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Impact of a new integrated medicine program on students' approaches to learning

This paper presents the results of a study on the impact of a new integrated medical educational design on students' approaches to learning. Although the new program was based on curriculum features identified in the research literature as likely to promote deeper approaches to learning, the results revealed a more complex response from students. While a proportion of students reacted as expected and changed to deeper approaches, a significant subgroup moved in the opposite direction and adopted more surface approaches. Further analysis revealed that specific features of the new curriculum – integration of content, requirement for both independent and collaborative learning - were likely to polarise students. The findings suggest that shifting students towards deeper approaches to learning may be a more complex task than previously understood. The authors suggest some ways in which such major curriculum change may be moderated so that all learners are more likely to benefit.

Keywords: *Students' approaches to learning, changes in approaches, impact of medical curricula, integrated learning, medical students' learning, collaborative learning, inquiry based learning, problem based learning, impact of curricular features*

Background

Over the past twenty years, medical education has been at the forefront of curriculum change in higher education. Particularly influential has been the introduction of inquiry-based programs such as problem based learning (PBL) and its many variants.

These inquiry based programs in medical education typically incorporate a number of features, identified through research as encouraging higher quality learning outcomes (PBLI, 1999). Such features include:

- a greater focus on student autonomy and self-directed learning (Trigwell & Prosser, 1991; Gibbs, 1992)
- collaborative learning (McKeachie & Kulik, 1975; Gokhale, 1995; Springer et al., 1999)
- emphasising relevance to practice (Prosser & Trigwell, 1999; McCune & Entwistle, 2000; Biggs, 2003)

The quality of the learning outcome has been shown to relate to students' approach to learning or the manner in which they engage with a learning task (Marton & Saljo, 1976). A deep approach is associated with intent to understand and apply learning, while a surface approach is associated with intent to meet institutional assessment requirements by memorising and reproducing. A deep approach has been shown to be associated with better retention, understanding and greater ability to use the information (Marton & Saljo, 1976; van Rossum & Schenk, 1984; Hegarty-Hazel & Prosser, 1991; Trigwell & Prosser, 1991). While the literature on approaches to learning originated in higher education in general, it has also been found to be applicable to medical education in particular (Newble & Jaeger, 1983; Newble & Gordon, 1985; Newble & Clarke, 1986; Newble & Entwistle, 1986; Newble, 2002).

Research questions and methods

Our study was designed to look at the impact on student learning of the design of a new medical curriculum. At the point when the study was carried out, the medical school involved was developing a new program to replace a traditional, discipline-based curriculum that had been in place for a number of years. (This program will be referred

to as the 'Traditional program'.) Based on research into community and professional expectations of medical graduates, the new program broadened the curriculum to include a greater focus on critical evaluation, reflection, communication and teamwork along with the core outcomes in biomedical science, social and cultural underpinnings of health, clinical performance and ethics. The new program features early clinical experience and considerable small group teaching built around medical 'scenarios' – everyday situations that graduates can expect to meet in practice.

When the first two years of the program had been designed, the faculty conducted a pilot program – a full week of teaching and learning as it would occur in the new program, including extensive small group sessions, skills workshops, clinical experiences, a reduced number of lectures, a small group project and a written test at the end of the week. Student volunteers were sought among first and second year students in the traditional medicine program. 44 students volunteered.

We set out to explore how this very different educational experience would impact on the learning of the students involved and in particular what effect it would have on their motivation and learning strategies (their approach to learning). All students undertaking the pilot program completed the Revised Study Process Questionnaire R-SPQ-2F (Biggs et al. 2001) prior to the pilot and were asked to relate the questions to the way they normally approached their learning in the traditional program. Upon completion of the Pilot program, students completed a slightly modified version of the R-SPQ-2F which asked them to relate their responses to how they behaved during the Pilot program. After a careful consideration of the literature (Gow & Kember, 1990; Kember & Gow, 1991; Kember et al., 1997; Biggs et al., 2001), we decided to compare only the Deep Approach scores for students in the traditional and pilot programs.

