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Title: What do Deep and Surface Approaches to Learning mean for medical students and medical education?

Short Title: Medical Students and Approaches to Learning

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Abstract: Approaches to learning refer to the manner in which students engage in learning tasks. Approaches encompass two significant aspects of learning – motivation to learn and the choice of learning strategies that students make. Research has identified two distinctly different approaches that can be broadly categorised as *deep* or *surface* approaches to learning. A number of studies have established an association between deep approaches to learning and qualitatively better learning outcomes, which are characterised by a high level of understanding. Although recent increases in graduate admissions have clouded the issues somewhat, medical students, on entry to undergraduate medicine programs are the highest achieving group among their peers. How do their approaches to learning fit the paradigm? Are they consistently deep learners? This article explores the literature on approaches to learning, together with some preliminary data from a study in progress with Australian and Sri Lankan medical students. It considers some of the implications for medical education and raises further questions about the factors that determine students' approaches to learning.

Key words: Medical Students, Medical Education, Deep and Surface Approaches to Learning, curricular change, innovation, higher quality learning outcomes

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Introduction

Medical students in Australia are a very select group. In order to enter the Australian medical school involved in this study, students¹ had to achieve a tertiary entrance rank which put them in the top 0.5 percent (99.5 percentile) of their matriculation cohort. It is not possible to achieve this level of academic success without a high level of intelligence, a high degree of motivation and mastery of a range of successful learning strategies.

Entry to Medicine in Sri Lankan universities is based on criteria similar to those used in the Australian medical school. The criteria differ only in that in Sri Lanka, the criteria are applied nationally as well as to each geographic area. 40% of the available places are allocated to the top 0.5% of each matriculation cohort. The remaining places are allocated to the top achievers in each district, in an attempt to ensure regional equity.

What happens to these students and how do they approach learning when they enter into the study of medicine?

Undergraduate medical education aims to produce ethical and caring doctors with a clear understanding of medical sciences, clinical skills, problem solving skills and sound judgement. The everyday practice of medicine, however, requires practitioners to have access to a large amount of factual information in order to utilise the above capabilities in relation to clinical problems. This bank of factual information, often constructed by memorisation, has been seen as a prerequisite to the learning and practice of many clinical skills in medicine. Until recently this focus on acquiring factual information has tended to play a dominant role in the early years of undergraduate medical education. Recent trends in medical education

¹ Except for a small proportion of rural students who were chosen by other criteria and overseas fee paying students

have drawn attention to this disproportionate emphasis on memorising factual information, out of context and often at the cost of understanding (General Medical Council 1993; 2003).

The nature of this problem can be seen in students' perceptions of learning in medicine, reflected in statements such as 'memorisation is the only way to learn medicine' and 'you've got to remember all the little details'. These perceptions have emerged from interviews with medical students as part of an ongoing research project that is currently being conducted by the authors.

The study in progress

This research project is largely qualitative in nature and is set in two medical schools, one in Australia and the other in Sri Lanka. Both schools utilised traditional teaching programs at the time of data collection. The programs were similar in structure, but no other assumptions are made with regard to comparability of the two programs.

Initial data collection was done on first and second year medical students at a medical school in Australia (n=44). Subsequently we were interested to find out whether the approaches to learning which were observed in this component of the study were an artefact of a particular context or could also be found in other settings in medical education. In order to explore this question, we decided to carry out a similar data collection on a group of very different medical students at a different medical school in a different country (n=34). Our choice of country and medical school was influenced by practical considerations and was somewhat opportunistic.

Data collection in both countries consisted of administering the R-SPQ-2F (Biggs, Kember and Leung 2001) before and towards the end of a discrete educational module, and the collection of a wide range of qualitative data through interviews and written responses to open

ended questions. This included data relating to prior learning experience and experience during the module. Ethical clearance for each of the projects was obtained from the ethics committees of both medical schools.

Key issues that were addressed

Preliminary findings of the above study suggest that memorisation and recall of facts, rather than development of understanding and the ability to apply principles, continues to play a major role in medical education in both study samples. This problem has been recognised more widely in the medical education literature (General Medical Council 1993; 2003). A number of curricular innovations aimed at encouraging deeper approaches, greater understanding, and qualitatively higher learning outcomes, have been implemented in response. In this paper we explore the factors reported in the literature as encouraging deep approaches to learning, and compare them with those emerging from our own study. We relate these to recent curricular innovations in medical education and their associated costs and benefits and raise questions for further research.

