = -10.8) who were Map users.

UMP Roles

Staff members were also classified according to the UMP roles they held using data from various sources including the eMed Timetable database. Briefly, between 1 March 2004 and 12 November 2010 the eMed Timetable database contained a total of 38,407 individual teaching periods including teachers' details. See Appendix H for further information on the data sources used to identify the various UMP roles held by staff members.

The 1292 UMP staff members held a total of 2491 UMP roles, which on average represented about two roles per staff member. Table 5 shows that a large majority of Phase 1 facilitators (91%), group members (84%), administrators (84%), and convenors (82%) had used the Map, while about half the Principal teachers (53%), about one third of eMed Timetable teachers (35%), and a few Primary Care clinical teachers (5%) had used it. Since a staff member could have more than one UMP role, these categories were not mutually exclusive and hence the chi-square test of independence could not be used to explore the association between Map use status and all UMP roles.

Table 5: Roles held by UMP staff who used or did not use the Map between January 2004 and December 2010 (based on data from various sources including eMed Timetable).

UMP roles	**Total number of roles**	**Number of Map users per role**			**Number of Map non-users per role**	
		In Faculty database	Not in Faculty staff database	**Total**	**In Faculty database**	Without ID#
Convenor	76	62	0	62 (82%)	14 (18%)	0 (0.0%)
Group member	136	114	0	114 (84%)	22 (16%)	1 (0.7%)
eMed Timetable teacher*	1110	370	20	390 (35%)	720 (65%)	374 (33.7%)
Phase 1 Facilitator	236	207	9	216 (91%)	20 (9%)	8 (33.9%)
Principal teacher	414	215	4	219 (53%)	195 (47%)	60 (14.5%)
Administrator	49	40	1	41 (84%)	8 (16%)	5 (10.2%)
Primary Care clinical teacher	470	24	0	24 (5%)	446 (95%)	374 (79.6%)
Total number of roles	**2491**	1032 (41%)	34 (2%)	**1066 (43%)**	**1425 (57%)**	822 (33.0%)

*The number of clinical school teachers in eMed Timetable may under-represent the true numbers.

Table 5 also shows that 33% of roles (822 of 2491) were held by staff who did not appear to have an ID number and, therefore, were unable to access the Map by themselves since this number was required to log into the system. This included 80% (374) of Primary Care teachers and 34% (374) of eMed Timetable teachers (also see Table 6 below). Since UMP teachers without an ID number were not in the Faculty staff database, they were likely to be either casual or affiliated teachers. Similarly, those Map users with an ID number who were not in the Faculty staff database but who held 34 UMP roles in total were likely to be either casual or affiliated teachers. Since clinical schools did not tend to use eMed Timetable to schedule their teaching activities, the number of clinical school teachers included in these counts are likely to under-represent their true numbers (also refer to Table 6 below).

Table 6 shows the number of UMP teaching staff derived only from the eMed Timetable database, and categorised by school location. The small number of rural clinical teachers (14) captured in eMed Timetable is evidence that some clinical schools did not use this database to schedule their teaching activities, so the number of clinical school teachers shown in this table is likely to under-represent their true numbers. A total of 374 teachers in eMed Timetable (34%) did not appear to have a staff ID number, which in itself precluded them from using the Map.

Table 6: UMP teachers in the eMed Timetable database who used or did not use the Map categorised by school location (teachers include academic, general, casual, sessional and affiliated staff).

School location	**Total number of teachers in eMed Timetable**	**Map users**	**Map non-users**	
			Total number (with and without ID#)	Without ID#
Campus	310	224 (72%)	86 (28%)	3
Metropolitan Clinical*	358	125 (35%)	233 (65%)	9
Rural Clinical*	14	5 (36%)	9 (64%)	0
Not in Faculty database	25	20 (80%)	5 (20%)	1
Location unavailable	67	16 (24%)	51 (76%)	25
No staff ID#	336	0 (0%)	336 (100%)	336
Total	**1110**	**390 (35%)**	**720 (65%)**	374 (34%)

*The number of clinical school teachers in eMed Timetable may under-represent the true numbers.

Appendix L: Study 2—Cross-tabulations

This appendix contains all cross-tabulations (contingency tables) from statistically significant Pearson's chi-square results in the web log and data linkage study (Study 2). The Pearson's chi-square exact test for independence (with Monte Carlo approximate p-value and confidence interval, based on 10,000 sample tables with starting seed of 2,000,000) was used to test the association between various variables. Information in this appendix has been organised according to the corresponding sections in the study's Results chapter.

In keeping with the APA 6th ed. Style (American Psychological Association, 2010), percentage values in cross-tabulation tables of this appendix have been rounded as much as possible and are presented with no decimal places for ease of reading and comprehension. However, the numbers provided allow recalculation to one decimal point as reported in the body of the thesis.

Part 2 A: Analysis of Map Users versus Non-Users

These chi-square test and cross-tabulation results are for the 1263 UMP staff in the Faculty database. Following are the statistically significant cross-tabulations between the Map use status and staff characteristics of these 1263 UMP staff.

Table 1: Cross-tabulation of staff types and Map use status of UMP Map users in the Faculty database, showing cell counts, percentages and adjusted residual values, and a significant Pearson's chi-square test result (χ^2 (5, *n* = 1263) = 310.50, *p* < 0.001, 99% CI [0.000, 0.000], *Cramer's V* = 0.50).

Staff type	Map use status (UMP staff in Faculty database)		Staff type total
	Did not use Map	**Used Map**	
Academic	105 (28%) AR = -12.2	272 (72%) AR = 12.2	377 (100%)
Casual	12 (40%) AR = -1.6	18 (60%) AR = 1.6	30 (100%)
Conjoint	508 (77%) AR = 17.3	150 (23%) AR = -17.3	658 (100%)
External (including Science)	22 (51%) AR = -0.4	21 (49%) AR = 0.4	43 (100%)
General	31 (23%) AR = -7.8	106 (77%) AR = 7.8	137 (100%)
Visiting	4 (22%) AR = -2.7	14 (78%) AR = 2.7	18 (100%)
Map use status total	**682**	**581**	**1263**

Table 2: Cross-tabulation of gender and Map use status showing cell counts, percentages and adjusted residual (AR) values, and a significant Pearson's chi-square test result (χ^2 (2, *n* = 1263) = 39.72, *p* < 0.001, 99% CI [0.000, 0.000], *Cramer's V* = 0.177).

Gender	Map use status (UMP staff in Faculty database)		Gender total
	Did not use Map	Used Map	
Female	232 (44%) AR = -6.3	299 (56%) AR = 6.3	531 (100%)
Male	430 (62%) AR = 6.1	266 (38%) AR = -6.1	696 (100%)
Not available	20 (56%) AR = 0.2	16 (44%) AR = -0.2	36 (100%)
Map use status total	**682**	**582**	**1263**

Table 3: Cross-tabulation of age range and Map use status showing cell counts, percentages and adjusted residual values, and a significant Pearson's chi-square test result (χ^2 (6, *n* = 1263) = 22.39, *p* = .001, 99% CI [0.000, 0.002], *Cramer's V* = 0.133).

Age	Map use status (UMP staff in Faculty database)		Age total
	Did not use Map	Used Map	
20-29	33 (75%) AR = 2.8	11 (25%) AR = -2.8	44 (100%)
30-39	116 (57%) AR = 1.1	86 (43%) AR = -1.1	202 (100%)
40-49	160 (51%) AR = -1.5	157 (49%) AR = 1.5	317 (100%)
50-59	140 (47%) AR = -2.8	159 (53%) AR = 2.8	299 (100%)
60-69	86 (56%) AR = 0.6	67 (44%) AR = -0.6	153 (100%)
70+	13 (45%) AR = -1.0	16 (55%) AR = 1.0	29 (100%)
NA	134 (61%) AR = 2.3	85 (39%) AR = -2.3	219 (100%)
Map use status total	**682**	**581**	**1263**

Table 4: Cross-tabulation of school location of teaching staff and Map use status showing cell counts, percentages and adjusted residual values, and a significant Pearson's chi-square test result (χ^2 (2, *n* = 1153) = 164.17, *p* < 0.001, CI= [0.000-0.000], *Cramer's V* = 0.38).

School location of teaching staff	Map use status (UMP staff in Faculty database)		School location total
	Did not use Map	Used Map	
Campus	126 (35%) AR = -9.9	234 (65%) AR = 9.9	360 (100%)
Metropolitan clinical	258 (59%) AR = 1.6	176 (41%) AR = -1.6	434 (100%)
Rural	242 (83%) AR = 10.5	50 (17%) AR = -10.5	292 (100%)
Not in Faculty	20 (44%) AR = -1.8	26 (56%) AR = 1.8	46 (100%)
Not available	5 (24%) AR = -3.0	16 (76%) AR = 3.0	21 (100%)
Map use status total	**651**	**502**	**1153**

Table 5: Cross-tabulation of school location of general staff and Map use status showing cell counts, percentages and adjusted residual values, and a significant Pearson's chi-square test result (χ^2 (3, *n* = 138) = 12.81, *p* = .002, CI= [0.001-0.003], *Cramer's V* = 0.30); the one case with non-available school information was excluded.

School location of general staff	Map use status (UMP staff in Faculty database)		School location total
	Did not use Map	Used Map	
Campus	5 (10%) AR = -2.6	46 (90%) AR = 2.6	51 (100%)
Metropolitan clinical	10 (20%) AR = -0.5	41 (80%) AR = 0.5	51 (100%)
Rural	15 (42%) AR = 3.4	21 (58%) AR = -3.4	36 (100%)
Map use status total	**30**	**108**	**138**

Table 6: Cross-tabulation of school location of general staff and Map use status showing cell counts, percentages and adjusted residual values, and a significant Pearson's chi-square test result (χ^2 (1, *n* = 1292) = 58.08, *p* <= .001, CI= [0.000-0.000], *Cramer's V* = 0.21)

Type of UMP staff	Map use status (UMP staff in Faculty database)		School location total
	Did not use Map	Used Map	
Teaching staff	651 (56%) AR = 7.6	502 (44%) AR = -7.6	1153 (100%)
General staff	31 (22%) AR = -7.6	108 (78%) AR = 7.6	139 (100%)
Map use status total	**682**	**610**	**1292**

Table 7: Cross-tabulation of school location of all UMP staff and Map use status showing cell counts, percentages and adjusted residual values, and a significant Pearson's chi-square test result (χ^2 (4, *n* = 1292) = 168.89, *p* <= .001, CI= [0.000-0.000], *Cramer's V* = 0.362).

School location of all staff	Map use status (UMP staff in Faculty database)		School location total
	Did not use Map	Used Map	
Campus	131 (32%) AR = -10.2	280 (68%) AR = 10.2	411 (100%)
Metropolitan clinical	268 (55%) AR = 10.8	217 (45%) AR = -10.8	485 (100%)
Rural	257 (78%) AR = 1.4	71 (22%) AR = -1.4	328 (100%)
Not in Faculty	20 (43%) AR = -1.3	26 (56%) AR = 1.3	46 (100%)
Not available	5 (23%) AR = -2.8	17 (77%) AR = 2.8	22 (100%)
Map use status total	**681**	**611**	**1292**

Part 2 B: Analysis of Individual UMP Map Users

Non-meaningful versus Meaningful Map use

These chi-square test and cross-tabulation results are for all 610 UMP Map users, and compare those users with meaningful session durations (sessions lasting a total of 1 minute or more in seven years) to those with non-meaningful session durations (sessions lasting less than 1 minute in seven years).

Table 8: Cross-tabulation of gender and total Map session duration showing cell counts, percentages and adjusted residual values, and a significant Pearson's chi-square test result (χ^2 (2, *n* = 610) = 6.04, *p* = 0.049, 99% CI [0.043, 0.054], *Cramer's V* = 0.099).

Gender	Session duration (UMP staff)		Gender total
	Non-meaningful (< 1 min)	Meaningful (>= 1 min)	
Female	42 (13%) AR = -2.5	274 (87%) AR = 2.5	316 (100%)
Male	57 (21%) AR = 2.3	218 (79%) AR = -2.3	275 (100%)
Not available	4 (21%) AR = 0.5	15 (79%) AR = -0.5	19 (100%)
Session duration total	**103**	**507**	**610**

Table 9: Cross-tabulation of school location and total Map session duration showing cell counts, percentages and adjusted residual values, and a significant Pearson's chi-square test result (χ^2 (4, *n* = 610) = 10.73, *p* = 0.028, 99% CI [0.024, 0.032], *Cramer's V* = 0.133).

School location of teaching staff	Session duration (UMP staff)		School location total
	Non-meaningful (< 1 min)	Meaningful (>= 1 min)	
Campus	36 (13%) AR = -2.4	244 (87%) AR = 2.4	280 (100%)
Metropolitan clinical	50 (23%) AR = 3.1	166 (77%) AR = -3.1	216 (100%)
Rural	10 (14%) AR = -0.7	61 (86%) AR = 0.7	71 (100%)
Not in Faculty	3 (11%) AR = -0.7	23 (88%) AR = 0.7	26 (100%)
Not available	4 (23%) AR = 0.7	13 (77%) AR = -0.7	17 (100%)
Session duration total	**103**	**507**	**610**

Meaningful Map use

These chi-square test and cross-tabulation results are for the 507 UMP Map users with meaningful total session durations (sessions lasting a total of 1 minute or more).

Staff demographics

What follows are the statistically significant cross-tabulations between the main staff demographic variables and the total session range for the 507 UMP Map users who performed meaningful session durations.

Table 10: Cross-tabulation of main staff types by range of total sessions showing cell counts, percentages and adjusted residual values, and a significant Pearson's chi-square test result (χ^2 (10, *n* = 439) = 58.25, *p* < 0.001, 99% CI [0.000, 0.000], *Cramer's V* = 0.258).

Staff type	Range of total Map sessions						Staff type total
	1-2	3-5	6-9	10-17	18-45	46+	
Academic	34 (15%) AR = -2.8	34 (15%) AR = -1.3	26 (11%) AR = -0.9	39 (16%) AR = 0.3	46 (20%) AR = 2.2	54 (23%) AR = 2.6	233 (100%)
Conjoint	43 (38%) AR = 5.7	25 (22%) AR = 1.7	19 (17%) AR = 1.6	10 (9%) AR = -2.5	11 (9%) AR = -2.2	6 (5%) AR = -4.3	114 (100%)
General	9 (10%) AR = -2.7	15 (16%) AR = -0.2	10 (11%) AR = -0.5	22 (24%) AR = 2.3	14 (15%) AR = -0.3	22 (24%) AR = 1.4	92 (100%)
Range total	**86**	**74**	**55**	**71**	**71**	**82**	**439**

Table 11: Cross-tabulation of main school locations by range of total sessions showing cell counts, percentages and adjusted residual values, and a significant Pearson's chi-square exact test result (χ^2 (10, *n* = 471) = 38.91, *p* < 0.001, 99% CI [0.000, 0.000], *Cramer's V* = 0.203).

School location	Range of total Map sessions						School location total
	1-2	3-5	6-9	10-17	18-45	46+	
Campus	33 (14%) AR = -3.5	39 (16%) AR = -1.1	35 (14%) AR = 0.9	44 (18%) AR = 1.3	40 (16%) AR = 0.3	53 (22%) AR = 2.4	244 (100%)
Metropolitan clinical	50 (30%) AR = 4.2	35 (21%) AR = 1.4	23 (14%) AR = 0.4	24 (14%) AR = -0.6	24 (13%) AR = -1.4	13 (8%) AR = -4.1	166 (100%)
Rural	10 (16%) AR = -0.7	10 (16%) AR = -0.3	3 (5%) AR = -2.0	7 (12%) AR = -1.0	14 (23%) AR = 1.6	17 (28%) AR = 2.3	61 (100%)
Range total	**93**	**84**	**61**	**75**	**75**	**83**	**471**

What follows are the statistically significant layered cross-tabulations between the main staff demographics variables the total session range for the 507 UMP Map users, while controlling for either the main school location (campus, metropolitan clinical and rural) or the main staff type variable (academic, conjoint and general).

Table 12: Layered cross-tabulation of main staff type by range of total sessions while controlling for the main school location showing cell counts and percentages, and a significant Pearson's chi-square exact test result (χ^2 (10, *n* = 215) = 30.64, *p* = 0.001, 99% CI [0.000, 0.001], *Cramer's V* = 0.267).

Main staff type	Range of total Map sessions (Campus schools)						Staff type total
	1-2	3-5	6-9	10-17	18-45	46+	
Academic	11 (8%) AR = -2.8	19 (14%) AR = 0.1	14 (10%) AR = -1.5	27 (20%) AR = 0.5	25 (19%) AR = 0.9	39 (29%) AR = 2.1	135 (100%)
Conjoint	13 (35%) AR = 4.4	4 (11%) AR = -0.6	8 (22%) AR = 1.7	2 (5%) AR = -2.3	6 (16%) AR = -0.1	4 (11%) AR = -2.1	37 (100%)
General	4 (9%) AR = -0.8	7 (16%) AR = 0.5	6 (14%) AR = 0.2	12 (28%) AR = 1.6	5 (12%) AR = -1.0	9 (21%) AR = -0.6	43 (100%)
Range Total	**28**	**30**	**28**	**41**	**36**	**52**	**215**

Table 13: Layered cross-tabulation of main staff type by range of total sessions while controlling for the main school location showing cell counts and percentages, and a significant Pearson's chi-square exact test result (χ^2 (10, *n* = 161) = 24.06, *p* = 0.007, 99% CI [0.005, 0.009], *Cramer's V* = 0.273).