All students completing the pilot were also invited to undertake an in-depth interview about their experience; 18 students agreed. Interview transcripts were then analysed for themes relating to their perceptions of learning in both the traditional program and the pilot, as well as for their motivation and learning strategies in each context. The motive and strategy components were assessed against criteria drawn from the literature. Based on these criteria, each student's approach to learning in each context was assessed. Comparison of the approach adopted in each context revealed the pattern of change of approaches.

The qualitative criteria that were used to make assessments of the extent to which a *deep* approach was present included:
- active interest and personal engagement
- creating outlines and structures, seeking the main point
- questioning and using evidence critically to draw conclusions
- seeing the purpose of a task or seeing it in its wider context
- seeking meaning (an intention to understand)
- interest in ideas and content
- preference for environments that encourage understanding
- intention to gain an overview
- relating ideas
- checking understanding
(McCune & Entwistle, 2000).

Similarly, qualitative criteria for categorizing an approach as *surface* included:
- lack of understanding
- lack of purpose
- syllabus boundness
- fear of failure
- information transmitting environments preferred
- negative attitude towards advice
- restricted goals
- lack of explicit emphasis on development

(McCune & Entwistle, 2000)
- preference for assessment that rewarded rote learning
- perceptions of high workload

(Prosser & Trigwell, 1999)

Findings

The Pilot program appeared to go well. Observers were present in all teaching sessions. Focus groups were held with all participants at the completion of the Pilot and the report from the focus groups was very positive (BrowneWright Consulting Pty Ltd 2002). Some modifications to the design were suggested but overall the curriculum designers and teachers were very pleased with the results.

However, when we looked more closely - at an individual level - at what had happened to the students' approaches to learning during the Pilot the results were surprising. These findings suggested that different students perceived the pilot program in different and contradictory ways. Of the 18 students interviewed, five responded to the pilot program – designed to enhance deeper approaches to learning - by adopting deeper approaches, six did not change their approach in response to the pilot while six others responded by adopting more surface approaches. (One student's interview suggested many mixed and contradictory features and could not be classified).

There was a close match between the changes of approaches of each student, when assessed by qualitative criteria through the interviews, and by quantitative means through the R-SPQ-2F instrument. A discrepancy between quantitative and qualitative findings was seen in the case of only one student.

This difference in response between those who adopted a deeper approach in response to the pilot program and those who moved in the opposite direction (and adopted a more surface approach) was found to relate to their perception of specific curricular features. Certain features that were established in the literature as generally encouraging deep approaches actually seemed to have a polarising effect. They promoted a deep approach in some students, while they stimulated surface approaches in others.

In attempting to explain these findings, so at odds with most of the published literature on approaches to learning, we will focus on the interview data and the explanations which the students themselves provide.

How students' approaches to learning changed in response to the pilot program

When the interviews were analysed using the above criteria, five of the eighteen interviewed students had clearly changed towards deeper approaches in response to the Pilot program.

The views of Martin (pseudonym) represented the views of the students in this subgroup. He described how his approach to learning was influenced by the different context of each program. He perceived the traditional medicine program as requiring surface strategies and adopted a surface approach in response. In contrast he perceived the pilot program as requiring a deeper approach, and was able to respond accordingly. He expressed the view that he actually felt himself change in response to the learning context of the pilot program, albeit temporarily.

Martin described how assessment drove his learning during the traditional program:
> You look at the trend in the past questions that they ask and looking at that trend of the questions that they might ask and making sure that I know those really well.

He made several references to the role of assessment in the traditional program. This appeared to be his main motivation for learning.

Martin's description of learning during the traditional program suggested that he used surface strategies. He appeared to be happy with the high level of direction and guidance given during this program, and believed that the better lecturers don't require students to do extra research:
> Some lecturers are very good – they give you a very good structure – you don't have to go and do much research.

This suggested a preference for 'information transmission' which is associated with the surface approach (McCune & Entwistle, 2000). He went on to describe the learning strategies that he believed were required for success in the traditional program:
> You have to get a visual image of everything that you see in the tutorial, in the practical class. … even though it's a lot of memorizing what things are and rote learning.
> I think right before the exam memorising is a good way to get a lot of information in a short period of time.
> I guess before exams there isn't much time for understanding.