The concept of approaches to learning

An 'approach to learning' refers to the manner in which a student engages a learning task. It encompasses two significant aspects of learning: motivation to learn and the choice of learning strategy. Marton & Saljo (1976) first identified two distinctly different approaches which they categorised as *deep* and *surface* approaches to learning. Their research method involved interviewing students immediately after they had completed a learning task. In this way they were able to distinguish students who aimed to achieve a *deep* understanding, reconciling new information with what they already knew, and students who only looked for a *surface* or superficial understanding, focusing on the kinds of isolated facts which might be

reproducible on a test but which meant little to the student. They found that these different processes used by different students, accounted for qualitatively different learning outcomes.

Independently, researchers in the UK and Australia were also investigating the ways students went about learning (Biggs 1979; Entwistle and Ramsden 1982). These early studies used factor analysis of questionnaires on study intentions and behaviour and produced remarkably similar results to those of Marton & Saljo (1976). The deep and surface approaches stood out as consistent and fundamentally different approaches to studying.

Entwistle and Ramsden (1981) developed the Approaches to Study Inventory (ASI) and Biggs (1979) developed the Study Process Questionnaire (SPQ) as ways of measuring students' approaches to learning. These instruments have gone through many phases of evolution since their original conception and have been used in many research studies (Biggs and Moore 1993; Biggs and Watkins 1996; Biggs, Kember and Leung 2001; Entwistle and Kozeli 1985; Entwistle, McCune and Walker 2001). The ongoing research by the authors of this article used Biggs's revised two-factor Study Process Questionnaire R-SPQ-2F (Biggs, Kember and Leung 2001). This instrument measures approaches to learning by scores on Deep and Surface scales. The maximum score on each scale is 50.

Approaches to learning as a combination of motive and strategy

An Approach consists of motive and strategy components, and these components are responsive to, and therefore dependent on the learning context.

The Surface Approach

A Surface Approach consists of an extrinsic motive combined with surface strategies.

Motivation is considered extrinsic when the student is driven by either positive or negative consequences of the act of learning, rather than by learning itself. This could be in the form of a preoccupation with gaining paper qualifications, or the fear of failure. In this situation, the student's willingness to engage with the meaning of the learning task is minimal.

Learning strategies are considered surface when a student attempts to do the bare minimum to meet the requirements of a learning task. These strategies often involve *rote learning*, characterised by a focus on discrete elements or details, with the intention of reproducing them when required by teachers or tests, and by disregard for the relationships among the elements learnt and the overall meaning (Biggs and Moore 1993; Biggs 2003).

In our work to date with Sri Lankan and Australian medical students we have found that notwithstanding their previous learning success and their high level of ability, the surface approach is alive and well. Here is a first year student from Australia talking about the way he learns:

Well, if a lecture is interesting, I'd listen to it, I won't retain too much of it.

Essentially, most of my learning comes from cramming for exams. Pracs are nice, if you listen during the lecture they are interesting, if you don't, they are boring. But the majority of your learning and the whole coming together thing happens during exam time. ... But just because I'm lazy I don't come back to it.

(Australian medical student. Scores on the Revised Study Process Questionnaire:

Deep = 15, Surface = 24)

If you thought that more advanced students might be better able to see the relationship between their studies and their future clinical practice, here is a final year Sri Lankan student illustrating that other factors may still get in the way and produce a surface approach:

When we get a case we try to read that topic or refer lecture notes. ... Time for preparation for exams is not enough. Every third day is casualty, 5 days of shadow house officer and weekend casualty causes less time to study. ... Yes (I) have to memorise. Can't keep all the subject matter in my brain. We already forget (what we learned in) first two (clinical) appointments. ... We always under stress, fear about exam and our future.

(Sri Lankan medical student. Scores on the Revised Study Process Questionnaire:

Deep = 26, Surface = 30)

The Deep Approach

The deep approach combines intrinsic motivation with deep learning strategies that focus on understanding. Intrinsic motivation is characterised by interest in the subject material, and an intention to seek meaning. Deep learning strategies aim to maximise understanding and the student focuses on finding the main ideas, themes and principles (Biggs and Moore 1993; Biggs 2003).

This final year Sri Lankan student exemplifies a deep approach. Medical academics might welcome his obvious passion for medicine but may be surprised by his disdain for examination success:

I didn't have any ambition to become a doctor, nor did my parents insist.... Any way I found it very interesting when I came to the Faculty, so I'm continuing. (I learn by) reading, discussing with colleagues, clarifying things by asking questions from HO's (House Officers) Registrars etc. ...No, it is (only a) few facts that need to be memorised. If we can understand the principles and concepts it is easy to work out. Actually I'm not an exam-oriented person. My way of studying is not focused towards the exam – my weak point. No matter whether we have the exam at the end of the appointment or not, I would continue my studying. But I believe there should be some other way to assess whereabouts I am.