Main staff type	Range of total Map sessions (Metropolitan clinical schools)						Staff type total
	1-2	3-5	6-9	10-17	18-45	46+	
Academic	17 (26%) AR = -0.7	12 (18%) AR = -0.7	9 (14%) AR = -0.1	7 (11%) AR = -1.0	12 (19%) AR = 1.7	8 (12%) AR = 1.6	65 (100%)
Conjoint	27 (42%) AR = 2.8	16 (25%) AR = 0.9	10 (15%) AR = 0.3	7 (11%) AR = -1.0	4 (6%) AR = -2.1	1 (1%) AR = -2.5	65 (100%)
General	3 (10%) AR = -2.7	6 (19%) AR = -0.3	4 (13%) AR = -0.2	9 (29%) AR = -2.6	5 (16%) AR = 0.6	4 (13%) AR = 1	31 (100%)
Range Total	**47**	**34**	**23**	**23**	**21**	**13**	**161**

Table 14: Layered cross-tabulation of main staff type by range of total sessions while controlling for the main school location showing cell counts and percentages, and a significant Pearson's chi-square exact test result (χ^2 (10, *n* = 61) = 18.12, *p* = 0.047, 99% CI [0.041, 0.052], *Cramer's V* = 0.385).

Main staff type	Range of total Map sessions (Rural school)*						Staff type total
	1-2	3-5	6-9	10-17	18-45	46+	
Academic	5 (16%)	3 (9%)	3 (9%)	5 (16%)	9 (28%)	7 (22%)	32 (100%)
Conjoint	3 (27%)	5 (46%)	0 (0%)	1 (9%)	1 (9%)	1 (9%)	11 (100%)
General	2 (11%)	2 (11%)	0 (0%)	1 (6%)	4 (22%)	9 (50%)	18 (100%)
Range Total	**10**	**10**	**3**	**7**	**14**	**17**	**61**

* Adjusted residual values are not included since 13 cells (72%) had expected counts of less than 5.

Table 15: Layered cross-tabulation of main staff type by range of total sessions while controlling for the main school location showing cell counts and percentages, and a significant Pearson's chi-square exact test result (χ^2 (10, *n* = 232) = 20.68, *p* = 0.023, 99% CI [0.019, 0.026], *Cramer's V* = 0.211).

School location	Range of total Map sessions (Academic staff)						School location total
	1-2	3-5	6-9	10-17	18-45	46+	
Campus	11 (8%) AR = -3.1	19 (14%) AR = -0.3	14 (10%) AR = -0.5	27 (20%) AR = 1.5	25 (18%) AR = -0.6	39 (29%) AR = 2.4	135 (100%)
Metropolitan clinical	17 (26%) AR = 3.2	12 (18%) AR = 1.0	9 (14%) AR = 0.8	7 (11%) AR = -1.5	12 (18%) AR = -0.3	8 (12%) AR = -2.5	65 (100%)
Rural	5 (16%) AR = 0.2	3 (9%) AR = -0.9	3 (9%) AR = -0.4	5 (16%) AR = -0.2	9 (28%) AR = 1.3	7 (22%) AR = -0.2	32 (100%)
Range Total	**33**	**34**	**26**	**39**	**46**	**54**	**232**

UMP roles

What follows are the layered cross-tabulations for the UMP roles of the 507 meaningful UMP Map users. Adjusted residual values are not included in these cross-tabulations since often more than 20% of expected cell counts were less than 5.

Table 16: Layered cross-tabulation of main school location by range of total sessions for the UMP role of Principal Teacher showing cell counts and percentages, and a significant Pearson's chi-square exact test result (χ^2 (10, *n* = 180) = 29.03, *p* = 0.001, 99% CI [0.00, 0.01], *Cramer's V* = 0.284).

School location	Range of total Map sessions (Principal teacher)*						School location total
	1-2	3-5	6-9	10-17	18-45	46+	
Campus	8 (8%)	14 (14%)	13 (13%)	11 (10%)	12 (11%)	45 (44%)	103 (100%)
Metropolitan clinical	19 (25%)	16 (21%)	11 (15%)	8 (11%)	11 (14%)	11 (14%)	76 (100%)
Rural	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (100%)	0 (0%)	1 (100%)
Range Total	**27**	**30**	**24**	**19**	**24**	**56**	**180**

*Adjusted residual values not included since more than 20% of expected cell counts were less than 5.

Table 17: Layered cross-tabulation of main staff type by range of total sessions for the UMP role of Committee/Group Member showing cell counts and percentages, and a significant Pearson's chi-square exact test result (χ^2 (10, *n* = 104) = 24.02, *p* = .012, 99% CI [0.009, 0.015], *Cramer's V* = 0.271).

Staff type	Range of total Map sessions (Committee/Group member)						Staff type total
	1-2	3-5	6-9	10-17	18-45	46+	
Academic	2 (3%)	4 (5%)	4 (5%)	6 (8%)	20 (26%)	41 (53%)	77 (100%)
Conjoint	1 (7%)	1 (7%)	5 (33%)	1 (7%)	3 (20%)	4 (26%)	15 (100%)
General	0 (0%)	0 (0%)	0 (0%)	4 (33%)	4 (33%)	4 (33%)	12 (100%)
Range total	**3**	**5**	**9**	**11**	**27**	**49**	**104**

*Adjusted residual values not included since more than 20% of expected cell counts were less than 5.

Table 18: Layered cross-tabulation of main staff type by range of total sessions for the UMP Role of Principal Teacher showing cell counts and percentages, and a significant Pearson's chi-square exact test result (χ^2 (10, *n* = 175) = 25.63, *p* = .004, 99% CI [0.002, 0.005], *Cramer's V* = 0.271).

Staff type	Range of total Map sessions (Principal teacher)						Staff type total
	1-2	3-5	6-9	10-17	18-45	46+	
Academic	13 (11%)	19 (15%)	11 (9%)	15 (12%)	18 (15%)	47 (38%)	123 (100%)
Conjoint	13 (30%)	8 (18%)	10 (23%)	4 (9%)	5 (11%)	4 (9%)	44 (100%)
General	0 (0%)	2 (25%)	1 (12.5%)	0 (0%)	1 (12.5%)	4 (50%)	8 (100%)
Range total	**26**	**29**	**22**	**19**	**24**	**55**	**175**

*Adjusted residual values not included since more than 20% of expected cell counts were less than 5.

Table 19: Layered cross-tabulation of main staff type by range of total sessions for the UMP Role of eMed Timetable Teacher showing cell counts and percentages, and a significant Pearson's chi-square exact test result (χ^2 (10, *n* = 280) = 41.48, *p< 0.001*, 99% CI [0.000, 0.000], *Cramer's V* = 0.272).

Staff type	Range of total Map sessions (eMed Timetable teacher)						Staff type total
	1-2	3-5	6-9	10-17	18-45	46+	
Academic	20 (11%)	27 (14%)	21 (11%)	35 (19%)	38 (20%)	48 (25%)	189 (100%)
Conjoint	23 (32%)	11 (16%)	17 (24%)	6 (8%)	9 (13%)	5 (7%)	71 (100%)
General	1 (5%)	6 (30%)	1 (5%)	3 (15%)	3 (15%)	6 (30%)	20 (100%)
Range total	**44**	**44**	**39**	**44**	**50**	**59**	**280**

*Adjusted residual values not included since more than 20% of expected cell counts were less than 5.

What follows are the cross-tabulations for the total number of UMP roles held by the 507 UMP Map users.

Table 20: Cross-tabulation of total number of UMP roles by range of total sessions showing cell counts, percentages and adjusted residual values, and a significant Pearson's chi-square exact test result (χ^2 (30, *n* = 507) = 176.06, *p* <0.001, 99% CI [0.000, 0.000], *Cramer's V* = 0.264).

Number of UMP roles	**Range of total Map sessions***						**UMP roles total**
	1-2	**3-5**	**6-9**	**10-17**	**18-45**	**46+**	
1	56 (32%)	40 (23%)	18 (10%)	26 (15%)	19 (11%)	15 (9%)	174 (100%)
2	21 (16%)	25 (20%)	22 (17%)	30 (23%)	20 (16%)	10 (8%)	128 (100%)
3	17 (16%)	20 (19%)	21 (19%)	21 (19%)	20 (19%)	9 (8%)	108 (100%)
4	8 (17%)	2 (4%)	6 (12%)	4 (8%)	9 (19%)	19 (40%)	48 (100%)
5	0 (0%)	3 (8%)	1 (3%)	1 (3%)	7 (18%)	26 (68%)	38 (100%)
6	0 (0%)	0 (0%)	0 (0%)	0 (0%)	5 (50%)	5 (50%)	10 (100%)
7	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (100%)	0 (0%)	1 (100%)
Range total	**102**	**90**	**68**	**82**	**81**	**84**	**507**

* Adjusted residual values not included since 29% of cells had expected counts of less than 5.

Total years of Map use

What follows are the cross-tabulations for the total years of Map use by the 507 UMP Map users.

Table 21: Cross-tabulation of staff type by total years of Map use showing cell counts, percentages and adjusted residual values, and a significant Pearson's chi-square exact test result (χ^2 (30, *n* = 507) = 60.28, *p* = 0.001, 99% CI [0.000, 0.002], *Cramer's V* = 0.154).

Staff type	**Total years of Map use***							**Staff type total**
	1	**2**	**3**	**4**	**5**	**6**	**7**	
Academic	66 (28%)	44 (19%)	41 (18%)	21 (9%)	21 (9%)	11 (5%)	29 (12%)	233 (100%)
Conjoint	59 (52%)	22 (19%)	12 (10%)	9 (8%)	7 (6%)	1 (1%)	4 (4%)	114 (100%)
General	30 (33%)	15 (16%)	18 (20%)	18 (20%)	3 (3%)	3 (3%)	5 (5%)	92 (100%)
Casual	14 (47%)	12 (40%)	3 (10%)	0 (0%)	0 (0%)	0 (0%)	1 (3%)	30 (100%)
External (incl. Science)	8 (32%)	4 (16%)	5 (20%)	3 (12%)	1 (4%)	2 (8%)	2 (8%)	25 (100%)
Visiting	7 (53%)	2 (15%)	1 (8%)	1 (8%)	1 (8%)	0 (0%)	1 (8%)	13 (100%)
Year of use total	**184**	**99**	**80**	**52**	**33**	**17**	**42**	**507**

* Adjusted residual values not included since 48% of cells had expected counts of less than 5.

Table 22: Cross-tabulation of school location by total years of Map use showing cell counts, percentages and adjusted residual values, and a significant Pearson's chi-square exact test result (χ^2 (24, n = 507) = 39.16, p = 0.027, 99% CI [0.023, 0.031], *Cramer's V* = 0.139).

School location	**Total years of Map use***							**School location total**
	1	**2**	**3**	**4**	**5**	**6**	**7**	
Campus	73 (30%)	53 (22%)	37 (15%)	22 (9%)	21 (8%)	12 (5%)	26 (11%)	244 (100%)
Metropolitan clinical	71 (43%)	32 (19%)	25 (15%)	17 (10%)	6 (4%)	3 (2%)	12 (7%)	166 (100%)
Rural	23 (38%)	9 (15%)	12 (20%)	10 (16%)	5 (8%)	0 (0%)	2 (3%)	61 (100%)
Not in Faculty	6 (26%)	4 (17%)	5 (22%)	3 (13%)	1 (4%)	2 (9%)	2 (9%)	23 (100%)
Not available	11 (84%)	1 (8%)	1 (8%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	13 (100%)
Year of use total	**184**	**99**	**80**	**52**	**33**	**17**	**42**	**507**

*Adjusted residual values not included since 43% of cells had expected counts of less than 5.

Appendix M: Study 2—Non-Meaningful versus Meaningful Map Use

This appendix provides supplementary information on the results of meaningful and non-meaningful Map use presented in Part 2B of Chapter 6 on the web log and data linkage study (Study 2).

Defining Meaningful Session Durations

The prevalence of 1 or 0 as the mode for the number of Map sessions and the duration of sessions across the seven years was investigated further. An analysing of the frequency of session duration values between 0 and 1 minute indicated that a significant percentage of sessions lasted a few seconds. As shown in Table 1, there was a substantial increase in visits lasting less than 0.25 minutes (15 seconds) from 2004 to 2010. This increase could be explained by the general increase in the use of eMed whereby users may have clicked the Map's navigation button by mistake when intending to click one of the other buttons, such as the button for eMed Tracking or eMed Timetable. The increase in 2009 may represent the effect of the Faculty-wide email announcement about this Map study.

A close analysis of the data across all seven years also revealed that some staff had used the Map only once for 1 or 2 seconds in one calendar year, but then used it a few times for a considerable number of minutes in another calendar year. Table 1 also shows the re-count of Map session users per year after excluding sessions lasting less than 0.25, 0.5 or 1.0 minutes. These results show that while the total increase in the count of session users across the seven years was obviously lower, the percentage increase was still substantial at between 49% to 53% increase when comparing the 2004 to 2010 total session user counts and depending on the session duration period excluded. Note that session durations refer to the total duration of sessions for an individual Map user for a whole calendar year.

Table 1. Number of Map session users per year before and after excluding sessions lasting less than 0.25, 0.5 and 1.0 minute.

Year	Total count of session users	Frequency and percentage of sessions by specified duration periods (in decimal minutes)			Total count of session users after excluding sessions of specified duration period		
		<0.25 min	<0.5 min	<1 min	<0.25 min	<0.5 min	<1 min
2004	157	5 (3%)	9 (6%)	17 (11%)	152	148	140
2005	181	11 (6%)	16 (9%)	20 (11%)	170	165	161
2006	195	16 (8%)	20 (10%)	30 (15%)	179	175	165
2007	245	25 (10%)	35 (14%)	49 (20%)	220	210	196
2008	257	48 (19%)	57 (22%)	73 (28%)	209	200	184
2009	285	61 (21%)	68 (24%)	76 (27%)	224	217	209
2010	274	48 (17%)	54 (20%)	59 (21%)	226	220	215

Since there was no direct way of gauging from the web log data if a session had been 'meaningful', this was done indirectly by exploring the total duration of sessions for each Map user in each calendar year. Deciding if a session was meaningful based on its duration was open to interpretation. Visits lasting only a few seconds were more than likely unintentional visits. However, a Map user could have performed one session lasting many minutes yet been lost in the system and not achieved much. On the other hand, an experienced Map user could have done something useful during a session lasting less than 1 minute, such as downloading lecture notes or briefly reviewing a form. Data analysis also revealed that some staff had used the Map only once for 1 or 2 seconds in one calendar year, but then used it a few times for many minutes in another calendar year. Either way, it was necessary to find a reasonable cut-off point for defining a session duration that was 'meaningful'.

After informal discussions with other Map and research experts, the researcher decided that the cut-off point would relate to accessing a Learning Activity Form (LAF), which was the form that was accessed the most (see results in Part 1 of Chapter 6). It was estimated that, in experienced hands, a quick review of a LAF accessed through a direct web link via its unique URL code (e.g. as found in an email or in a WebCT or Blackboard course site) would take a minimum of 0.5 minutes (30 seconds). Hence, the cut-off point for 'meaningful session duration' was set at <u>1 minute or more per calendar year</u>. Therefore, prior to conducting the data linkage analysis of individual Map users, the session user data-set was revised to separate Map session durations lasting less than 1 minute from those lasting 1 minute or more, as described next.

Defining New Data-Sets

Cases with total session durations of 1 minute or more in seven years were retained in the main SPSS data-set; cases with total sessions of less than 1 minute in seven years were analysed and then removed from the data-set; and cases with total sessions of less than 1 minute in a particular calendar year were filtered from that year when required.

Table 2 shows that, out of the 672 cases of Map users, 124 cases used the Map for less than 1 minute in seven years, which is 18.5% of total Map users. This percentage increased over the seven years from 6.4% (10 of 157) in 2004 to a peak of 15.1% (43 of 285) in 2009, with a decline to 8.4% (23 of 274) in 2010.

Table 2: Total numbers for Map use measurements from January 2004 to December 2010. The total population of Map users (*N* = 672) is divided into cases with a total duration of 1 min or more in 7 years (*n* = 548), and cases with a total duration of less than 1 minute in 7 years (*n* = 124).

Year	Measurement of Map use	Total for the measurements of Map use from January 2004 to December 2010		
		All duration periods (*N* = 672)	Durations >= 1min in 7 years (*n* = 548)	Duration < 1min in 7 years (*n* = 124)
2004	Session users	157	147	10
	Sessions	2931	2920	11
	Session duration	44800	44795	6
	Session events	192737	192562	175
2005	Session users	181	170	11
	Sessions	3083	3070	13
	Session duration	47123	47118	5
	Session events	187641	187486	155
2006	Session users	195	182	13
	Sessions	2987	2971	16
	Session duration	46906	46903	3
	Session events	132984	132838	146
2007	Session users	245	218	27
	Sessions	3148	3116	32
	Session duration	41405	41399	6
	Session events	145221	144906	315
2008	Session users	257	231	26
	Sessions	2936	2886	50
	Session duration	38633	38629	4
	Session events	136143	135900	243
2009	Session users	285	242	43
	Sessions	4035	3983	52
	Session duration	50535	50532	3

Year	Measurement of Map use	Total for the measurements of Map use from January 2004 to December 2010		
		All duration periods (*N* = 672)	Durations >= 1min in 7 years (*n* = 548)	Duration < 1min in 7 years (*n* = 124)
	Session events	133926	133699	227
2010	Session users	274	251	23
	Sessions	5817	5785	32
	Session duration	64183	64180	2
	Session events	148334	148183	151

Three cases with an ID number but unknown name were also excluded from the dataset, bringing the total number of Map users from 672 to 669. Table 3 shows that of the 669 Map users, 59 were not involved in the UMP. Since the focus of this study's data linkage analysis was on UMP Map users, these 59 non-UMP users were excluded from the dataset and the remaining analysis.

Table 3: Frequency and percentage of Map users who were or were not involved in the UMP, and who used the Map for either less than 1 minute or for 1 minute or more between 2004 to 2010 (*n* = 669).