Martin's account of learning in the traditional program thus had many features of the surface approach.

During the pilot program however, he seemed to be driven by interest and enthusiasm. "I was excited about the pilot program because it was something new …" This change in motivation appears to have influenced his choice of learning strategies. He appreciated the way content was integrated in the pilot program:
> … the good thing was that everything you do was around a topic so you integrate everything … whereas in the current curriculum, you do things individually, physiology you do something, anatomy you do something else … I think the (pilot program) was a bit better on that. …

He also appreciated the purpose of the various learning activities:
> I think seeing the relevance of what we were doing makes (it easier for) me personally.

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He found the active nature of the program useful to gain understanding, and as motivation for learning:

> Because you have to do work, research. And you pick up things by doing that. And also when lecturers say something interesting or when you're in a tutorial group, or workshop, and you do something interesting, you really try to learn.

Martin's account suggests that he changed to a deep approach during the pilot program. His scores on the R-SPQ-2F support this with a deep approach score during the traditional program of 24 which increased to 32 during the pilot program.

He sums up the overall impact of the pilot program on his way of learning when he says "… I guess it's because I was doing something different, I felt I changed in terms of the way that I worked during that week." The changes can be summarised as follows:

- Change from an 'assessment focus' to 'learning for interest'
- Change from rote learning strategies to seeking meaning
- Change from preference for transmission of information, to willingness to explore in a self-directed manner

However, he is quick to point out that returning to the traditional program reversed this change: "Now I've gone back to the same."

Martin's experience exemplifies the response to the pilot program of 5 of the 18 students who were interviewed. A key characteristic of these students was their ability to identify various features within each context, and evaluate the impact of these features on their learning. They expressed the view that the traditional program required rote learning, that the examinations did not measure what they knew, that it did not reward broader learning, and that surface strategies were required for success in this program. One student in particular described the backwash effect (Biggs, 2003) that the traditional program had on him; he described how deep learning strategies had led to poor examination results, and how he had consequently decided to use more surface strategies to maximise his examination scores. The features identified by these students relate well to 'surface enhancing' curricular features described in the literature (Prosser & Trigwell, 1999; McCune & Entwistle, 2000; Biggs, 2003).

Students in this group were able to identify some positives within the traditional program: one such feature was the perception that learning in a traditional program was 'systematic' – this is a feature that relates to discipline-based learning, where learning material is organised within disciplinary boundaries.

In relation to the pilot program, these students were able to identify and appreciate other curricular features. For example, they valued the integration of basic foundational science and social science with clinical practice. They responded to the collaborative nature of learning during the pilot program by using it as an opportunity to learn through discussion and appreciated the opportunity to hear a range of different perspectives from their colleagues. They enjoyed exploring areas of personal interest, and committed time and effort for this.

If we were to attempt to extrapolate the qualities which this group shared we might say that their motivation is enhanced when they can see the big picture, they are able to

tolerate uncertainty and find a variety of views stimulating, and they like to construct their own personal frameworks for meaning. In fact they seem to fit very well the learning style which Gordon Pask (1976) called *holist processors*. Pask described holist processors as preferring personal organisation and a broad view, preferring to build up their own overview of the topic, thriving on illustration, analogy and anecdote and actively seeking connections between ideas (Pask cited by Entwistle, 2001).

It thus appears that students who preferred a holist learning style responded to the new curriculum in the way that the curriculum designers had hoped and expected – that is they adopted a deeper approach. However, only 5 of the 18 interviewed students responded in this manner.

The remaining students behaved differently, with six students changing towards more surface approaches in response to the Pilot program. These students include four students who changed from deep approaches during the traditional program, to surface approaches during the Pilot program. The other two students adopted surface approaches in both contexts, but changed towards even more surface approaches in response to the Pilot program.

We will use Cally to represent the views of this group. Cally described the way in which she preferred to learn: "I can't learn about things in parts. I need to learn ….so that you understand it as a whole. If they give you an equation, I need to understand the proof of where it came from." She believed that the 'foundation of basic sciences', taught as separate disciplines in the traditional program satisfied this need.