(Sri Lankan medical student. Scores on the Revised Study Process Questionnaire:

Deep = 36, Surface = 15)

This first year Australian student expresses a similarly deep interest in the subject matter and a similar disregard for the examination system:

I really enjoy reading up about medical issues, discoveries, scientific work.... I'm a person who tries to fulfil my interests, and if they are not fulfilled, I get disappointed, so I try to fulfil my interests. I'm happy with where I am, I've passed my exams, I'll be content with that for the time being. I think medicine shouldn't be about exams. I'm really disappointed that I hear lots of reports from medical students that we just learn it for the exam and that's that. In the end – that's what it all boils down to – learning for an exam.

(Australian medical student. Scores on the Revised Study Process Questionnaire:

Deep = 41, Surface = 16)

The importance of encouraging a Deep Approach

A number of studies have demonstrated the relationship between approaches to learning, and the quality of the learning outcome. Studies by Marton and Saljo (1976), van Rossum and Schenk (1984), Trigwell & Prosser (1991), Hegerty-Hazel & Prosser (1991) and Crawford et al (1998) have established that students who take a deep approach retain knowledge longer, have better understanding, produce more logical and coherent work and can make more connections between different topics. This evidence provides the basis for using approaches to learning as an indicator of the quality of learning outcomes. It supports the argument that qualitatively higher learning outcomes can be achieved by encouraging deep approaches to learning.

The context dependent nature of Approaches to Learning

A key feature of the approach to learning is its *context-dependent-nature*. This means that the same student is likely to adopt different approaches in response to different learning contexts. A student who adopts a surface approach in response to a learning context that expects factual recall, could adopt a deep approach when faced with a different learning context that values understanding.

The Australian medical student quoted above as taking a deep approach, also said of a particular curriculum innovation in which he took part: 'It really involved investigation, discussion - something which we don't often do in medicine. (We) had to do problem solving, we had to use our brains.' Laurillard (1984) and Ramsden (1992) suggested that such responses to subject matter, teacher and assessment expectations, are at the heart of students' choice of approaches to learning. The student just quoted supports this interpretation with his recognition of and adaptation to the somewhat novel requirements of the curriculum

innovation. Certainly, a raft of recent curriculum innovations in medicine has been built on the premise that if you create the right teaching and assessment conditions then students will respond with appropriately deep approaches to learning, and achieve higher quality learning outcomes.

The impact of the curriculum on approaches to learning

A number of medical schools have introduced Problem Based Learning (PBL) curricula to encourage a greater focus on understanding. In Australia, Newble and Clarke (1986) carried out a landmark study on the impact of problem based curricula on student approaches to learning. Their study compared the approaches to learning of students at a medical school that used a traditional discipline based curriculum (University of Adelaide), with a medical school that uses a PBL curriculum (University of Newcastle). Students' approaches to learning were ascertained by the use of the Approaches to Studying Inventory. (This instrument uses the terms Meaning Orientation for Deep Approach and Reproducing Orientation for Surface Approach.) Students in each university at first, third and final year were compared with the equivalent group in the other university.

With regard to meaning orientation (deep approach), Newcastle students scored higher than Adelaide students in all years. The differences were statistically significant in years one and three. However in the Adelaide group of students, from first to third to final year, the scores rose, indicating that their approach became deeper, as their studies progressed. This difference was also statistically significant.

The score for reproducing orientation (surface approach) displayed a similar but reverse pattern. Newcastle students scored lower than Adelaide students at all years, and these differences were statistically significant.

These findings highlight a number of factors pertinent to medical education. They are supported by the modest success that has been demonstrated for Problem Based Learning in producing students with better clinical skills, albeit with possibly weaker knowledge of science (Albanese and Mitchell 1993).

The approaches to learning adopted by students during the later clinical years in the traditional curriculum were similar to those adopted by students throughout the problem based curriculum. This is in contrast to the more surface approach adopted by students during the discipline-based program in the early years of their traditional curriculum. These findings suggest that changes limited to the early, non-clinical years of the curriculum may be sufficient to achieve a similar pattern of approaches to learning as achieved through a full problem based curriculum. This would have significant and positive resource implications for many medical faculties that are struggling towards curriculum improvement with limited resources.

In the research literature on higher education (university education not confined to medical education) a wide range of curriculum design factors have been found to support deep approaches to learning. They are summarised in the table below.