Involved in UMP	Map user with session duration of less than 1 min in seven years (*n* = 123)	Map user with session duration of 1 min or more in seven years (*n* = 546)	Total Map users (*n* = 669)
Yes	103 (84%)	507 (93%)	610 (91%)
No	20 (16%)	39 (7%)	59 (9%)

Comparing Meaningful and Non-Meaningful Session Users

The Pearson's chi-square exact test was used to establish if there were any statistically significant differences between those who performed meaningful or non-meaningful sessions and their staff characteristics. Table 4 shows the count of UMP Map users with meaningful or non-meaningful total session durations in seven years, grouped by staff characteristics. The chi-square test showed no significant association between the performance of meaningful or non-meaningful sessions and the staff type or age variable. However, there was a significant association with gender (χ^2 (2, *n* = 610) = 6.04, *p* = 0.049, 99% CI [0.043, 0.054], *Cramer's V* = 0.099), and the cross-tabulation showed that more females (87% or 274 of 316, AR = 2.5) performed meaningful sessions than males (79% or 218 of 275, AR = -2.3). There was also a significant association with school location (χ^2 (4, *n* = 610) = 10.73, *p* = 0.028, 99% CI [0.024, 0.032], *Cramer's V* = 0.133), and the cross-tabulation showed that more campus staff (87% or

244 of 280, AR = 2.4) performed meaningful sessions than metropolitan clinical staff (77% or 166 of 216, AR = -3.1).

Table 4: Count of UMP Map users with total session durations of less than 1 minute (non-meaningful use) or of 1 minute or more (meaningful use) in seven years, grouped by staff characteristics (*N* = 610).

Staff characteristics	Category	Non-meaningful UMP Map users (*n* = 103)	Meaningful UMP Map users (*n* = 507)	Total UMP Map users (*N* = 610)
Gender	Female	42	274	316
	Male	57	218	275
	NA	4	15	19
Age range (on 31/12/2010)	20-29	1	10	11
	30-39	17	68	85
	40-49	31	126	157
	50-59	19	140	159
	60-69	10	57	67
	70+	3	13	16
	NA	22	93	115
Staff Type	Academic	39	233	272
	Conjoint/Adjunct	36	114	150
	Casual	8	30	38
	General	16	92	108
	External (incl. Science)	3	25	28
	Visiting	1	13	14
School Location	Campus	36	244	280
	Metropolitan Clinical	50	166	216
	Rural Clinical	10	61	71
	Not in Faculty	3	23	26
	NA	4	13	17

Table 5 shows the count of UMP Map users with meaningful or non-meaningful total session durations, grouped by UMP roles. These counts showed that all UMP roles had non-meaningful Map users including two convenors (3.2% or 2 of 62), and that the role of eMed Timetable Teacher had the largest percentage of non-meaningful Map users (13% or 52 of 390), followed by the role of Principal Teacher (9% or 19 of 215) and P1 Facilitator (9% or 18 of 206). Since a staff member could have more than one UMP role, these categories were not mutually exclusive so the chi-square test of independence could not be used to explore the association between the UMP roles variable and the meaningful or non-meaningful Map use variable.

Table 5: Count of UMP Map users with total session durations of less than 1 minute (non-meaningful use) or of 1 minute or more (meaningful use) in seven years, grouped by UMP roles (*N* = 610).

UMP Role	Non-meaningful UMP Map users per role (*n* = 103)	Meaningful UMP Map users per role (*n* = 507)	Total UMP Map users per role
Convenor	2	60	62
Group member	5	109	114
Administrator	2	38	40
Principal teacher	19	196	215
P1 Facilitator	18	188	206
eMed Timetable teacher	52	338	390
Primary Care clinical teacher	2	22	24
Total number of UMP roles	**100**	**951**	**1051**

Appendix N: Study 2—Association between Demographics Variables

This appendix provides supplementary information on the results of the association between the staff demographic variables presented in Part 2 of Chapter 6 on the web log and data linkage study (Study 2).

Overview

Many of the results in Part 2 of Study 2 supported the hypothesis that certain staff characteristics were associated with different patterns of Map use. To better understand these results, the Pearson's chi-square test for independence was used to explore the association between each of the four staff demographic variables (gender, age, staff type and school location) within the following population groups: (a) the 610 UMP Map users, (b) the 1263 UMP staff and (c) the 5196 staff in the Faculty database. To reduce the number of cells with an expected count of less than 5, only the major categories for each of these variables were included in this analysis (i.e. the 'not applicable' and the minor categories were excluded). The association between demographic variables and each UMP role was also tested for the UMP Map user population, but not for the other two population groups since data on UMP roles for those population groups were only analysed in Excel and their analysis in SPSS was beyond the scope of this study.

Overall, this statistical analysis explored if there were any significant associations between the staff demographic variables, and if the associations were similar in each of the three population groups. The results presented below show that significant associations did exist between variables, and that these results were similar across the three population groups.

UMP Map User Population

The **research question** for the 601 UMP Map users was: Were there any significant associations between the gender, age, staff type and school location of the UMP Map users? Results for the chi-square tests were as follows:

- Gender and staff type: there was a significant association between these two variables ($\chi 2$ (2, *n* = 521) = 54.17, $p < 0.001$, 99% CI [0.00, 0.00], *Cramer's V* = 0.322), and the cross-tabulation showed that significantly more general staff were females (84% or 89 of 106, AR = 7.1) and significantly more conjoint staff were males (61% or 91 of 149, AR = 4.2).

- Gender and school location: there was a significant association between these two variables ($\chi2$ (3, *n* = 576) = 8.00, p = .044, 99% CI [0.039, 0.050], *Cramer's V* = 0.118), and the cross-tabulation showed that campus schools had significantly more females (57% or 155 of 271, AR = 2.0) and metropolitan clinical schools had significantly more males (54% or 115 of 212, AR = 2.6).
- Age and staff type: there was a significant association between these two variables ($\chi2$ (10, *n* = 476) = 34.45, p < 0.001, 99% CI [0.00, 0.01], *Cramer's V* = 0.190), and the cross-tabulation showed that significantly more of those in the 20-29 age group were general staff (73% or 8 of 11, AR = 4.7) and significantly fewer were conjoint staff (0% or 0 of 11, AR = -2.2).
- Age and school location: there was no significant association between these two variables ($\chi2$ (10, *n* = 493) = 17.20, p = .066, 99% CI [0.060, 0.072], *Cramer's V* = 0.132).
- Age and gender: there was a significant association between these two variables ($\chi2$ (5, *n* = 493) = 35.38, p < 0.001, 99% CI [0.00, 0.00], *Cramer's V* = 0.268), and the cross-tabulation showed that significantly more of those in the 20-29 (82% or 9 of 11, AR = 2.0), 30-39 (64% or 54 of 85, AR = 2.4) and 40-49 (60% or 94 of 156, AR = 2.5) age groups were females, and significantly more in the 60-69 (65% or 43 of 66, AR = 3.0) and 70+ (94% or 15 of 16, AR = 3.7) were males.
- Staff type and school location: there was a significant association between these two variables $\chi2$ (4, *n* = 528) = 36.91, *p* < 0.001, 99% CI [0.00, 0.00], *Cramer's V* = 0.264), and the cross-tabulation showed that campus schools had significantly more academic staff (63% or 154 of 246, AR = 4.8) and that metropolitan clinical schools had significantly more conjoint staff (41% or 87 of 211, AR = 5.4).

The UMP roles (convenor, group member, administrator, principal teacher, eMed Timetable teacher and Primary Care clinical teacher) held or not held by a UMP Map user was also cross-tabulated with the staff demographic variables. In this case, the **research question** was: were there any significant associations between the gender, age, staff type or school location of UMP Map users and each of their UMP roles? Results for the chi-square tests were as follows:

- Age and UMP roles: there was no significant association with the UMP roles of convenor, group member, administrator, P1 Facilitator or Primary Care clinical teacher. However, there was a significant association for the role of Principal Teacher ($\chi 2$ (5, n = 414) = 26.49, p < 0.001, 99% CI [0.00, 0.00], *Cramer's V* = 0.253) with the cross-tabulation showing more principal teachers in the 50-59 age group (42% or 73 of 173, AR = 3.1); and for the role of eMed Timetable Teacher ($\chi 2$ (5, n = 414) = 11.81, p = 036, 99% CI [0.031, 0.040], *Cramer's V* = 0.169) with the cross-tabulation showing fewer eMed Timetable Teachers in the 20-29 (1% or 3 of 272, AR = -2.4) and the 30-39 (14% or 37 of 272, AR = -2.1) age groups.

- Gender and UMP roles: there was no significant association with the UMP roles of convenor, group member, P1 Facilitator or Primary Care clinical teacher. However, there were significantly more females in the UMP role of administrator (79% or 30 of 38, AR = 3.0; $\chi 2$ (1, n = 492) = 9.03, p = .003 (exact significance), *Cramer's V* = 0.135). There were also significantly more males in the role of Principal Teacher (55% or 106 of 194, AR = 3.7; $\chi 2$ (1, n = 492) = 13.85, p < 0.001 (exact significance) *Cramer's V* = 0.178), and in the role of eMed Timetable Teacher (51% or 165 of 326, AR = 3.9; $\chi 2$ (1, n = 492) = 15.56, p < 0.001 (exact significance), *Cramer's V* = 0.178).
- Staff type and UMP Roles: there were significant associations for each of the UMP roles. Results showed significantly more academic staff in the UMP role of Convenor (83% or 50 of 60, AR = 5.1; $\chi 2$ (2, n = 439) = 27.55, p < 0.001, 99% CI [0.00, 0.00], *Cramer's V* = 0.251); Committee/Group Member (74% or 77 of 104, AR = 4.9; $\chi 2$ (2, n = 439) = 24.05, p < 0.001, 99% CI [0.00, 0.00], *Cramer's V* = 0.234); Principal Teacher (70% or 123 of 175, AR = 5.9; $\chi 2$ (2, n = 439) = 53.60, p < 0.001, 99% CI [0.00, 0.00], *Cramer's V* = 0.349); P1 Facilitator (81% or 132 of 163, AR = 9.0; $\chi 2$ (2, n = 439) = 83.04, p < 0.001, 99% CI [0.00, 0.00], *Cramer's V* = 0.435); and eMed Timetable Teacher (68% or 189 of 280, AR = 8.0; $\chi 2$ (2, n = 439) = 100.81, p < 0.001, 99% CI [0.00, 0.00], *Cramer's V* = 0.479). There were significantly more general staff in the UMP role of administrator (95% or 35 of 37, AR = 11.5; $\chi 2$ (2, n = 439) = 132.34, p < 0.001, 99% CI [0.00, 0.00], *Cramer's V* = 0.549). There were also significantly more conjoint staff in the role of UMP Primary Care clinical teacher (64% or 14 of 22, AR = 4.1; $\chi 2$ (2, n = 439) = 17.60, p < 0.001, 99% CI [0.00, 0.00], *Cramer's V* = 0.200).
- School location and UMP Roles: there was no significant association for the UMP role of administrator or Primary Care clinical teacher. However, there were significantly more campus staff in the UMP role of Committee/Group Member (66% or 69 of 105, AR = 3.2; $\chi 2$ (2, n = 471) = 16.23, p < 0.001, 99% CI [0.00, 0.01], *Cramer's V* = 0.186), P1 Facilitator (75% or 133 of 177, AR = 7.9; $\chi 2$ (2, n = 471) = 67.70, p < 0.001, 99% CI [0.00, 0.00], *Cramer's V* = 0.379), and eMed Timetable Teacher (65% or 199 of 307, AR = 7.7; $\chi 2$ (2, n = 471) = 116.83,

p < 0.001, 99% CI [0.00, 0.00], *Cramer's V* = 0.498). There were also fewer rural staff in the UMP role of Convenor (2% or 1 of 60, AR = -2.8; χ2 (2, *n* = 471) = 7.84, *p* = 020, 99% CI [0.016, 0.023], *Cramer's V* = 0.129), or Principal Teacher (1% or 1 of 180, AR = -6.3; χ2 (2, *n* = 471) = 40.24, *p* < 0.001, 99% CI [0.00, 0.00], *Cramer's V* = 0.292).

UMP Staff Population

The **research question** for all 1263 UMP staff in the Faculty database was: Were there any significant associations between the gender, age, staff type and school location of UMP Faculty staff? Results of the chi-square tests were as follows:

- Gender and staff type: there was a significant association between these two variables (χ^2 (2, *n* = 1151) = 120.50, *p* < 0.001, 99% CI [0.00, 0.00], *Cramer's V* = 0.324), and the cross-tabulation showed that significantly more general staff were females (84% or 114 of 135, AR = 10.3) and significantly more conjoint staff were males (67% or 432 of 647, AR = 7.7).
- Gender and school location: there was a significant association between these two variables (χ^2 (2, *n* = 1184) = 22.72, *p* < 0.001, 99% CI [0.000, 0.000], *Cramer's V* = 0.139), and the cross-tabulation showed that campus schools had significantly more females (51% or 202 of 393, AR = 3.8), and the rural school had significantly more males (67% or 210 of 316, AR = 4.2).
- Age and staff type: there was a significant association between these two variables (χ^2 (10, *n* = 1014) = 32.80, *p* < 0.001, 99% CI [0.00, 0.01], *Cramer's V* = 0.127), and the cross-tabulation showed that significantly fewer of those in the 20-29 age group (9% or 4 of 43, AR = -3.3) were academic staff.
- Age and school location: there was a significant association between these two variables (χ^2 (10, *n* = 1037) = 40.39, *p* < 0.001, 99% CI [0.000, 0.000], *Cramer's V* = 0.140), and the cross-tabulation showed that significantly more of those in the 20-29 age group (66% or 29 of 44, AR = 3.1) and the 30-39 age group (55% or 110 of 202, AR = 3.7) were in metropolitan clinical schools, and significantly more of those in the 50-59 age group were in campus schools (39% or 116 of 296, AR = 2.6).
- Age and gender: there was a significant association between these two variables (χ^2 (5, *n* = 1040) = 37.84, *p* < 0.001, 99% CI [0.00, 0.00], *Cramer's V* = 0.191), and the cross-tabulation showed that significantly more of those in the 20-29 (57% or 25 of 44, AR = 2.0), 30-39

(50% or 99 of 202, AR = 2.2) and 40-49 (49% or 154 of 316, AR = 2.9) age groups were females, and significantly more of those in the 60-69 (72% or 110 of 152, AR = 3.9) and 70+ (86% or 25 of 29, AR = 3.1) age groups were males.

- Staff type and school location: there was a significant association between these two variables χ^2 (4, n = 1164) = 115.81, p < 0.001, 99% CI [0.00, 0.00], *Cramer's V* = 0.223), and the cross-tabulation showed that campus schools had significantly more academic staff (52% or 189 of 362, AR = 9.9), and that metropolitan clinical schools (66% or 315 of 475), AR = 5.8) and the rural school (66% or 217 of 327, AR = 4.4) had significantly more conjoint staff.

Faculty Staff Database Population

The **research question** for all 5196 staff members in the Faculty database was: Were there any significant associations between the gender, age, staff type and school location of Faculty staff members in general? Results of the chi-square tests were as follows:

- Gender and staff type: there was a significant association between these two variables (χ^2 (2, n = 4633) = 685.98, p < 0.001, 99% CI [0.00, 0.00], *Cramer's V* = 0.385), and the cross-tabulation showed that significantly more general staff were females (78% or 1081 of 1379, AR = 24.5) and significantly more conjoint staff were males (66% or 1564 of 2373, AR = 23.3).
- Gender and school location: there was a significant association between these two variables (χ^2 (2, n = 4713) = 136.41, p < 0.001, 99% CI [0.000, 0.000], *Cramer's V* = 0.170), and the cross-tabulation showed that campus schools had significantly more females (60% or 1128 of 1879, AR = 10.7), metropolitan clinical schools had significantly more males (54% or 1329 of 2458, AR = 6.5) and the rural school also had significantly more males (67% or 253 of 376, AR = 7.2).
- Age and staff type: there was a significant association between these two variables (χ^2 (10, n = 3844) = 391.38, p < 0.001, 99% CI [0.00, 0.00], *Cramer's V* = 0.226), and the cross-tabulation showed that significantly more of those in the 20-29 age group (65% or 194 of 298, AR = 16.8) and 30-39 age group (31% or 329 of 1058, AR = 5.6) were general staff, and significantly more of those in the 50-59 age group (63% or 548 of 866, AR = 5.0), 60-69 age

group (69% or 289 of 418, AR = 6.0) and 70+ age group (79% or 63 of 80, AR = 4.3) were conjoint staff.

- Age and school location: there was a significant association between these two variables (χ^2 (10, n = 3816) = 63.86, p = .000, 99% CI [0.000, 0.000], *Cramer's V* = 0.091), and the cross-tabulation showed that significantly more of those in the 20-29 age group were in campus schools (59% or 150 of 301, AR = 4.3), and significantly more of those in the 30-39 age group were in metropolitan clinical schools (58% or 608 of 1047, AR = 3.3).
- Age and gender: there was a significant association between these two variables (χ^2 (5, n = 3977) = 237.26, p < 0.001, 99% CI [0.00, 0.00], *Cramer's V* = 0.244), and the cross-tabulation showed that significantly more of those in the 20-29 (71% or 214 of 301, AR = 8.4) and 30-39 (57% or 613 of 1083, AR = 6.7) age groups were females, and significantly more of those in the 50-59 (58% or 518 of 893, AR = 4.0), 60-69 (74% or 326 of 441, AR = 9.8) and 70+ (84% or 85 of 101, AR = 6.5) age groups were males.
- Staff type and school location: there was a significant association between these two variables χ^2 (4, n = 4574) = 914.75, p < 0.001, 99% CI [0.00, 0.00], *Cramer's V* = 0.316), and the cross-tabulation showed that campus schools had significantly more academic staff (30% or 519 of 1764, AR = 4.8) and general staff (47% or 828 of 1764, AR = 20.8), that metropolitan clinical schools had significantly more conjoint staff (70%% or 1678 of 2422, AR = 25.6), and that the rural school also had significantly more conjoint staff (66% or 257 of 388, AR = 6.1).