She was happy with her learning experience in the traditional medical curriculum: "… it's really good. Content wise I like what I'm doing." She also seemed to be driven by competition, and said: "it's competitive because everyone's smart so they try to outdo each other." However, she also seemed to be motivated by her own interest in learning and appeared to seek meaning in what she learns: "I like to understand things, why things really happen …I want it to be logical for it to make sense."

She went on to describe her learning during the traditional program:
> I find that if I sit and listen to the lecture I learn more than taking notes; try to absorb as much of it as possible. … when I just listen I absorb more and think of the questions that I would have, so I try to make just small notes and also listen. So then I go home and read my textbook or go on the net …
> I almost always study with a friend so that it's easier to figure things out and less frustrating that way. … so that you think *do you know all the answers* and *can I actually turn it around and explain to someone else*?

The above description suggested that Cally's approach during the traditional program had many elements of the deep approach (in spite of a few features suggestive of an extrinsic motivation).

As opposed to this, she was less pleased with the pilot program:
> I find that things overlap in the course (pilot program) … it's very fragmented. You know a lot about little pieces but you don't know how they come together.
> … If that was the course as a whole, I wouldn't like it.

Cally appeared to rely mainly on extrinsic factors for her motivation. During the pilot program, she perceived the reduction in lectures and the amount of time available for

self-directed work, as a less motivating experience: "…if you're given a lot of work to do you get more work done than if you're given a little bit of work".

Her account of learning during the Pilot program has many features suggestive of extrinsic motivation, and use of surface strategies. Her change to a surface approach during the Pilot program can be summarised as follows:

- Change from a situation of enjoying learning and seeking meaning, to one of completing the task requirements.
- Change from using strategies aimed at gaining understanding, to completing tasks without seeing their purpose.
- Change from a questioning approach to a syllabus-bound approach.

The findings are supported by Cally's R-SPQ-2F deep approach score which changed from 37 during the traditional program to 29 during the Pilot.

Other students in this group had similar perceptions. Stephanie believed that didactic methods were a more efficient way to learn: "The projects we had to do … if we'd spent time with a textbook or tutorial, we'd have learnt much more." Belinda appeared reluctant to put in the required work: "I didn't really enjoy the group activities where we had to go and research on our own. … maybe we felt it was too much of an effort".

Overall, six of the eighteen interviewed students responded to the pilot program by changing towards more surface approaches. A characteristic shared by the students in this group was their favourable perception of the traditional program. Students expressed their satisfaction with the content and the disciplinary structure of the traditional program, which they felt made learning 'systematic'. They also expressed the view that the traditional program fitted well with methods they had successfully used during high school. They felt that the traditional program set clear and difficult goals, which they found intellectually stimulating.

These students were particularly displeased with the breakdown of disciplinary boundaries that resulted from the integration of content during the pilot program. They expressed concern that they were unable to handle certain clinical issues without the 'basic science knowledge' that they considered a pre-requisite. They expressed reservations about the value of collaborative learning, self-directed learning, and the emphasis that was placed on social and cultural issues during the pilot program. A further characteristic that was common to the students in this group was their assessment related motivation.

If we attempt to characterise those students who changed to a more surface approach in response to the pilot program we might say that they seem to be convergent rather than divergent learners, with little tolerance for uncertainty, who prefer a high degree of structure in learning, have a high respect for authority and prefer to tackle one subject at a time in a thorough and organised way. They seem to fit Pask's (1976) category of learners who prefer a *serial processing* style, which he describes as preferring step by step, tightly structured learning, preferring to focus on the topic in isolation, concentrating on details and evidence, adopting a cautious logical stance.

Varied perceptions of certain curricular features

It was clear that students were reacting differently to certain curricular features of the same innovation. We analysed the interview data to see whether any of these curriculum features stood out as being likely to polarise student opinion and consequently affect their approach to learning. Three curricular features of the new design were identified as invoking positive responses from some students, but negative responses from others. These features and the variation in response to each of the features are examined below.