Table 1 : Teaching and curriculum factors associated with approaches to learning

Factors that encourage Deep Approaches	Factors that encourage Surface Approaches
<i>Trigwell and Prosser (1991)</i>	
Clear goals	Perceptions of high workload
Independence in learning	Assessment that rewards rote learning
<i>Gibbs (1992)</i>	
Learning climate that is safe and supportive	Relatively high (class) contact hours Excessive amount of course material
Environment that facilitates learners taking responsibility for their learning	Lack of opportunity to pursue subjects in-depth
Relevance to practice	Lack of choice over subjects and method of study
Learning by doing	Assessment system that is threatening and anxiety provoking
<i>Biggs (2003)</i>	
Contexts that explicitly bring out the structure of the topic or subject	Contexts that do not highlight the structure of the learning material
Contexts that elicit an active response from students rather than those which expound information	Contexts that assess for independent details rather than structure and relationships
Contexts that confront and eradicate students' misconceptions	Contexts that creates undue anxiety and low expectations of success
Contexts that assess for structure rather than for independent facts	
Contexts that allow students to make mistakes and learn from them	
Contexts that emphasise depth of knowledge over breadth	
Contexts that support the explicit aims and objectives	

Preliminary results from our ongoing study involving medical students from Australia and Sri Lanka have generally supported these findings. However, preliminary analysis of our qualitative data suggests that of all the factors found to promote a deep approach to learning in other studies, three factors play an overwhelming role in shaping the learning experience of the medical students in our study. These three factors are: relevance of learning material to the practice of medicine; students' willingness to accept responsibility for their own learning; and the assessment system.

Relevance of learning material to the practice of medicine

Students in our study frequently expressed the need to understand the relevance of their learning to the practice of medicine. The student quoted below highlights the value of demonstrating the relevance of learning material to students:

Material (in first year) was stuff that I had to rote learn – which I never enjoyed even in school. ... So I found it mostly quite tedious – still do. As you progress, the material starts to be more relevant – you see why you are learning it – so it makes it easier.

(Australian medical student)

The need to be explicit about the clinical relevance of scientific material is linked to another important feature - the need to justify the inclusion of this material in the undergraduate program. Focusing on the relevance of learning material to the practice of medicine provides curriculum planners a basis for prioritising what must be included in their curriculum. This is of utmost importance to counter *information overload* which could push students towards surface approaches (Biggs 2003; Trigwell and Prosser 1991).

Responsibility for own learning

We found that the level of responsibility that students are willing to accept for their learning greatly influenced their perceptions of learning experiences. Accepting responsibility for

one's own on-going learning is a feature of professional life that many educational innovations have attempted to encourage. However, with a willingness to take responsibility for one's own learning comes a concomitant need for a degree of flexibility in the curriculum. Students cannot develop a sense of individual responsibility if all the decisions about what to learn, when to learn it and what constitutes evidence of learning, are made by their teachers. However, the need for flexibility obviously needs to be balanced against the requirements for practitioners to possess certain *core* competencies in order to practice in a safe manner. The challenge is to provide flexibility coupled with adequate supervision and feedback, so as to ensure high quality learning outcomes for safe medical practice. Our findings suggest that given the appropriate environment, students are willing to accept responsibility for their own learning. The student account given below exemplifies a response to curricular innovation in our study:

... it wasn't until Wednesday that I decided, "I'm not actually understanding how all these bits are fitted together", and went off and did some reading, and worked out how they were fitting together, that the learning experience was useful. ...the good point was, once I got myself motivated and tracked it down, ... I think I learnt more than any standard week at university.

(Australian medical student)

In order to accept responsibility and learn independently, students also require a set of learning skills. These include skills required to identify and prioritise learning goals, to utilise appropriate learning resources and strategies, to make best use of learning opportunities, and to manage time effectively. These learning skills are often taken for granted but it is clear from our interviews that even though these students were formerly high achievers in high school some of them still find managing their own learning to be difficult and stressful:

In year 12 teachers went out of their way to help. ... in lectures ... there's really no one to tell you how to make your choices, it's up to you how much you want to learn ... It was too much of an effort to do ... Having to do that everyday – I would find it a bit of a hassle.

(Australian medical student)

These two students' views illustrate the diversity of student preferences and features that are likely to be present in student groups. Failure to address issues such as this may negate the impact of carefully designed curricular innovations.