Appendix O: Study 3—Self-Reporting eMed Map Survey

This appendix contains a copy of the PDF version of the final online self-reporting eMed Map survey instrument (see overleaf). This survey was developed and implemented using the software application KeySurvey v6.9, and made available to Faculty staff members and other select staff involved in the UMP through the eMed Map homepage.

The number of items to be completed by a respondent depended on the person's level of Map use and role in the UMP. Hence, the logical pathways function of the KeySurvey application was used to direct respondents to different survey items depending on the answers they provided.

The survey was released to all staff members of the Faculty of Medicine and select staff members from the Faculty of Science through a Faculty-wide email broadcast. The online survey was opened on 12 October 2009 and closed on 23 November 2009. A reminder email was sent on 10 November 2009. All those who completed the survey had the opportunity to enter a lucky draw to win one of three prizes.

eMed Map Evaluation Study

This questionnaire is part of the eMed Map Evaluation Study (HREC 09084). This study is exploring how staff members involved in the Undergraduate Medicine Program (UMP) at the University of New South Wales use the web-based curriculum mapping system eMed Map.

Please complete this questionnaire if you are a staff member involved in the teaching or administration of the UMP, and even if you have never used eMed Map.This questionnaire should take you between 5 and 30 minutes to complete depending on your level of Map use and your role(s) in the UMP. There are 10 questions for non-Map users (approx. 5 minutes to complete), 27 questions for general teachers or administrators (approx. 20 minutes), and 33 questions for principal teachers or convenors (approx. 30 minutes). Most questions are multiple-choice and some questions have a number of items to answer. Questions are based on the findings from the observations and textual documentation data previously analysed in this study, and cover issues relating to the individual user, the information technology and the organisation.

Please complete and submit this questionnaire by Monday 23 November 2009. If you submit your completed questionnaire by the due date you are invited to go into a luck draw to win an iPod nano, book voucher or Oxfam gift as thanks for your time and valued input. Further details on how to enter this lucky draw are provided once you submit your completed questionnaire.

If you have any questions or concerns about this questionnaire, please contact either Ms Eilean Watson (phone: (02) 9385-1009, email: e.watson@unsw.edu.au) or Professor Jeffrey Braithwaite (phone: (02) 9385 2590, email: j.braithwaite@unsw.edu.au), School of Public Health and Community Medicine, UNSW, Sydney 2052.

All questionnaire respondents will remain anonymous. Any information that is obtained in connection with this questionnaire and that can be identified with you will remain confidential and will be disclosed only with your permission, except as required by law. Participation is voluntary, and your decision whether or not to answer this questionnaire will not prejudice your future relations with the University of New South Wales. Complaints may be directed to the Ethics Secretariat, The University of New South Wales, SYDNEY 2052 AUSTRALIA (phone: (02) 9385 4234, fax: (02) 9385 6648, email: ethics.sec@unsw.edu.au). Any complaint you make will be investigated promptly and you will be informed of the outcome.

To read the full Participant Information Statement for this questionnaire please click here (Acrobat Reader required).

Note: to increase the font size on your browser press the "Control" and "+" keys together (to decrease the font size press the "Control" and "-" keys together).

Section 1 - About You

1. Your gender:

Please pick one of the answers below.

- O Male
- O Female

2. Your age range:

Please pick one of the answers below.

- ○ 20 to 30
- ○ 31 to 40
- ○ 41 to 50
- ○ 51 to 60
- ○ 61 and above

3. Your Faculty:

Please pick one of the answers below or add your own.

- ○ Medicine
- ○ Science

Other (please specify):

....

4. Your School / Unit / Centre:

Please use the blank space to write your answers.

Please specify:

....

5. Your staff type:

Please pick one of the answers below or add your own.

- ○ Academic
- ○ General
- ○ Conjoint
- ○ Casual / Sessional / Affiliated

Other (please specify)

....

6. What role(s) do you currently have in the Undergraduate Medicine Program (UMP)? Tick all that apply to you:

Please check all that apply and/or add your own variant.

- ☐ Teacher - campus based
- ☐ Teacher - clinical school based
- ☐ Teacher - general practice or primary care
- ☐ Convenor / co-convenor (course, element or phase)
- ☐ Curriculum design, overview or evaluation group or committee member
- ☐ Administrator

Other (please specify):

....

7. Which Phase(s) of the UMP are you currently involved in? You may select more than one Phase:

Please check all that apply.

- ☐ Phase 1 (Years 1 and 2 of UMP)
- ☐ Phase 2 (Years 3 and 4 of UMP)
- ☐ Phase 3 (Years 5 and 6 of UMP)

8. In general, how often do you use the Internet (excluding email use)? Choose the best answer:

Please pick one of the answers below.

- ○ Every day
- ○ Every two or three days
- ○ Once a week
- ○ Once a fortnight
- ○ Once a month
- ○ Rarely

9. Have you used the Map in the past 12 months?

Please pick one of the answers below.

- ○ Yes
- ○ No

10. Briefly explain why you have not used the Map:

Please write your answer in the space below.

....

....

....

....

Section 2: Your Use of the Map
Unless otherwise stated the questions in this section relate to your use of the Map in the past 12 months

11. Have you ever had any problems accessing the Map (e.g., accessing the Map from a hospital, acquiring a University staff number or password to access the Map etc)?

Please pick one of the answers below and add your comments.

- ○ No
- ○ Yes

If "Yes", please specify the problems you have had and indicate if they are now resolved or if still present:

....

12. How often do you use the Map? Choose the best answer:

Please pick one of the answers below or add your own.

- ○ Daily
- ○ Weekly
- ○ Fortnightly
- ○ Monthly
- ○ Once per teaching period / academic session
- ○ Once per year

Other (please specify):

....

13. How often do you use the following sources to find information about the UMP courses?

Please mark the corresponding circle - only one per line.

	Often	Sometimes	Rarely	Never
The Map	○	○	○	○
Online course site in WebCT Vista (or Blackboard)	○	○	○	○
Open-access online course site (e.g., Primary Care website)	○	○	○	○
Course guide for teachers	○	○	○	○
Course guide for students	○	○	○	○

14. How often do you use the following Map forms, features or functions?

Please mark the corresponding circle - only one per line.

	Often	Sometimes	Rarely	Never
Learning Activity Forms (LAFs)	○	○	○	○
Assessment Activity Forms (AAFs)	○	○	○	○
Learning Context Forms (LCFs)	○	○	○	○
Course Outline Forms (COFs)	○	○	○	○
Content files attached to forms	○	○	○	○
Views menu	○	○	○	○
Search tool	○	○	○	○
Export function (only available to those with editing access)	○	○	○	○
Archive tool	○	○	○	○
Map hyperlinks in online course sites	○	○	○	○

15. How often do you use the following Map and eMed Help sites?

Please mark the corresponding circle - only one per line.

	Often	Sometimes	Rarely	Never
Map Help (via eMed Help button)	○	○	○	○
eMed Help Website (at http://medprogram.med.unsw.edu.au/Med3802Web.nsf/p age/eMed?open&login)	○	○	○	○
Map Online Tutorial (at http://web.med.unsw.edu.au/Emed/Map.htm)	○	○	○	○

Section 3: Your Type of Map Use

16. Please indicate how often you have used the Map for any of the following reasons in the past three years:

Please mark the corresponding circle - only one per line.

	Often	Sometimes	Rarely	Never
Find course information (e.g., learning activities, assessments, lecture notes, key references)	○	○	○	○
Develop course activities	○	○	○	○
Provide course content	○	○	○	○
Prepare timetables	○	○	○	○
Prepare course guides	○	○	○	○
Prepare assessments	○	○	○	○
Prepare yourself to teach students	○	○	○	○
Prepare yourself to assess students	○	○	○	○
Review or revise activities (in a course, phase or program)	○	○	○	○
Check for gaps or redundancies (in a course, phase or program)	○	○	○	○
Align outcomes, activities and assessments (in a course, phase or program)	○	○	○	○
Explore the whole curriculum	○	○	○	○
Research (e.g., in an Independent Learning Project)	○	○	○	○
Staff development (e.g., to help staff understand the UMP)	○	○	○	○
Student learning (e.g., to help students integrate what they learn in the UMP)	○	○	○	○
Learn about the process of learning and teaching	○	○	○	○
Search & retrieve information	○	○	○	○

Export data	○	○	○	○
Audit data (e.g., for data quality)	○	○	○	○
Integrate data with other systems (e.g., eMed Timetable)	○	○	○	○
Answer professional enquiries (e.g., from medical colleges)	○	○	○	○
Prepare organisational reports on the UMP (e.g., Faculty reports, AMC accreditation)	○	○	○	○
Workforce management	○	○	○	○

Section 4: Effect of the Map on the UMP and the Faculty

17. Please indicate your level of agreement with the following statements.

In general the Map has helped to:

Please mark the corresponding circle - only one per line.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Don't know
Provide a transparent curriculum	○	○	○	○	○	○
Support the delivery of an integrated curriculum	○	○	○	○	○	○
Reduce the use of paper-based course materials	○	○	○	○	○	○
Reduce the workload of updating a course	○	○	○	○	○	○
Simplify the process for updating the curriculum	○	○	○	○	○	○
Reduce information duplication	○	○	○	○	○	○
Break down discipline barriers	○	○	○	○	○	○
Encourage teacher responsibility for course activities	○	○	○	○	○	○
Promote a shared ownership of the curriculum amongst staff	○	○	○	○	○	○
Promote a knowledge-sharing culture amongst staff	○	○	○	○	○	○

Section 5: Personal Factors Affecting Map Use

Unless otherwise stated the questions in this section relate to your use of the Map in the past 12 months

18. Please indicate your level of agreement with the following statements relating to your own use of the Map:

Please mark the corresponding circle - only one per line.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Don't know
I generally like using the online Map to find information about the UMP	○	○	○	○	○	○
I generally prefer using the paper-based course guide to the online Map to find course information	○	○	○	○	○	○
I generally don’t need to use the Map	○	○	○	○	○	○
I generally don’t like using Information Technology (IT)	○	○	○	○	○	○
I generally know how to use the IT functions of the Map (e.g., its views, search, exports, archive, help functions)	○	○	○	○	○	○
I need IT training on how to use the Map	○	○	○	○	○	○
I need educational training on how to use the Map	○	○	○	○	○	○
The Map has too much information for what I need	○	○	○	○	○	○
The Map has too little information for what I need	○	○	○	○	○	○
There is too much duplication of information between the Map, course guides and WebCT Vista course sites	○	○	○	○	○	○
I often find inconsistencies in information between the Map, course guides and WebCT Vista course sites	○	○	○	○	○	○
I think we should refer staff and students to information in the Map instead of duplicating it in the course guides	○	○	○	○	○	○

I generally find the Map information useful	O	O	O	O	O	O
I have too much other work to do to be using the Map	O	O	O	O	O	O
It helps when a colleague shows me how to use the Map	O	O	O	O	O	O
It helps when a colleague reminds me to use the Map	O	O	O	O	O	O

19. The NEXT question is only for current principal teachers, course convenors or co-convenors, or course DIG members.

If you currently have such role(s) in the UMP please select YES, otherwise select NO.

(Principal teacher: person responsible for developing and delivering a learning activity. DIG: course Design and Implementation Group)

Please pick one of the answers below.

- O YES
- O NO

20. Question for principal teachers, course convenors or co-convenors, or course DIG members:

Please mark the corresponding circle - only one per line.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Don't know
As a principal teacher, I find it useful to complete the "principal teacher" fields in my Learning Activity Forms (LAFs) in the Map	○	○	○	○	○	○
As a principal teacher, I use the information provided in the "course convenor" fields of my LAF to help me develop my learning activity	○	○	○	○	○	○
I generally find the Map forms suitable to capture the on-campus learning activities	○	○	○	○	○	○
I generally find the Map forms suitable to capture learning activities in the clinical setting	○	○	○	○	○	○
I generally update my own Map forms	○	○	○	○	○	○
I generally update my Map forms directly online	○	○	○	○	○	○
I generally use a Word document to update my Map information	○	○	○	○	○	○
Completing the Map forms takes up a lot of my time	○	○	○	○	○	○
I've got too much other work to do to be completing Map forms	○	○	○	○	○	○
I don't get any personal benefits from entering information in the Map	○	○	○	○	○	○
I don't get any staff recognition for entering information in the Map	○	○	○	○	○	○

21. The NEXT question is only for current course convenors, co-convenors or DIG members.

If you currently have such role(s) in the UMP please select YES, otherwise select NO.

(DIG: course Design and Implementation Group)

Please pick one of the answers below.

- ○ YES
- ○ NO

22. Question for course convenors, co-convenors or DIG members:

Please mark the corresponding circle - only one per line.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Don't know
As a course convenor, co-convenor or DIG member, I find it useful to complete the Map forms	○	○	○	○	○	○
I regularly update or help update the various Map forms for my course	○	○	○	○	○	○
I regularly update or help update the course guide for my course	○	○	○	○	○	○

Section 6: Information System Factors Affecting Map Use
Unless otherwise stated the questions in this section relate to your use of the Map in the past 12 months

23. Please indicate your level of agreement with the following statements relating to the Map an an information system:

Please mark the corresponding circle - only one per line.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Don't know
I find the quality of information in the Map for Phase 1 is good	○	○	○	○	○	○
I find the quality of information in the Map for Phase 2 is good	○	○	○	○	○	○
I find the quality of information in the Map for Phase 3 is good	○	○	○	○	○	○
I find the Map information to be readable, clear and well formatted	○	○	○	○	○	○
I find the Map information easy to understand	○	○	○	○	○	○
I like having the content files (e.g., lecture notes, audio files) attached to the Map forms	○	○	○	○	○	○
I find the Map simple to use	○	○	○	○	○	○
The IT features and functions of the Map meet my needs	○	○	○	○	○	○
I have experienced IT glitches when using the Map	○	○	○	○	○	○
I have experienced IT glitches when using other eMed systems	○	○	○	○	○	○
I generally report IT glitches when they occur	○	○	○	○	○	○
I generally like the IT features of the eMed system	○	○	○	○	○	○

24. The NEXT question is only for current principal teachers, course convenors or co-convenors, or course DIG members.

If you currently have such role(s) in the UMP please select YES, otherwise select NO.

(Principal teacher: person responsible for developing and delivering a learning activity. DIG: course Design and Implementation Group)

Please pick one of the answers below.

○ YES

○ NO

25. Question for principal teachers, course convenors or co-convenors, or course DIG members:

Please mark the corresponding circle - only one per line.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Don't know
I find the Map's controlled vocabulary (i.e., streams, themes, content topics, graduate capabilities, thesaurus keywords) suitable for indexing the various activities, contexts and courses in the UMP	○	○	○	○	○	○
I find the Excel export function in Map Search useful	○	○	○	○	○	○

Section 7: Organisational factors affecting Map use
Unless otherwise stated the questions in this section relate to your use of the Map in the past 12 months

26. Please indicate your level of agreement with the following statements on organisational issues relating to the use of the Map:

Please mark the corresponding circle - only one per line.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Don't know
I was informed about the Map when I first got involved in the UMP (e.g., by a course convenor, teacher, general administrator, senior academic manager)	○	○	○	○	○	○
I found out about the Map by chance (e.g., through an email broadcast, newsletter, casual conversation)	○	○	○	○	○	○
I agree with the organisation's use of the Map to share curriculum information with staff members	○	○	○	○	○	○
I agree with the organisation's use of the Map to share curriculum information with students	○	○	○	○	○	○
I would like to see more teaching information (e.g., teaching tips and ideas, lesson plans, marking guides) shared through the Map's teacher-only fields	○	○	○	○	○	○
I agree with the organisation's use of the Map for teaching workload calculations	○	○	○	○	○	○
I agree with the organisation's use of other eMed tools for teaching workload calculations	○	○	○	○	○	○
In general I use the Map on my own	○	○	○	○	○	○
I have used the Map while working with other staff members	○	○	○	○	○	○

In general my colleagues involved in the UMP use the Map	O	O	O	O	O	O
In general my school does not use the Map	O	O	O	O	O	O
In general my school does not use the eMed system	O	O	O	O	O	O
My school has a strong commitment to supporting the UMP	O	O	O	O	O	O

27. The NEXT question is only for current principal teachers. If you currently have such a role in the UMP please select YES, otherwise select NO.

(Principal teacher: person responsible for developing and delivering a learning activity.)

Please pick one of the answers below.

O YES

O NO

28. Question for principal teachers:

Please mark the corresponding circle - only one per line.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Don't know
Usually, a general staff member (e.g., map administrator, course administrator, school administrator) completes and updates my Map forms online for me	O	O	O	O	O	O
I am unable to complete or update my Map forms online because I have no online editing access to the Map	O	O	O	O	O	O

29. The NEXT question is only for current course convenors, co-convenors or DIG members.

If you currently have such role(s) in the UMP please select YES, otherwise select NO.

(DIG: course Design and Implementation Group)

Please pick one of the answers below.

- ○ YES
- ○ NO

30. Question for course convenors, co-convenors or DIG members:

Please mark the corresponding circle - only one per line.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Don't know
I share the Map work with other academic staff involved in the course (e.g., convenor, co-convenor, other DIG members, principal teachers)	○	○	○	○	○	○
I have no other academic staff involved in the course to share the Map work with	○	○	○	○	○	○
I generally make sure that all my course's Map forms (LAFs, AAFs, LCFs and COFs) are up-to-date	○	○	○	○	○	○
I generally invite the principal teachers in my course to update their Map forms	○	○	○	○	○	○
Usually, a general staff member (e.g., map administrator, course administrator, school administrator) invites the principal teachers in my course to update their Map forms	○	○	○	○	○	○
I would like some Map procedures and guidelines to help me manage my Map work	○	○	○	○	○	○
I would like some Map timelines to help me plan my Map work	○	○	○	○	○	○
I think the map administrators or course administrators should do all my Map data entry for me	○	○	○	○	○	○

Section 8: You Overall Opinion

31. Please indicate your level of agreement with the following overall statements about the Map:

Please mark the corresponding circle - only one per line.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Don't know
Overall the impact of the Map on me has been positive	○	○	○	○	○	○
Overall the impact of the Map on the UMP has been positive	○	○	○	○	○	○
Overall the quality of the Map as an IT system is satisfactory	○	○	○	○	○	○
Overall the quality of information in the Map is satisfactory	○	○	○	○	○	○
Overall my perception of the usefulness of the Map has improved over the years	○	○	○	○	○	○

Section 9: Optional Questions

32. If you have any comments about any aspect of the Map or its use please include them here:

Please write your answer in the space below.

....

....

....

....

33. If you have any comments about any other eMed systems or other IT systems used in the UMP please include them here:

Please write your answer in the space below.

....

....

....

....

Appendix P: Study 3—Classification of Survey Items

Table 1 shows the items in the eMed Map survey from Study 3 classified according to the following parameters:

- Research questions explored
- Factors affecting Map use as identified from the qualitative study
- Levels and categories from the SUV evaluation model (Jokela, Karlsudd, & Östlund, 2008).
- Dimensions from the IS-impact evaluation model (Gable, Sedera, & Chan, 2008).

Table 1: Items in the self-reporting Map evaluation survey classified according various parameters derived from Study 1 and the literature.

Section 1: About you	Research question	SUV Evaluation Model
Your gender: • Male • Female	Did the gender or age of individuals influence their use of the Map?	**Background questions:** Data from these background demographic questions were used for statistical analysis to explore the differences between groups of staff and significant associations between variables
Your age range: • 20 to 30 • 31 to 40 • 41 to 50 • 51 to 60 • 61 and above		
Your Faculty: • Medicine • Science • Other Faculty (please specify):	Did the Faculty or School affiliation of individuals influence their use of the Map?	
Your School / Unit / Centre Please specify		
Your staff type: • Academic • General • Conjoint • Casual/Sessional/Affiliated • Other (please specify):	Did the staff type of individuals influence their use of the Map?	
What role(s) do you currently have in the Undergraduate Medicine Program (UMP). Tick all that apply to you: • Teacher—campus based • Teacher—clinical school based • Teacher—general practice and primary care • Convenor/co-convenor (course, element or phase) • Curriculum design, overview or evaluation group or committee member	Did the UMP roles or Phase involvement of individuals influence their use of the Map?	

• Administrator • Other (please specify):		
Which Phase(s) of the UMP are you currently involved in? You may select more than one Phase: • Phase 1 (years 1 and 2) • Phase 2 (years 3 and 4) • Phase 3 (years 5 and 6)		
In general, how often do you use the Internet (excluding email use)? Choose the best answer: • Every day • Every two or three days • Once a week • Once a fortnight • Once a month • Rarely	Did the frequency of Internet use by individuals influence their use of the Map?	
Have you used the Map in the past 12 months? • Yes (go on to next question) • No	Which individuals involved in the UMP had or had not used the Map in the past 12 months?	**SUV Category:** Hierarchy and relations **SUV Level:** Individual
Briefly explain why you have not used the Map: *Thank you, you have no further questions to answer (end of survey)*		

Section 2: Your use of the Map in the past 12 months	Research question	SUV Evaluation Model	
		Category	**Level**
Have you ever had any problems accessing the Map (e.g. accessing the Map from a hospital, acquiring a University staff number or password to access the Map etc.?) • No • Yes (please specify the problems you have had and indicate if they are now resolved or if still present)	Were individuals experiencing access problems?	Inputs	Technical
How often do you use the Map? • Daily • Weekly • Fortnightly • Monthly • Once per teaching period/academic session • Once per year • Other (please specify):	How often did individuals use the Map?	Inputs	Individual
Response scale: often, sometimes, rarely, never			
How often you use the following sources to find information about UMP courses?	What sources of UMP course information did they use?	Differentiation and entropy	Technical

• The Map • Online course site in WebCT Vista (or Blackboard) • Open-access online course site (e.g. Primary Care website) • Course guides for teachers • Course guides for students			
How often do you use the following Map forms, features or functions? • Learning Activity Forms (LAFs) • Assessment Activity Forms (AAFs) • Learning Context Forms (LCFs) • Course Outline Forms (COFs) • Content files attached to forms • Views menu • Search tool • Export function (only available to those with editing access) • Archive tool • Map hyperlinks in online course sites	Which Map forms, features and functions did they use?	Inputs	Individual
Please indicate how often you use the following Map and eMed help sites: • Map Help (via eMed Help button) • eMed Help website (at http://medprogram.med.unsw.edu.au/Med3802Web.nsf/page/eMed?open&login) • Map Online Tutorial (at http://web.med.unsw.edu.au/Emed/Map.htm)	Which Map help sites did they use?	Differentiation and entropy	Individual

Section 3: Your types of Map use in the past three years (response scale: often, sometimes, rarely, never)	**Research question**	**SUV Evaluation Model**	
		Category	**Level**
Please indicate how often you have used the Map for the following reasons: • Find course information (e.g. learning activities, assessments, lecture notes, key references) • Develop course activities • Provide course content • Prepare timetables • Prepare course guides • Prepare assessments • Prepare yourself to teach students • Prepare yourself to assess	Was the Map being used for the purpose it had been designed? Were the educational and information management goals of the Map being achieved?	Goal-seeking	Individual Organisational Technical

students • Review or revise activities (in a course, phase or program) • Check for gaps or redundancies (in a course, phase or program) • Align outcomes, activities and assessments (in a course, phase or program) • Explore the whole curriculum • Research (e.g. in an Independent Learning Project) • Staff development (e.g. help staff understand the UMP) • Student learning (e.g. help students integrate what they learn in the UMP) • Learn about the process of learning and teaching • Search & retrieve information • Export data • Audit data (e.g. for data quality) • Integrate data with other systems (e.g. Timetable) • Answer professional enquiries (e.g. from medical colleges) • Prepare organisational reports on the UMP (e.g. Faculty reports, AMC accreditation) • Workforce management			

Section 4: Effect of the Map on the UMP and the Faculty (response scale: strongly agree, agree, neutral, disagree, strongly disagree, don't know)	**Research question**	**SUV Evaluation Model**	
		Category	**Level**
Please indicate your level of agreement with the following statements. The Map has helped to: • Provide a transparent curriculum • Support the delivery of an integrated curriculum • Reduce the use of paper-based course materials • Reduce the workload of updating a course • Simplify the process for updating the curriculum • Reduced information duplication • Break down discipline barriers • Encourage teacher responsibility for course	Had the Map had an effect on the UMP and the Faculty in achieving the goals of curriculum mapping? Had the Map helped to change the Faculty culture? Had the Map produced changes within the organisation?	Goal-seeking	Organisational

activities • Promote a shared ownership of the curriculum amongst staff • Promote a knowledge sharing culture amongst staff			

Section 5: Personal factors affecting Map use (response scale: strongly agree, agree, neutral, disagree, strongly disagree, don't know)	**Factor** (from Study 1)	**SUV Evaluation Model**	
		Category	**Level**
For all Map users			
I generally like using the online Map to find information about the UMP	Attitude	Inputs	Individual
I generally prefer using the paper-based course guide to the online Map to find course information	Attitude	Inputs	Individual
I generally don't need to use the Map	Attitude	Inputs	Individual
I generally don't like using information technology	Attitude	Inputs	Individual
I generally know how to use the IT functions of the Map (e.g. its views, search, exports, archive, help functions)	Knowledge	Differentiation and entropy	Individual
I need IT training on how to use the Map	Knowledge	Differentiation and entropy	Individual
I need educational training on how to use the Map	Knowledge	Differentiation and entropy	Individual
The Map has too much information for what I need	Need	Outputs	Individual
The Map has too little information for what I need	Need	Outputs	Individual
There is too much duplication of information across the Map, the course guides and WebCT Vista course sites	Effect	Differentiation and entropy	Technology
I often find inconsistencies in information between the Map, course guides and WebCT Vista course sites	Effect	Differentiation and entropy	Technology
I think we should refer staff and students to the information in the Map instead of duplicating it in the course guides	Effect	Differentiation and entropy	Technology
I generally find the Map information useful	Reward	Outputs	Individual
I have too much other work to do to be using the Map	Perspective	Regulation	Individual
It helps when a colleague shows me how to use the Map	Advocacy	Hierarchy and relations	Individual
It helps when a colleague reminds me to use the Map	Advocacy	Hierarchy and relations	Individual
For principal teachers, convenors or co-convenors, or course DIG members only			
As a principal teacher, I find it useful to complete the "principal teacher" fields in my Learning Activity Forms (LAFs) in the Map	Knowledge	Inputs	Individual

As a principal teacher, I use the information provided in the "course convenor" fields of my LAF to help me develop my learning activity	Knowledge	Inputs	Individual
I generally find the Map forms suitable to capture the on-campus learning activities	Need (Data and data structure)	Transformation	Technology
I generally find the Map forms suitable to capture learning activities in the clinical setting	Need (Data and data structure)	Transformation	Technology
I generally update my own Map forms	Effect	Transformation	Individual
I generally update my Map forms directly online	Effect	Transformation	Individual
I generally use a Word document to update my Map information	Effect	Transformation	Individual
Completing the Map forms takes up a lot of my time	Effect	Transformation	Individual
I've got too much other work to do to be completing Map forms	Perspective	Regulation	Individual
I don't get any personal benefits from entering information in the Map	Reward	Regulation	Individual
I don't get any staff recognition for entering information in the Map	Reward	Regulation	Individual
For convenors, co-convenors or DIG members only			
As a course convenor, co-convenor or DIG member, I find it useful to complete the Map forms	Knowledge	Transformation	Individual
I regularly update or help update the various Map forms for my course	Effect	Transformation	Individual
I regularly update or help update the course guide for my course	Effect	Transformation	Individuhial

Section 6: Information systems factors affecting Map use (response scale: strongly agree, agree, neutral, disagree, strongly disagree, don't know)	**Factor** (from Study 1)	**SUV Evaluation Model**	
		Category	**Level**
For all Map users			
I find the quality of information in the Map for Phase 1 is good	Data	Outputs	Technology
I find the quality of information in the Map for Phase 2 is good	Data	Outputs	Technology
I find the quality of information in the Map for Phase 3 is good	Data	Outputs	Technology
I find the Map information to be readable, clear and well formatted	Data	Outputs	Technology
I find the Map information easy to understand	Data	Outputs	Technology
I like having the content files (e.g. lecture notes, audio files) attached to the Map forms	IT feature	Outputs	Technology
I find the Map simple to use	IT feature	Outputs	Technology
The IT features and functions of the Map meet my needs	IT feature	Outputs	Technology

I have experienced IT glitches when using the Map	IT feature	Outputs	Technology
I have experienced IT glitches when using other eMed systems	Other IT	Outputs	Technology
I generally report IT glitches when they occur	Other IT (Communication)	Regulation	Technology
I generally like the IT features of the eMed system	Other IT	Outputs	Technology
For principal teachers, course convenors or co-convenors, or DIG members only			
I find the Map's controlled vocabulary (i.e. streams, themes, content topics, graduate capabilities, thesaurus keywords) suitable for indexing the various activities, contexts and courses capture in the Map	Data and data structure	Transformation	Technology
I find the Excel export function in Map Search useful	IT features	Transformation	Technology

Section 7: Organisational factors affecting Map use (response scale: strongly agree, agree, neutral, disagree, strongly disagree, don't know)	**Factor** (from Study 1)	**SUV Evaluation Model**	
		Category	**Level**
For all Map users			
I was informed about the Map when I first got involved in the UMP (e.g. by a course convenor, teacher, general administrator, senior academic manager)	Communication	Hierarchy and relations	Organisation
I found out about the Map by chance (e.g. through an email broadcast, newsletter, casual conversation)	Communication	Hierarchy and relations	Organisation
I agree with the organisation's use of the Map to share curriculum information with staff members	Culture	Hierarchy and relations	Organisation
I agree with the organisation's use of the Map to share curriculum information with students	Culture	Hierarchy and relations	Organisation
I would like to see more teaching information (e.g. teaching tips and ideas, lesson plans, marking guides) shared through the Map's teacher-only fields	Culture	Hierarchy and relations	Organisation
I agree with the organisation's use of the Map for teaching workload calculations	Management	Regulation	Organisation
I agree with the organisation's use of other eMed tools for teaching workload calculations	Management	Regulation	Organisation
In general I use the Map on my own	Culture	Hierarchy and relations	Organisation
I have used the Map while working with other staff members	Culture	Hierarchy and relations	Organisation
In general my colleagues involved in the	Culture	Transformation	Organisation

UMP use the Map			
In general my school does not use the Map	Management	Transformation	Organisation
In general my school does not use the eMed system	Management	Transformation	Organisation
My school has a strong commitment to supporting the UMP	Management	Differentiation and entropy	Organisation
For principal teachers only			
Usually, a general staff member (e.g. map administrator, course administrator, school administrator) completes and updates my Map forms online for me	Administration	Differentiation and entropy	Organisation
I am unable to complete or update my Map forms online because I have no online editing access to the Map	Central services	Input	Organisation
For course convenors or co-convenors, or DIG members			
I share the Map work with other academic staff involved in the course (e.g. convenor, co-convenor, other DIG members, principal teachers)	Culture	Hierarchy and relations	Organisation
I have no other academic staff involved in the course to share the Map work with	Management	Hierarchy and relations	Organisation
I generally make sure that all my course's Map forms (LAFs, AAF, LCFs and COFs) are up-to-date	Administration	Inputs	Organisation
I generally invite the principal teachers in my course to update their Map forms	Administration	Inputs	Organisation
Usually, a general staff member (e.g. map administrator, course administrator, school administrator) invites the principal teachers in my course to updated their Map forms	Administration	Inputs	Organisation
I would like some Map procedures and guidelines to help me manage my Map work	Administration	Regulation	Organisation
I would like some Map timelines to help me plan my Map work	Administration	Regulation	Organisation
I think the Map administrators or course administrators should do all my Map data entry for me	Administration	Hierarchy and relations	Organisation

Section 8: Your overall opinion (response scale: strongly agree, agree, neutral, disagree, strongly disagree, don't know)	**Dimension from IS-impact measurement model (Gable 2008)**	**SUV Evaluation Model**	
		Category	**Level**
Overall the impact of the Map on me has been positive	Individual-impact	Outputs	Individual
Overall the impact of the Map on the UMP has been positive	Organisational-impact	Outputs	Organisation
Overall the quality of the Map as an IT system is satisfactory	System-quality	Outputs	Technology

Overall the quality of information in the Map is satisfactory	Information-quality	Outputs	Technology
Overall my perception of the usefulness of the Map has improved over the years	Individual impact	Outputs	Individual

Section 9: Optional questions	**Research question**	**SUV Evaluation Model**
If you have any further comments about any aspect of the Map or its use please include them here:	What else did users think about that Map?	**Open questions** Comments and opinions about the Map and other IT systems used in the UMP
If you have any comments about any other eMed systems or IT systems used in the UMP please include them here:	What did users think about other IT systems used in the UMP?	

Appendix Q: Study 3—Cross-Tabulations

This appendix contains the cross-tabulations (contingency tables) of statistically significant Fisher's Exact Test (FET) results from Study 3, which were performed in SPSS v20. The information has been organised according to the corresponding parts of the Results section of Chapter 7 (the survey study).

In keeping with the APA 6th ed. Style (American Psychological Association, 2010), percentage values in cross-tabulation tables of this appendix have been rounded as much as possible and are presented with no decimal places for ease of reading and comprehension. However, the numbers provided allow recalculation to one decimal point as reported in the body of the thesis.

Fisher's Exact Test Cross-Tabulations from Study 3

The Fisher's Exact Test of association (either with the exact p-value, or with the Monte Carlo approximate p-value and confidence interval based on 10,000 sample tables with starting seed of 2,000,000) was used to test the association between Map use by UMP staff and their staff characteristics (i.e. staff demographics and UMP roles).

Results from Section 2 onward are for the 39 UMP staff members who had used the Map in the previous 12 months from the date when the survey was released. These results report the exact p-value for the Fisher's exact test. Some Likert-scale levels were combined to facilitate the cross-tabulation analysis. In one scale, the levels 'strongly agree' and 'agree' were combined into the level 'agree', and the levels 'strongly disagree' and 'disagree' were combined into the level 'disagree', but the 'don't know' and 'neutral' levels were kept separate. In another scale, the levels 'often' and 'sometimes' were combined into the level 'often', while the levels 'rarely' and 'never' were combined into the level 'rarely'.

Section 1—About the Respondents

The FET and cross-tabulation results in this section are for the 148 UMP staff members who completed the Map survey. The following tables show the statistically significant cross-tabulation results between the demographic characteristics of these 148 staff members and their Map use status.

Table 1: Cross-tabulation of respondents' specific schools and Map use status showing cell counts and percentages, and a significant Fisher's exact test result (FET (*n* = 148) = 22.642, *p* = 0.034, 99% CI [0.029, 0.038]; *Cramer's V* = 0.406).