Assessment

The assessment process has long been known to have a significant impact on student learning. It has even been identified by some as the major force that drives learning (Trigwell and Prosser 1991; Brown 2000; Lindblom-Ylänne and Lonka 2001). Findings from our study support this view; the four student views presented previously as examples of deep and surface approaches to learning, all refer to the influence of assessment processes.

A number of attempts have been made to encourage deep approaches to learning by designing assessment tasks that require students to demonstrate understanding, integrate knowledge from different areas and apply their understanding to clinical problems (Gibbs 1995; Nightingale *et al.* 1996; Baillie and Toohey 1997).

Our research in Australia and Sri Lanka points towards another dimension of the impact of the assessment process. This is the level of emphasis that students attach to achieving high scores at examinations. It is not surprising that students who have had to achieve the highest scores among their peers to enter medicine should maintain this concern once they are in the program. But our findings suggest that students who are concerned with competing for higher

scores tend to adopt surface approaches. Perhaps this says something about the kinds of assessment that students expect and find in medicine programs, and highlights the negative effects of some assessment practices on approaches to learning. What is perhaps more surprising given their previous conditioning, is that there are students with relatively little concern for achieving high scores and these are the ones who tended to adopt deep approaches. This latter group of students is more motivated by a need to understand what they require for future practice.

In order to counter the negative effects of assessment, it may be appropriate to consider strategies that change the culture within universities that attaches undue importance to results of examinations. This might include a move from norm-referenced to criterion-referenced assessment, a review of the mechanisms used to identify high performing students such as the honours system, and methods to change the general culture of importance attached to high examination scores.

Implications for the design of Medical Education

In the past two decades, medical education throughout the world has been going through a phase of change, moving from traditional to more innovative programs (Rosenthal and Ogden 1998). These innovations have been largely driven by the need for students to access, understand, and use an exponentially increasing knowledge base in medicine. The growth in the medical knowledge base in the past twenty years has been so great that it is no longer possible to imagine that undergraduate training can equip students with all that they need to know for their career. Many institutions of medical education have recognized that students will need to develop the ability to reason through problems, recognizing and discarding what is pertinent and what is not, and will also need to develop strong intrinsic motivation and

skills for life long learning. A medical education that encourages students to take a deep approach to learning would go a long way towards meeting these requirements.

Much of the curriculum innovation introduced in the past twenty years has followed the Problem Based Learning model or some variant of it. The studies on the effectiveness of PBL suggest that it has been modestly effective in achieving objectives such as improved clinical reasoning and diagnosis (Norman and Schmidt 2000) and improved student motivation and self directed learning (Norman and HG 1992; Vernon and Blake 1993; Albanese and Mitchell 1993; Berkson 1993; Moore *et al.* 1994; Kaufman and Mann 1996). The effectiveness of PBL is a somewhat controversial topic, but a discussion of the details of this debate (Albanese and Mitchell 1993; Norman and Schmidt 2000; Albanese 2000; Colliver 2000; Major and Palmer 2001; Smits, Verbeek and de Buissonjé 2002) is beyond the scope of this article. Beyond effectiveness, one of the major issues that accompany the introduction of PBL is cost. Very large costs are involved in the redesign of the curriculum, the re-orientation and re-training of staff for new forms of teaching, development of new teaching materials and sometimes even new accommodation. Thus it becomes necessary to question whether such major and expensive changes are necessary to achieve the desired changes in outcome. Could similar results be achieved through less radical changes to the curriculum and teaching methods?

The study by Newble and Clarke (1986) quoted above shows that students in the clinical years of a traditional program achieved similar high scores for deep approaches to their counterparts in a PBL program. This suggests that elements within both programs are capable of encouraging deep approaches. The challenge is to identify elements within traditional curricula that are most influential in achieving the maximum positive effect on approaches to

learning and learning outcomes. A clear understanding of the factors that encourage deep approaches to learning is crucial in making these decisions.

The three factors identified in the ongoing study - emphasizing relevance to clinical practice in teaching materials and examples; development of individual responsibility and greater freedom of choice; focusing assessment on understanding and application, and downplaying the importance attached to examination scores - suggest a starting point for reform of existing curricula. They represent means by which higher quality learning outcomes may be achieved irrespective of the curricular method. Experimentation and further research are needed to tell us what level of change will provide the greatest benefit for the least cost.

Limitation of resources is a problem experienced by many educational institutions around the world, and is not limited to the developing world. Major curricular reform, such as the introduction of problem-based curricula, requires a heavy commitment of resources in order to achieve desired outcomes. Our research suggests a starting point for less radical reform which would require a more manageable commitment of resources but which may yet deliver many of the same benefits.

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