Specific School, Centre or Unit	Q: Have you used the Map in the past 12 months?		School total
	Yes	No	
Centre for Primary Health Care and Equity	1 (100%)	0 (0%)	1 (100%)
Clinical school (unspecified)	0 (0%)	5 (100%)	5 (100%)
Medicine Education and Student Office	6 (67%)	3 (33%)	9 (100%)
National Centre in HIV Epidemiology and Clinical Research	0 (0%)	1 (100%)	1 (100%)
National Drug and Alcohol Research Centre	0 (0%)	1 (100%)	1 (100%)
Prince of Wales Clinical School	2 (22%)	7 (78%)	9 (100%)
Rural Clinical School	5 (36%)	9 (65%)	14 (100%)
School of Psychiatry	2 (33%)	4 (67%)	6 (100%)
South Western Sydney Clinical School	3 (14%)	18 (86%)	21 (100%)
School of Medical Sciences	8 (47%)	9 (53%)	17 (100%)
School of Public Health and Community Medicine	2 (13%)	13 (87%)	15 (100%)
St George Clinical School	4 (25%)	12 (75%)	16 (100%)
St Vincent's Clinical School	4 (36%)	7 (64%)	11 (100%)
South Western Sydney Clinical School	2 (10%)	19 (90%)	21 (100%)
The Garvan Institute	0 (0%)	1 (100%)	1 (100%)
Total	39 (26%)	109 (74%)	148 (100%)

Table 2: Cross-tabulation of respondents' staff type and Map use status showing cell counts and percentages, and a significant Fisher's exact test result (FET (*n* = 148) = 36.166, *p* < 0.001, 99% CI [0.000, 0.000]; *Cramer's V* = 0.486).

Staff type	Q: Have you used the Map in the past 12 months?		Staff type total
	Yes	No	
Academic	20 (45%)	24 (55%)	44 (100%)
General	10 (53%)	9 (47%)	19 (100%)
Conjoint	6 (7%)	75 (93%)	81 (100%)
Casual*	3 (75%)	1 (25%)	4 (100%)
Total	39 (26%)	109 (74%)	148 (100%)

*Casual: includes casual, sessional, affiliated or visiting staff.

Table 3: Cross-tabulation of respondents' UMP Roles and Map use status showing cell counts and percentages, and a significant Fisher's exact test result (FET (n = 148) = 68.349, p < 0.001, 99% CI [0.000, 0.000]; *Cramer's V* = 0.698).

All UMP roles (coded*)	Q: Have you used the Map in the past 12 months?		UMP roles total
	Yes	No	
1 only	6 (25%)	18 (75%)	24 (100%)
2 only	4 (6%)	66 (94%)	70 (100%)
3 only	0 (0%)	2 (100%)	2 (100%)
4 only	0 (0%)	2 (100%)	2 (100%)
6 only	8 (57%)	6 (43%)	14 (100%)
7 only	0 (0%)	4 (100%)	4 (100%)
1 & 2	3 (60%)	2 (40%)	5 (100%)
1 & 3	0 (0%)	1 (100%)	1 (100%)
1 & 5	4 (100%)	0 (0%)	4 (100%)
2 & 3	1 (100%)	0 (0%)	1 (100%)
2 & 4	1 (100%)	0 (0%)	1 (100%)
2 & 5	0 (0%)	2 (100%)	2 (100%)
2 & 7	1 (33%)	2 (67%)	3 (100%)
5 & 6	1 (100%)	0 (1%)	1 (100%)
1, 2 & 3	1 (100%)	0 (1%)	1 (100%)
1, 2 & 4	0 (0%)	1 (100%)	1 (100%)
1, 2 & 5	1 (50%)	1 (50%)	2 (100%)
1, 3 & 4	1 (100%)	0 (0%)	1 (100%)
1, 4 & 5	2 (100%)	0 (0%)	1 (100%)
2, 4 & 5	1 (100%)	0 (0%)	1 (100%)
4, 5 & 6	1 (100%)	0 (0%)	1 (100%)
1, 2, 4 & 5	2 (67%)	1 (33%)	3 (100%)
1, 4, 5 & 7	1 (100%)	0 (0%)	1 (100%)
2, 4, 5 & 6	0 (0%)	1 (100%)	1 (100%)
Total	39 (26%)	109 (74%)	148 (100%)

*Code: (1) Teacher—campus based; (2) Teacher—clinical school based; (3) Teacher—general practice or primary care; (4) Convenor / co-convenor (course, element, or phase); (5) Curriculum design, overview or evaluation group or committee member; (6) Administrator; (7) Other.

Table 4: Cross-tabulation of respondents' UMP Phase involvement and Map use status showing cell counts and percentages, and a significant Fisher's exact test result (FET (n = 148) = 32.523, p < 0.001, 99% CI [0.000, 0.000]; *Cramer's V* = 0.462).

All Phase (coded)*	Q: Have you used the Map in the past 12 months?		UMP roles total
	Yes	No	
Phase 1 only	6 (26%)	17 (74%)	23 (100%)
Phase 2 only	5 (26%)	14 (74%)	19 (100%)
Phase 3 only	0 (0%)	27 (100%)	27 (100%)
Phases 1 & 2	5 (71%)	2 (29%)	7 (100%)
Phases 1 & 3	1 (100%)	0 (0%)	1 (100%)
Phases 2 & 3	8 (18%)	37 (82%)	45 (100%)
Phases 1, 2 & 3	14 (54%)	12 (46%)	26 (100%)
Total	39 (26%)	109 (74%)	**148 (100%)**

Association between demographic variables

Table 5 reports the FET results for the associations between pairs of demographic variables (gender, age, staff type, school location, UMP roles, UMP phase involvement and Internet use) for the following three population groups: (a) the 39 respondents who had used the Map, (b) the 109 respondents who had not used the Map and (c) all 148 respondents. These results show that significant associations existed between some demographic variables, although many of these were highly predicable due to the characteristics of the UMP and the staff involved. One consistent result for all three populations groups was that there was no significant association between Internet use and any of the other demographic variables.

Table 5: Results of the Fisher's Exact Test p-values for the association between staff demographic variables for the population of all survey respondents (*n* = 148), of respondents who were not Map users (*n* = 109) and of respondents who were Map users (*n* = 39).

Demographic variable and population group	**Age**	**Staff type**	**School location**	**UMP roles**	**UMP phases**	**Internet use**
Gender						
All respondents	$p = 0.037$*	$p = 0.003$*	$p = 0.560$	$p < 0.001$*	$p = 0.699$	$p = 0.675$
Map non-users	$p = 0.514$	$p = 0.484$	$p = 0.441$	$p = 0.123$	$p = 0.510$	$p = 0.732$
Map users	$p = 0.031$*	$p < 0.001$*	P = 1.000	$p = 0.001$*	$p = 0.116$	$p = 0.571$
Age						
All respondents		$p = 0.004$*	$p = 0.284$	$p = 0.006$*	$p = 0.951$	$p = 0.364$
Map non-users		$p = 0.029$*	$p = 0.079$	$p = 0.112$	$p = 0.825$	$p = 0.159$
Map users		$p = 0.177$	$p = 0.071$	$p = 0.156$	$p = 0.687$	$p = 0.753$
Staff type						
All respondents			$p < 0.001$*	$p < 0.001$*	$p < 0.001$*	$p = 0.530$
Map non-users			$p = 0.006$*	$p < 0.001$*	$p < 0.001$*	$p = 0.231$
Map users			$p = 0.709$	$p < 0.001$*	$p = 0.150$	$p = 0.807$
School location						
All respondents				$p < 0.001$**	$p < 0.001$*	$p = 0.938$
Map non-users				$p < 0.001$*	$p = 0.001$*	$p = 1.000$
Map users				$p = 0.025$*	$p = 0.001$*	$p = 1.000$
UMP roles						
All respondents					$p < 0.001$*	$p = 0.356$
Map non-users					$p < 0.001$*	$p = 0.404$
Map users					$p = 0.223$	$p = 0.613$
UMP phases						
All respondents						$p = 0.720$
Map non-users						$p = 0.623$
Map users						$p = 0.752$

*Statistically significant results at p<= 0.05.

The population group of main interest in this study was the group of 39 UMP Map users, and results of the Fisher's exact test showed a statistically significant association between the following variables, most of which were predictable due to the characteristics of the UMP and its staff (actual cross-tabulations for these results are not included in this study since they were of less importance):

- Gender and age: there were more females in the 41-50 age group (64% or 9 of 14; (FET (n = 39) = 9.082, p = 0.031, 99% CI [0.027, 0.036]; *Cramer's V* = 0.489).
- Gender and staff type: there were more females who were general staff (64% or 9 of 14; (FET (n = 39) = 17.469, p < 0.001, 99% CI [0.000, 0.001]; *Cramer's V* = 0.685).
- Gender and UMP roles: there were more females who were UMP administrators (57% or 8 of 14; (FET (n = 39) = 26.381, p = 0.001, 99% CI [0.000, 0.002]; *Cramer's V* = 0.860).
- Staff type and UMP role: there were more general staff who were UMP administrators (80% or 8 of 10; (FET (n = 39) = 64.546, p < 0.001, 99% CI [0.000, 0.000]; *Cramer's V* = 0.778).
- School location and UMP phase: there were more campus school staff in phase 1 (31% or 5 of 16) or phases 1 and 2 (31% or 5 of 16), and significantly more clinical school staff in phases 2 and 3 (32% or 7 of 22; (FET (n = 39) = 23.938, p = 0.001, 99% CI [0.000, 0.001]; *Cramer's V* = 0.563).
- School location and UMP role: there were more clinical school staff who were clinical school-based teachers (18% or 4 of 22) or general practice/ primary care based teachers (27% or 6 of 22; (FET (n = 39) = 51.029, p = 0.025, 99% CI [0.021, 0.029]; *Cramer's V* = 0.633)—this highly predictable result was included for the sake of completion.

Section 2—Frequency of Map use

What follows are the statistically significant cross-tabulations between the staff type or the school location of the 39 Map users and their answers to items in Section 2 of the survey.

Table 6: Cross-tabulation of respondents' school location and frequency of Map use showing cell counts and percentages, and a significant Fisher's exact test result (FET (*n* = 39) = 15.438, *p* = 0.001; *Cramer's V* = 0.434).

School location	Q: How often do you use the Map?			School location total
	Often (daily, weekly, fortnightly)	Sometimes (monthly, teaching period)	Rarely (yearly, seldom, rare)	
Campus schools	12 (75%)	2 (12.5%)	2 (12.5%)	16 (100%)
Clinical schools	4 (18%)	15 (68%)	22 (14%)	22 (100%)
Centre	0 (0%)	1 (100%)	0.(0%)	1 (100%)
Total	16 (41%)	18 (46%)	5 (13%)	**39 (100%)**

Table 7: Cross-tabulation of respondents' school location and item response showing cell counts and percentages, and a significant Fisher's exact test result (FET (*n* = 38) = 9.556, *p* = 0.006; *Cramer's V* = 0.498).

School location	Q: Use of online course site in WebCT Vista/Blackboard		School location total
	Often/Sometimes	Rarely/Never	
Campus schools	15 (94%)	1 (6%)	16 (100%)
Clinical schools	10 (48%)	11 (52%)	21 (100%)
Centre	1 (100%)	0 (%)	1 (100%)
Total	26 (%)	12 (%)	**38 (100%)**

Table 8: Cross-tabulation of respondents' staff type and item response showing cell counts and percentages, and a significant Fisher's exact test result (FET (*n* = 37) = 8.814, *p* = 0.017; *Cramer's V* = 0.488).

Staff type	Q: Use of course guide for students		Staff type total
	Often/Sometimes	Rarely/Never	
Academic	8 (42%)	11 (58%)	19 (100%)
General	9 (90%)	1 (10%)	10 (100%)
Conjoint	1 (20%)	4 (80%)	5 (100%)
Casual*	2 (67%)	1 (33%)	3 (100%)
Total	20 (54%)	17 (46%)	**37 (100%)**

*Casual: includes casual, sessional, affiliated or visiting staff.

Table 9: Cross-tabulation of respondents' staff type and item response showing cell counts and percentages, and a significant Fisher's exact test result (FET (*n* = 38) = 9.789, *p* = 0.010; *Cramer's V* = 0.530).

Staff type	Q: Use of Course Outline Form (COF)		Staff type total
	Often/Sometimes	Rarely/Never	
Academic	2 (10%)	17 (90%)	19 (100%)
General	5 (50%)	5 (50%)	10 (100%)
Conjoint	4 (67%)	2 (33%)	6 (100%)
Casual*	0 (%)	3 (100%)	3 (100%)
Total	11 (29%)	27 (71%)	**38 (100%)**

*Casual: includes casual, sessional, affiliated or visiting staff.

Table 10: Cross-tabulation of respondents' school location and item response showing cell counts and percentages, and a significant Fisher's exact test result (FET (*n* = 39) = 6.350, *p* = 0.028; *Cramer's V* = 0.411).

School location	Q: Use of Map Export function		School location total
	Often/Sometimes	**Rarely/Never**	
Campus schools	7 (44%)	9 (56%)	16 (100%)
Clinical schools	2 (9%)	20 (91%)	22 (100%)
Centre	0 (0%)	1 (100%)	1 (100%)
Total	9 (23%)	30 (77%)	**39 (100%)**

Section 3—Types of Map use

What follows are the statistically significant cross-tabulations between the staff type or the school location of the 39 Map users and their answers to items in Section 3 of the survey.

Table 11: Cross-tabulation of respondents' staff type and item response showing cell counts and percentages, and a significant Fisher's exact test result (FET (*n* = 39) = 11.965, *p* = 0.003; *Cramer's V* = 0.558).

Staff type	Q: Develop course activities		Staff type total
	Often/Sometimes	**Rarely/Never**	
Academic	14 (70%)	6 (30%)	20 (100%)
General	1 (10%)	9 (90%)	10 (100%)
Conjoint	1 (17%)	5 (83%)	6 (100%)
Casual*	1 (33%)	2 (66%)	3 (100%)
Total	17 (44%)	22 (56%)	**39 (100%)**

*Casual: includes casual, sessional, affiliated or visiting staff.

Table 12: Cross-tabulation of respondents' staff type and item response showing cell counts and percentages, and a significant Fisher's exact test result (FET (*n* = 39) = 13.882, *p* = 0.001; *Cramer's V* = 0.587).

Staff type	Q: Prepare yourself to teach students		Staff type total
	Often/Sometimes	**Rarely/Never**	
Academic	13 (65%)	7 (35%)	20 (100%)
General	0 (0%)	10 (100%)	10 (100%)
Conjoint	1 (17%)	5 (83%)	6 (100%)
Casual*	1 (33%)	2 (67%)	(100%)
Total	15 (38%)	24 (62%)	**39 (100%)**

*Casual: includes casual, sessional, affiliated or visiting staff.

Table 13: Cross-tabulation of respondents' staff type and item response showing cell counts and percentages, and a significant Fisher's exact test result (FET (*n* = 38) = 8.406, *p* = 0.021; *Cramer's V* = 0.478).

Staff type	Q: Prepare yourself to assess students		Staff type total
	Often/Sometimes	Rarely/Never	
Academic	10 (50%)	10 (50%)	20 (100%)
General	0 (0%)	9 (100%)	9 (100%)
Conjoint	2 (33%)	4 (66%)	6 (100%)
Casual*	0 (0%)	3 (100%)	3 (100%)
Total	12 (32%)	26 (68%)	**38 (100%)**

*Casual: includes casual, sessional, affiliated or visiting staff.

Table 14: Cross-tabulation of respondents' staff type and item response showing cell counts and percentages, and a significant Fisher's exact test result (FET (*n* = 39) = 6.326, *p* = 0.047; *Cramer's V* = 0.426).

Staff type	Q: Learn about the process of learning and teaching		Staff type total
	Often/Sometimes	Rarely/Never	
Academic	0 (0%)	20 (100%)	20 (100%)
General	2 (20%)	8 (80%)	10 (100%)
Conjoint	0 (0%)	6 (100%)	6 (100%)
Casual*	1 (33%)	2 (67%)	3 (100%)
Total	3 (8%)	36 (92%)	**39 (100%)**

*Casual: includes casual, sessional, affiliated or visiting staff.

Table 15: Cross-tabulation of respondents' school location and item response showing cell counts and percentages, and a significant Fisher's exact test result (FET (*n* = 39) = 5.855, *p* = 0.030; *Cramer's V* = 0.394).

School location	Q: Prepare yourself to teach students		School location total
	Often/Sometimes	Rarely/Never	
Campus schools	9 (56%)	9 (44%)	16 (100%)
Clinical schools	5 (23%)	17 (77%)	22 (100%)
Centre	1 (100%)	0 (0%)	1 (100%)
Total	15 (38%)	24 (62%)	**39 (100%)**

Section 4—Effects of Map use

What follows are the statistically significant cross-tabulations between the staff type or the school location of the 39 Map users and their answers to items in Section 4 of the survey.

Table 16: Cross-tabulation of respondents' staff type and item response showing cell counts and percentages, and a significant Fisher's exact test result (FET (*n* = 39) = 15.555, *p* = 0.019, *Cramer's V* = 0.385).

Staff type	Q: Map supports delivery of an integrated curriculum				Staff type total
	Agree	Neutral	Disagree	Don't know	
Academic	15 (75%)	1 (5%)	2 (10%)	2 (10%)	20 (100%)
General	5 (50%)	5 (50%)	0 (0%)	0 (0%)	10 (100%)
Conjoint	2 (33%)	1 (17%)	1 (17%)	2 (33%)	6 (100%)
Casual*	1 (33%)	0 (0%)	1 (33%)	1 (33%)	3 (100%)
Total	23 (59%)	7 (18%)	4 (10%)	5 (13%)	**39 (100%)**

*Casual: includes casual, sessional, affiliated or visiting staff.

Table 17: Cross-tabulation of respondents' staff type and item response showing cell counts and percentages, and a significant Fisher's exact test result (FET (*n* = 39) = 14.868, *p* = 0.032, *Cramer's V* = 0.379).

Staff type	Q: Encouraged teacher responsibility for course activities				Staff type total
	Agree	Neutral	Disagree	Don't know	
Academic	10 (50%)	3 (15%)	5 (25%)	2 (10%)	20 (100%)
General	2 (20%)	6 (60%)	1 (10%)	1 (10%)	10 (100%)
Conjoint	0 (0%)	2 (33%)	1 (17%)	3 (50%)	6 (100%)
Casual*	2 (67%)	0 (0%)	0 (0%)	1 (33%)	3 (100%)
Total	14 (36%)	11 (28%)	7 (18%)	7 (18%)	**39 (100%)**

*Casual: includes casual, sessional, affiliated or visiting staff.

Table 18: Cross-tabulation of respondents' school location and item response showing cell counts and percentages, and a significant Fisher's exact test result (FET (*n* = 39) = 12.813, *p* = 0.016; *Cramer's V* = 0.405).

School location	Q: Reduce workload of updating a course				School location total
	Agree	Neutral	Disagree	Don't know	
Campus schools	8 (50%)	3 (19%)	4 (25%)	1 (6%)	16 (100%)
Clinical schools	6 (27%)	10 (46%)	0 (0%)	6 (27%)	22 (100%)
Centre	1 (100%)	0 (0%)	0 (0%)	0 (0%)	1 (100%)
Total	15 (38%)	13 (33%)	4 (10%)	7 (18%)	**39 (100%)**

Section 5—Factors affecting Map use

What follows are the statistically significant cross-tabulations between the staff type or the school location of the 39 Map users and their answers to items in Section 5 of the survey, subdivided into personal, organisational and technical factors (Questions 18 to 31). Some items applied to all Map users, while others applied to principal teachers only, or to course convenors, co-convenors or Design and Implementation Group (DIG) members only.

Personal factors

The following FET and cross-tabulation results are for all 39 UMP Map users.

Table 18: Cross-tabulation of respondents' staff type and item response showing cell counts and percentages, and a significant Fisher's exact test result FET (*n* = 39) = 18.463, *p* = 0.004, *Cramer's V* = 0.438.

Staff type	Q18.3: I generally don't need to use the Map				Staff type total
	Agree	Neutral	Disagree	Don't know	
Academic	4 (20%)	2 (10%)	13 (65%)	1 (5%)	20 (100%)
General	4 (40%)	0 (0%)	6 (60%)	0 (0%)	10 (100%)
Conjoint	2 (33%)	4 (67%)	0 (0%)	0 (0%)	6 (100%)
Casual*	0 (0%)	1 (33%)	1 (33%)	1 (33%)	3 (100%)
Total	10 (26%)	7 (18%)	20 (51%)	2 (5%)	**39 (100%)**

*Casual: includes casual, sessional, affiliated or visiting staff.

Table 19: Cross-tabulation of respondents' staff type and item response showing cell counts and percentages, and a significant Fisher's exact test result (FET (*n* = 39) = 13.918, *p* = 0.050, *Cramer's V* = 0.370).

Staff type	Q18.7: I need educational training on how to use the Map				Staff type total
	Agree	Neutral	Disagree	Don't know	
Academic	7 (35%)	1 (5%)	11 (55%)	1 (5%)	20 (100%)
General	3 (30%)	3 (30%)	4 (40%)	0 (0%)	10 (100%)
Conjoint	3 (50%)	3 (50%)	0 (0%)	0 (0%)	6 (100%)
Casual*	1 (33%)	0 (0%)	1 (33%)	1 (33%)	3 (100%)
Total	14 (36%)	7 (18%)	16 (41%)	2 (5%)	**39 (100%)**

*Casual: includes casual, sessional, affiliated or visiting staff.

Table 20: Cross-tabulation of respondents' staff type and item response showing cell counts and percentages, and a significant Fisher's exact test result (FET (*n* = 39) = 11.057, *p* = 0.046, *Cramer's V* = 0.345).

School location	Q18.3: I generally don't need to use the Map				School location total
	Agree	Neutral	Disagree	Don't know	
Campus schools	1 (6%)	2 (13%)	12 (75%)	1 (6%)	16 (100%)
Clinical schools	9 (41%)	5 (23%)	7 (32%)	1 (4%)	22 (100%)
Centre	0 (0%)	0 (0%)	1 (100%)	0 (0%)	(100%)
Total	10 (26%)	7 (18%)	20 (51%)	2 (5%)	**39 (100%)**

Table 21: Cross-tabulation of respondents' staff type and item response showing cell counts and percentages, and a significant Fisher's exact test result (FET (*n* = 38) = 15.495, *p* = 0.004, *Cramer's V* = 0.443).

School location	Q18.5: I generally know how to use the IT functions of the Map				School location total
	Agree	Neutral	Disagree	Don't know	
Campus schools	14(88%)	1 (6%)	0 (0%)	1 (6%)	16 (100%)
Clinical schools	8 (38%)	6 (29%)	6 (29%)	1 (5%)	21 (100%)
Centre	0 (0%)	0 (0%)	1 (100%)	0 (0%)	1 (100%)
Total	22 (58%)	7 (18%)	7 (18%)	2 (5%)	**38 (100%)**

Table 22: Cross-tabulation of respondents' staff type and item response showing cell counts and percentages, and a significant Fisher's exact test result (FET (*n* = 39) = 21.517, *p* < 0.001, *Cramer's V* = 0.504).

School location	Q18.5: I need IT training on how to use the Map				School location total
	Agree	Neutral	Disagree	Don't know	
Campus schools	1 (6%)	1 (6%)	13 (81%)	1 (6%)	16 (100%)
Clinical schools	10 (46%)	8 (36%)	3 (14%)	1 (4%)	22 (100%)
Centre	0 (0%)	0 (0%)	1 (100%)	0 (0%)	1 (100%)
Total	11 (28%)	9 (23%)	17 (44%)	2 (5%)	**39 (100%)**

Table 23: Cross-tabulation of respondents' staff type and item response showing cell counts and percentages, and a significant Fisher's exact test result (FET (*n* = 39) = 19.591, *p* < 0.001, *Cramer's V* = 0.477).

School location	Q18.7: I need educational training on how to use the Map				School location total
	Agree	Neutral	Disagree	Don't know	
Campus schools	3 (19%)	0 (0%)	12 (75%)	1 (6%)	16 (100%)
Clinical schools	11 (50%)	7 (32%)	3 (14%)	1 (4%)	22 (100%)
Centre	0 (0%)	0 (0%)	1 (100%)	0 (0%)	1 (100%)
Total	14 (36%)	7 (18%)	16 (41%)	2 (5%)	**39 (100%)**

Table 24: Cross-tabulation of respondents' staff type and item response showing cell counts and percentages, and a significant Fisher's exact test result (FET (*n* = 39) = 11.203, *p* = 0.038, *Cramer's V* = 0.396).

School location	Q18.8: There is too much information duplication between the Map, course guides and WebCT Vista/Blackboard course sites				School location total
	Agree	Neutral	Disagree	Don't know	
Campus schools	6 (38%)	4 (25%)	5 (31%)	1 (6%)	26 (100%)
Clinical schools	5 (23%)	11 (50%)	1 (4%)	5 (23%)	22 (100%)
Centre	0 (0%)	0 (0%)	1 (100%)	0 (0%)	1 (100%)
Total	11 (28%)	15 (38%)	7 (18%)	6 (15%)	**39 (100%)**

The following FET and cross-tabulation results are for the 17 Map users who were principal teachers, course convenors, co-convenors and/or DIG members:

Table 25: Cross-tabulation of respondents' staff type and item response showing cell counts and percentages, and a significant Fisher's exact test result (FET (*n* = 17) = 10.392, *p* = 0.040; *Cramer's V* = 0.617).

Staff type	Q20.9: I've got too much other work to do to be completing Map forms				Staff type total
	Agree	Neutral	Disagree	Don't know	
Academic	4 (29%)	1 (7%)	8 (57%)	1 (7%)	14 (100%)
General	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)
Conjoint	1 (100%)	0 (0%)	0 (0%)	0 (0%)	1 (100%)
Total	5 (29%)	3 (18%)	8 (47%)	1 (6%)	17 (100%)

Table 26: Cross-tabulation of respondents' staff type and item response showing cell counts and percentages, and a significant Fisher's exact test result (FET (*n* = 17) = 12.671, *p* = 0.026; *Cramer's V* = 0.713).

Staff type	Q20.11: I don't get any staff recognition for entering information in the Map				Staff type total
	Agree	Neutral	Disagree	Don't know	
Academic	11 (79%)	2 (14%)	0 (0%)	1 (7%)	14 (100%)
General	0 (0%)	0 (0%)	2 (100%)	0 (0%)	2 (100%)
Conjoint	1 (100%)	0 (0%)	0 (0%)	0 (0%)	1 (100%)
Total	12 (70%)	2 (12%)	2 (12%)	1 (6%)	17 (100%)

Information technology factors

The following FET and cross-tabulation results are for all 39 UMP Map users.

Table 27: Cross-tabulation of respondents' school location and item response showing cell counts and percentages, and a significant Fisher's exact test result (FET (*n* = 39) = 18.562, *p* = 0.003, *Cramer's V* = 0.482).

School location	Q23.1: I find the quality of information in the Map for Phase 1 is good				School location total
	Agree	Neutral	Disagree	Don't know	
Campus schools	11 (69%)	0 (0%)	4 (25%)	1 (6%)	16 (100%)
Clinical schools	7 (32%)	5 (23%)	0 (0%)	10 (45%)	22 (100%)
Centre	1 (100%)	0 (0%)	0 (0%)	0 (0%)	1 (100%)
Total	19 (49%)	5 (13%)	4 (10%)	11 (28%)	**39 (100%)**

Table 28: Cross-tabulation of respondents' school location and item response showing cell counts and percentages, and a significant Fisher's exact test result (FET (n = 39) = 11.676, p = 0.031, *Cramer's V* = 0.388).

School location	Q23.4: I find the Map information to be readable, clear and well formatted				School location total
	Agree	Neutral	Disagree	Don't know	
Campus schools	6 (37%)	3 (19%)	7 (44%)	0 (0%)	16 (100%)
Clinical schools	5 (23%)	8 (36%)	3 (14%)	6 (27%)	22 (100%)
Centre	1 (100%)	0 (0%)	0 (0%)	0 (0%)	1 (100%)
Total	12 (31%)	11 (28%)	10 (26%)	6 (15%)	**39 (100%)**

Table 29: Cross-tabulation of respondents' school location and item response showing cell counts and percentages, and a significant Fisher's exact test result (FET (n = 39) = 11.546, p = 0.034, *Cramer's V* = 0.382).

School location	Q23.5: I find the Map information easy to understand				School location total
	Agree	Neutral	Disagree	Don't know	
Campus schools	7 (44%)	6 (37%)	3 (19%)	0 (0%)	16 (100%)
Clinical schools	2 (9%)	11 (50%)	4 (18%)	5 (23%)	22 (100%)
Centre	1 (100%)	0 (0%)	0 (0%)	0 (0%)	1 (100%)
Total	10 (25%)	17 (44%)	7 (18%)	5 (13%)	**39 (100%)**

Table 30: Cross-tabulation of respondents' school location and item response showing cell counts and percentages, and a significant Fisher's exact test result (FET (n = 39) = 12.090, p = 0.027, *Cramer's V* = 0.388).

School location	Q23.7: I find the Map simple to use				School location total
	Agree	Neutral	Disagree	Don't know	
Campus schools	10 (63%)	1 (6%)	4 (25%)	1 (6%)	16 (100%)
Clinical schools	3 (14%)	5 (23%)	10 (45%)	4 (18%)	22 (100%)
Centre	1 (100%)	0 (0%)	0 (0%)	0 (0%)	1 (100%)
Total	14 (36%)	6 (15%)	14 (36%)	5 (13%)	**39 (100%)**

Organisational factors

The following FET and cross-tabulation results are for all 39 UMP Map users.

Table 31: Cross-tabulation of respondents' staff type and item response showing cell counts and percentages, and a significant Fisher's exact test result (FET (n = 39) = 16.268, p = 0.012, *Cramer's V* = 0.436).

Staff type	Q27.8: In general I use the Map on my own				Staff type total
	Agree	Neutral	Disagree	Don't know	
Academic	13 (65%)	1 (5%)	5 (25%)	1 (5%)	20 (100%)
General	10 (100%)	0 (0%)	0 (0%)	0 (0%)	10 (100%)
Conjoint	3 (50%)	3 (50%)	0 (0%)	0 (0%)	6 (100%)
Casual*	1 (33%)	1 (33%)	0 (0%)	1 (33%)	3 (100%)
Total	27 (69%)	5 (13%)	5 (13%)	2 (5%)	**39 (100%)**

*Casual: includes casual, sessional, affiliated or visiting staff.

Table 32: Cross-tabulation of respondents' staff type and item response showing cell counts and percentages, and a significant Fisher's exact test result (FET (*n* = 38) = 13.068, *p* = 0.023, *Cramer's V* = 0.379).

School location	Q27.2: I found out about the Map by chance				School location total
	Agree	Neutral	Disagree	Don't know	
Campus schools	2 (12%)	0 (0%)	14 (88%)	0 (0%)	16 (100%)
Clinical schools	6 (29%)	6 (29%)	8 (38%)	1 (4%)	21 (100%)
Centre	0 (0%)	0 (0%)	1 (100%)	0 (0%)	1 (100%)
Total	8 (21%)	6 (16%)	23 (60%)	1 (3%)	**38 (100%)**

The following FET and cross-tabulation result is for the 17 Map users who were principal teachers:

Table 33: Cross-tabulation of respondents' staff type and item response showing cell counts and percentages, and a significant Fisher's exact test result (FET (*n* = 17) = 7.525, *p* = 0.027, *Cramer's V* = 0.721).

School location	Q28.1: Usually a general staff member completes and updates my Map forms online for me				School location total
	Agree	Neutral	Disagree	Don't know	
Campus schools	0 (0%)	1 (8%)	11 (92%)	0 (0%)	12 (100%)
Clinical schools	2 (40%)	0 (0%)	2 (40%)	1 (20%)	5 (100%)
Total	2 (12%)	1 (6%)	13 (76%)	1 (6%)	**17 (100%)**

Section 6—Comparison of Scores for the Types, Effects and Factors of Map Use

What follows are the statistically significant cross-tabulation results between the summated scores of respondents to sets of items in Sections 3 to 7 of the survey (i.e. items on the types, effects or factors of Map use). Results between the total score for each section and the staff demographics variables (i.e. staff type or school location variables) were not statistically significant. However, some results between the total scores for the types Map use (Question 16) or the effects of Map use (Question 17) and the personal, technical or organisational factors affecting Map use (Questions 18 to 30) were statistically significant, as shown below.

Types of Map use

Table 34: Cross-tabulation of respondents' total scores for types of Map use (Q16) and personal factors affecting Map use (Q18), showing cell counts and percentages, and a significant Fisher's exact test result (FET (*n* = 39) = 21.576, *p* < 0.001; *Cramer's V* = 0.541).

Total score for types of Map use (Q16)	Total score for personal factors affecting Map use by all Map users (Q18)			Types of Map use total
	Negative (<=-1)	Neutral (0)	Positive (>=+1)	
Nil (0)	3 (50%)	3 (500%)	0 (0%)	6 (100%)
Low (1 to 5)	5 (38%)	3 (23%)	5 (38%)	13 (100%)
Medium (6 to 10)	1 (7%)	0 (0%)	14 (93%)	15 (100%)
High (11 and above)	0 (0%)	0 (0%)	5 (100%)	5 (100%)
Total	9 (23%)	6 (15%)	24 (62%)	**39 (100%)**

Table 35: Cross-tabulation of respondents' total scores for types of Map use (Q16) and technical factors affecting Map use (Q23), showing cell counts and percentages, and a significant Fisher's exact test result (FET (*n* = 39) = 14.264, *p* = 0.011; *Cramer's V* = 0.472).

Total score for types of Map use (Q16)	Total score for technical factors affecting Map use by all Map users (Q23)			Types of Map use total
	Negative (<=-1)	Neutral (0)	Positive (>=+1)	
Nil (0)	0 (0%)	4 (67%)	2 (33%)	6 (100%)
Low (1 to 5)	6 (46%)	3 (23%)	4 (31%)	13 (100%)
Medium (6 to 10)	2 (13%)	1 (7%)	12 (80%)	15(100%)
High (11 and above)	2 (40%)	0 (0%)	3 (60%)	5 (100%)
Total	10 (26%)	8 (20%)	21 (54%)	**39 (100%)**

Table 36: Cross-tabulation of respondents' total scores for types of Map use (Q16) and organisational factors affecting Map use (Q26), showing cell counts and percentages, and a significant Fisher's exact test result (FET (*n* = 39) = 11.940, *p* = 0.014; *Cramer's V* = 0.441).

Total score for types of Map use (Q16)	Total score for organisational factors affecting Map use by all Map users (Q26)			Types of Map use total
	Negative (<=-1)	Neutral (0)	Positive (>=+1)	
Nil (0)	1 (17%)	3 (50%)	2 (33%)	6 (100%)
Low (1 to 5)	3 (23%)	0 (0%)	10 (77%)	13 (100%)
Medium (6 to 10)	0 (0%)	2 (13%)	13 (87%)	15 (100%)
High (11 and above)	0 (0%)	0 (0%)	5 (100%)	5 (100%)
Total	4 (10%)	5 (13%)	30 (77%)	**39 (100%)**

Effects of Map use

Table 37: Cross-tabulation of respondents' total scores for effects of Map use (Q17) and personal factors affecting Map use (Q18), showing cell counts and percentages, and a significant Fisher's exact test result (FET (*n* = 39) = 15.549, *p* = 0.001; *Cramer's V* = 0.496).

Total score for effects of Map use (Q17)	**Total score for personal factors affecting Map use by all Map users (Q18)**			**Effects of Map use total**
	Negative (<=-1)	**Neutral (0)**	**Positive (>=+1)**	
Negative (<=-1)	4 (57%)	0 (0%)	3 (43%)	7 (100%)
Neutral (0)	2 (29%)	4 (57%)	1 (14%)	7 (100%)
Positive (>=+1)	3 (12%)	2 (8%)	20 (80%)	25 (100%)
Total	9 (23%)	6(15%)	24 (61%)	**39 (100%)**

Table 38: Cross-tabulation of respondents' total scores for effects of Map use (Q17) and personal factors affecting Map use by course convenors and DIG members (Q22), showing cell counts and percentages, and a significant Fisher's exact test result (FET (*n* = 12) = 9.484, *p* = 0.009; *Cramer's V* = 0.833).

Total score for effects of Map use (Q17)	**Total score for personal factors affecting Map use by course convenors and DIG members (Q22)**			**Effects of Map use total**
	Negative (<=-1)	**Neutral (0)**	**Positive (>=+1)**	
Negative (<=-1)	2 (50%)	0 (0%)	2 (50%)	4 (100%)
Neutral (0)	0 (%)	1 (100%)	0 (0%)	1 (100%)
Positive (>=+1)	0 (0%)	0 (0%)	7 (100%)	7 (100%)
Total	2 (17%)	1 (8%)	9 (75%)	**12 (100%)**

Table 39: Cross-tabulation of respondents' total scores for effects of Map use (Q17) and technical factors affecting Map use (Q23), showing cell counts and percentages, and a significant Fisher's exact test result (FET (*n* = 39) = 9.513, *p* = 0.025; *Cramer's V* = 0.385).

Total score for effects of Map use (Q17)	**Total score for technical factors affecting Map use by all Map users (Q23)**			**Effects of Map use total**
	Negative (<=-1)	**Neutral (0)**	**Positive (>=+1)**	
Negative (<=-1)	4 (57%)	1 (14%)	2 (29%)	7 (100%)
Neutral (0)	1 (14%)	4 (57%)	2 (29%)	7 (100%)
Positive (>=+1)	5 (20%)	3 (12%)	17 (68%)	25 (100%)
Total	10 (26%)	8 (20%)	21 (54%)	**39 (100%)**

Appendix R: Study 3—Classification of Open-Ended Responses

This appendix includes all original responses for the two open-ended questions at the end of the survey (i.e. Questions 41 and 42), classified according to the factors identified from the qualitative study (Study 1), the categories and levels in the SUV evaluation model, and the general type of issue.

Table 1: Question 41 (open-ended question)—original comments made about the Map and its use, and classified according to the factors from the qualitative study, the SUV evaluation categories and levels, and the general issue.

ID	**Q41. Original comments divided into sentences/sections containing a common theme**	**Qualitative study results**		**SUV model**		**Issue**
		Category	**Factor**	**Cat.**	**Level**	
33	Overall = is pretty good and many colleagues in other institutions are envious of this tool	User	Attitude	1	3	Pretty good overall. Others in other institutions are envious of it
63	When teaching part of the course I usually have to rely on secretarial staff to see whether anything useful is available. Often it is not.	Organisational	Culture	2	1	Relying on secretarial staff to see whether anything useful is available (access problem or habit?). Often no useful information available (judged by secretarial staff?)
		User	Knowledge			
57	Whenever I am doing something new, I appreciate VERY clear instructions.	User	Knowledge Needs	3	1	Need clear instructions on how to use it
57	I don't know enough about the map to use it effectively.	User	Knowledge	3	1	Don’t know how to use effectively
120	I hope it's clear from my answers above that I have hardly used the Map and am not really familiar with what it offers.	User	Knowledge Needs	3	1	Hardly used it. Not very familiar with what it offers.
120	I have managed to get information from eMed as required, but I am unaware how much more efficiently or satisfyingly the Map might have provided me with that information	User	Knowledge Needs	3	1	Not very familiar with the information it provides
125	It will be tremendously helpful to have a course to visually observe the depth the use of the map has to offer...	User	Knowledge Needs	3	1	Would be tremendously helpful to have a course to visually observe the depth of use the Map has to offer

ID	Q41. Original comments divided into sentences/sections containing a common theme	Qualitative study results		SUV model		Issue
		Category	Factor	Cat.	Level	
42	Used twice only. 1st - ok, 2nd - access not allowed to students portfolios	User	Knowledge	3	2	(Apparent confusion between Map and Portfolio)
134	I still find eVista easier to navigate than eMed. eVista remains my preference as a starting point, even though it usually links me to eMed at some point. It's easier to find course material in eVista.	Technical	IT features Other IT	3	2	Vista easier to navigate and to find course material than eMed
33	Map is very useful but like all such systems it works best when everyone uses it to the same level.	User	Attitude Knowledge	7	1	Map very useful Works best when everyone uses to the same level
		Organisation	Culture			
33	...and clinical teachers seem to use the LAFs less well.	User	Knowledge	7	1	Clinical teachers seem to use LAFs less well
39	As there are many access levels to the Map and emed sometimes certain teachers cannot have access to resources they require which can be frustrating.	Technical	IT features	4	2	Access by certain teachers prevented due to existence of many access levels
		Organisational	Administration Central services			
57	Many conjoints don't use the map because of access problems.	Organisational	Administration Central services	4	2	Many conjoint staff do not use the Map because of access problems
		Technical	IT features			
		Technical	Data			
33	Newer version is less labile, more user-friendly (eg search and download function)	Technical	IT features	6	2	Newer version more stable and user-friendly
61	Searchability by disciplines or topic areas, to provide graphically displayed maps of learning in disciplines, or by topics, is greatly needed.	User	Needs	6	2	Great need for graphically displayed maps of searches by disciplines or topics
		Technical	IT features			
33	The map would be much more useful if links between the content were visible (eg a diagram map showing the content links).	User	Needs	6	2	Would be much more useful if links between content were visible (e.g. a diagram map showing content links)
		Technical	IT features			

ID	Q41. Original comments divided into sentences/sections containing a common theme	Qualitative study results		SUV model		Issue
		Category	Factor	Cat.	Level	
57	The map can be slow.	Technical	IT features	6	2	Can be slow
		Organisational	Central services			
57	The map can crash.	Technical	IT features	6	2	Can crash
		Organisational	Central services			
57	I don't find the map easy to navigate.	Technical	IT features	6	2	Not easy to navigate
63	I use the system as little as possible as I have found it so user unfriendly.	Technical	IT features	6	2	User-unfriendly
105	As a former teacher, I found the Map impossible to navigate - a total waste of time.	Technical	IT features	6	2	Impossible to navigate. Waste of time
		User	Perspective or attitude			
61	I don't think the system comes close to providing accurate information on teaching workloads - still many things to do to make that achievable	Organisational	Management	6	2	Does not provide accurate information on teaching workload, and still many things to do to make this achievable
		Technical	Data IT features			
33	Phase 2 and 3 LAFs are improving but students find them less useful I believe...	User	Needs	6	3	Phase 2 and Phase 3 LAFs are improving but students find them less useful
63	Students have often not read material they should have read before a CMT tutorial, either because it is not there (and I use last year's material) or it is not available in time.	Technical	Data	6	3	Information in Map either not available or not available on time
		Organisational	Administration			
125	...Even doing this questionnaire has motivated me to explore the use of the map bit further. I would like to be able to be part of a hands on group to explore the uses of the map.	User	Knowledge Needs	7	3	Doing questionnaire motivated user to explore the Map's use a bit further, and they would like to be part of a hands on group to explore Map's use.
		Organisation	Culture Communication			

*SUV categories: (1) goal-seeking; (2) hierarchy and relations; (3) differentiation and entropy; (4) inputs; (5) transformation process; (6) outputs; (7) regulations.
*SUV levels: (1) individual; (2) technology; (3) organisation.

Table 2: Question 42 (open-ended question) - Comments about other eMed systems or IT systems used in the UMP, classified according to the factors from the qualitative study, the SUV evaluation categories and levels, and the general issue.

ID	Q42. Comments divided into sentences/sections containing a common theme	Qualitative study results		SUV model		Issue
		Category	Factor	Cat.	Level	
105	eMed appears to be designed to create the impression of quality education.	User	Attitude	1	3	Appears designed to create impression of quality education
		Organisational	Communication Culture			
105	I found eMed to be a nightmare-warren of arcane jargon and pretentiousness - a disservice to the education of future doctors.	User	Attitude Knowledge	1	3	Warren of arcane jargon and pretentiousness Disservice to the education of future doctors
		Technical	Data			
71	The use of Emed controlled by local coordinators sometimes limits its efficiency.	Organisational	Management Administration	2	3	Local coordinator control of eMed can limit its efficiency
134	It's easier to find course material in Evista.	Technical	IT features Other IT	3	2	Easier to find course material in Vista
33	As a convenor I find that Tracking works well on the whole (except when it crashes - although it seems more stable these days).	User	Needs	3	2	Tracking works well Crashes though now more stable
		Technical	IT features			
134	Evista remains my preference as a starting point, even though it usually links me to emed at some point.	User	Needs	3	2	Prefers Vista as starting point
134	I still find evista easier to navigate than emed.	Technical	Other IT	3	2	Vista easier to navigate than eMed
		Organisational	Central services			
105	The university Vista system was always more reliable and user-friendly.	Technical	IT features Other IT	3	2	Vista system more reliable and user-friendly
		Organisational	Central services			

ID	Q42. Comments divided into sentences/sections containing a common theme	Qualitative study results		SUV model		Issue
		Category	**Factor**	**Cat.**	**Level**	
33	I reckon that eMed functions could be used to do more than currently offered (e.g. monitoring / mentoring Assignment and project marking, a real map to show content links to aid students to study across topics rather than activities etc.)	User	Needs	6	2	eMed functions could do more - e.g. monitoring / mentoring assignment and project marking; a real map to show content links to aid students to study across topics rather than activities
		Technical	IT features Data			
39	Emed sometimes can be very slow to load and work with	Technical	IT features	6	2	eMed sometimes slow to load and work with
		Organisational	Central services			

*SUV categories: (1) goal-seeking; (2) hierarchy and relations; (3) differentiation and entropy; (4) inputs; (5) transformation process; (6) outputs; (7) regulations.
*SUV levels: (1) individual; (2) technology; (3) organisation.

Appendix S: Study 2—Classification of Key Findings

This appendix includes the key findings from Study 2 (i.e. the web log and data linkage study), classified according to the factors affecting Map use identified in the qualitative study (Study 1) and the categories and levels of the SUV evaluation model by Jokela et al. (2008).

Table 1: Summary of key research findings from Study 2 classified by the categories and levels of the SUV evaluation model and the factors affecting Map use from Study 1.

Key finding from the web log and data linkage study (Study 2)	Study 2: Part [1]	Study 1: Factor[2]	SUV model*	
			*Cat.	*Level
Results from Study 2 provided evidence in favour of H_1 since there were many statistically significant relationships between Map use and staff member characteristics, and the existence of sub-groups of Map users was also evident.	P2A and P2B	Knowledge Need	2	1
Significantly more UMP academic staff and general staff had used the Map and significantly fewer UMP conjoint staff had used it.	P2A	Knowledge Need	2	1
Over 80% of Phase 1 facilitators, group members, administrators and convenors had used the Map, but 18% of UMP convenors (14 of 76 convenors) had not used it.	P2A	Knowledge Need	2	1
A total of 24 UMP staff (3.9% of 610 UMP Map users) had accessed the Map Help site for meaningful session durations in seven years. Most were academic staff, from campus schools, aged between 40 and 59 years, and with UMP roles of eMed Timetable teacher, Principal teacher and/or Phase 1 facilitator.	P3	Knowledge Need	2	1
Nine of the top 10 users were from MESO; the top user was the general staff member in charge of the Map and the UMP learning resources; and the Associate Dean of Education since 2006 was amongst the top ten users. The top six Map users had performed over 800 sessions each in seven years.	P2B	Knowledge Need Advocacy	3	1
A total of 77 UMP Map users (15% of 507) performed over 50 meaningful sessions in seven years. There was no significant association between their Map use and staff demographics. Most of their roles were as eMed Timetable teacher, P1 Facilitator, Principal Teacher and/or Committee/Group member, about one third were convenor roles, about one fifth were administrator roles and none were Primary Care clinical teacher roles.	P2B	Knowledge Need Advocacy	3	1
Almost 17% of UMP Map users used it for less than 1 minute in seven years (non-meaningful use). These users may have accessed the Map by mistake, did not know what it was for or how to use it, or saw no need to use it after a very short visit. Significantly more were metropolitan clinical school staff.	P2B	Knowledge Need	3	1
Conjoint staff and clinical school staff members either did not use the Map, used it for non-meaningful session	P2A and P2B	Knowledge	3	1

Key finding from the web log and data linkage study (Study 2)	Study 2: Part [1]	Study 1: Factor[2]	SUV model*	
			*Cat.	*Level
durations or used it very infrequently (1-2 sessions in 7 years), which may indicate that these staff members either did not know about the Map, did not know how to use it or did not see the need to use it.		Need		
Overall, the Map Help site had barely been used (24 meaningful UMP users in 7 years). Possible reasons could be that staff did not know the help site existed, did not find it useful or easy to use, or chose to use trial and error instead of seeking online help.	P3	Knowledge Need	5	1
The most visited Map Help pages were (in decreasing order) the user instruction pages for principal teachers, for all staff, and for facilitators/tutors. The Glossary section had the most sessions overall, and the most visited pages in the Glossary were the Thesaurus, Content Topic and Theme pages. The Search Engine page on how to use exports (for Designers) had the second longest average session duration.	P3	Knowledge Need	5	1
Yearly results for meaningful UMP Map users showed that: (a) total session users rose from 132 (2004) to 206 (2010), (b) median scores for total sessions ranged from 5 to 7; (c) median scores for session durations ranged from 47 minutes (2004) to 18 minutes (2008) and (d) median scores for session events ranged from 212 (2004) to 72 (2008).	P2B	Effect	5	1
Meaningful UMP Map users had a median score of 9 sessions over seven years in total. However, the top 77 UMP Map users had used it much more frequently and for much longer session durations indicating that patterns of use varied between sub-groups of UMP Map users.	P2B	Need Knowledge	5	1
Of the 610 UMP Map users, 103 (16.9%) used the Map for a total of less than 1 minute in seven years, and 507 (83.1%) used it for a total of 1 minute or more in seven years.	P2B	Knowledge	5	1
The IT system seemed stable since few system errors were recorded in the access web logs.	P1	IT feature	4	2
Most users were accessing the Map through eMed-supported browsers and operating systems.	P1	IT feature	4	2
Staff members accessed the Map at all times of the day and from various geographical locations in Australia and overseas, although mostly accessed during working hours and within NSW were the Medical Faculty is located.	P1	IT feature	6	2
The Map form accessed the most was the LAF; the attachments accessed the most were PDF and MP3 files; and the Excel file for exporting Search results was rarely accessed.	P1	Data and data-structure	6	2
More UMP general staff (77.7%) than teaching staff (43.5%) used the Map, which may indicate that the Map was being used more for administrative reasons than learning and teaching reasons.	P2A	Administration	1	3
Use of the Map was not evenly distributed across staff types or school locations, with the common pattern being that conjoint and clinical school teaching staff used the Map significantly less often than campus school teaching staff or general staff (H_1).	P2B	Culture	2	3

Key finding from the web log and data linkage study (Study 2)	Study 2: Part [1]	Study 1: Factor[2]	SUV model*	
			*Cat.	*Level
Six of the 10 top Map users were general staff reflecting the importance of having administrative staff to manage such a system. It was promising to see that the Associate Dean of Education since 2006 was amongst the top ten Map users.	P2B	Administration Management	2	3
There were different patterns of Map use amongst staff members. This could have been due to a lack of understanding by conjoint staff and clinical school staff in particular on how to use the Map, a lack of training or a lack of perceived or actual need to use it.	P2A and P2B	Communication Management	3	3
School location and staff type were the two variables that were significantly associated with different patterns of Map use from year to year. This result lends support to the idea that staff training may need to be based around school locations such as clinical schools, as well as around staff types such as conjoint staff.	P2B	Management Administration	3	3
Overall, results from Study 2 show that there were distinct Map user population groups and that each of these groups may have specific uses of the Map as well as specific training needs. This information can help senior UMP managers and administrators decide which groups need training, and what type of training they need.	P2B	Management Administration	3	3
About 33% of UMP roles were held by staff without a staff ID number (79.6% of Primary Care teacher role, 33.7% of eMed Timetable teacher role and 14.5% of Principal teacher role). These staff could not access the Map with their own staff ID number.	P2A	Central services	4	3
While more UMP staff accessed the Map each year, their general Map use did not increase as indicated by the duration of sessions and number of session events. This pattern may reflect different stages in the development and review of the curriculum from year to year, or be due to one-off events such as staff training whereby user numbers increased temporarily but overall use was not sustained over time.	P2B	Management Administration	5	3
Of the 1292 UMP staff between January 2004 and December 2010, less than half (507 or 39.2%) used the Map for meaningful session durations while most (785 or 60.8%) either did not use it or used it for non-meaningful session durations.	P2A	Communication Culture	5	3
The top 10 and top 77 Map users could be encouraged to become Map champions who promote the use of the Map amongst their colleagues, and help them learn how to use the Map and exploit its educational potentials. They could also form a community of practice.	P2B	Culture Communication	7	3

[1] Study 2 Chapter part: (P1) collective patterns of Map use; (P2A) patterns of Map users and non-users; (P2B) patterns of UMP Map user; (P3) Map Help use

[2] Study 1: individual, technical and organisational factors affecting Map use

* SUV categories: (1) goal-seeking; (2) hierarchy and relations; (3) differentiation and entropy; (4) inputs; (5) transformation process; (6) outputs; (7) regulations

* SUV levels: (1) individual; (2) technology; (3) organisation

References

American Psychological Association. (2010). *Publication manual of the American Psychological Association* (6th ed.). Washington, DC: American Psychological Association.

Gable, Guy G., Sedera, Darshana, & Chan, Taizan (2008). Re-conceptualizing information system success: The IS-Impact Measurement Model. *Journal of the Association for Information Systems, 9*(7), 1-32.

Jokela, P., Karlsudd, P, & Östlund, M. (2008). Theory, methods and tools for evaluation using a systems-based approach. *The Electronic Journal of Information Systems Evaluation, 11*(3), 197-121.