1. Independent learning. Trigwell & Prosser (1991) and Gibbs (1992) cite independence in learning and taking responsibility for one's own learning as factors likely to encourage a deep approach. The pilot program encouraged learners to take on this responsibility. It was expected that medical scenarios would prompt students to identify learning needs and find appropriate resources, research their topic as far as possible and become aware of outstanding learning issues that would drive future learning.

As expected, some students responded in a positive manner. One student commented on a discussion in the pilot which made him think "what are we talking about, what do I need to work out?":

> … 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, which wasn't very hard … and thought about how it fitted in with the scenario, I think I learnt more than any standard week at university.

However other students were reluctant to accept this responsibility. Belinda recognised that there were gaps in knowledge that needed to be addressed, but was not prepared to commit the required effort:

> It was too much of an effort to do …Having to do that everyday – I would find it a bit of a hassle. …

Possible reasons for the above negative response to independent learning may include:
i) Having to take some responsibility for deciding what and how much to learn requires a degree of thought and effort that many students are unused to. Although all of the students in the study had been exceptionally successful learners in their high school studies, having met the rigorous entry requirements for the medicine program, some of them were very comfortable with being told exactly what to learn and appreciated lecturers in the traditional program who gave them comprehensive notes and did not expect much additional reading.
ii) Students may lack the necessary skills for independent learning. Although a limited amount of guidance on literature searching was provided in the pilot program this was probably not enough to instil confidence in all students.

2. Increasing relevance to practice by integrating basic and clinical sciences, social determinants of health and communication skills with medical practice. Prosser & Trigwell (1999), McCune & Entwistle (2000) and Biggs (2003) all suggest that increasing relevance to practice is likely to induce a deeper approach to learning. The pilot program incorporated a *number* of features to enable students to integrate basic

and social sciences with clinical practice. For example, when students met a scenario based on a patient with arthritis, they were guided to make sense of it by identifying relevant issues from anatomy, physiology, pathology, pharmacology, social and psychological aspects of health. This was conceptually different to a more traditional approach which expects that before students encounter arthritis in clinical practice they will have studied basic anatomy and physiology of the joints, basic pathology concepts such as inflammation and basic pharmacological concepts as well as knowledge of specific drugs and their actions and side effects. Whereas in the traditional program they studied these as separate subjects at different points in their first three years, now they were introduced to them simultaneously while considering the medical scenario.

Some students responded to the integrated nature of the program very positively. Ben valued this feature, and perceived it as beneficial to his development as a medical practitioner:

> I mean as a clinician – going to be a clinician – you need to integrate everything you learn. You have to do it anyway, whether you do it in the first year or whether you do it in the third year. If I have to do it I'd rather do it in the first year. And start it straight away. That's why I (prefer) scenario-based learning.

Other students however, perceived this negatively. They seem to favour a step-wise process of knowing facts before attempting to apply them to realistic situations. Mary describes how she finds integration confusing:

> … because otherwise you can't build on it later. It's just like Maths, if you know addition, and subtraction, then its all clear.

The patient presentations which formed the basis of many scenarios were always presented in a social and cultural context and students were expected to explore and research the impact of social and cultural factors on health.

Mark was pleased with the emphasis that the Pilot program placed on social and cultural aspects of health:

> I think this new course is good because it does involve, it does get us into the social aspects of medicine, as well as the physical…

Other students however, saw this as a negative:

> Why do we need to know the social issues when we don't even know the basic scientific stuff? I just don't feel that's important at the moment. We're still in Med1 – we haven't practiced at all. Maybe it would have been useful later on in Med6 or something …

Possible reasons for the above negative response to integrated learning may include:
i) Perception that integrated learning is less organised, and that much 'prior knowledge' is required to benefit from it.
ii) Inability to recognise relevance of social issues to the practice of medicine; belief that a science base is of primary importance, and that this may be compromised through integration.
iii) Preference for discipline-based learning, and inability to appreciate the purpose of integrated learning.
iv) Preference for a more 'linear' and 'information transmitting' way of learning.

3. Encouraging teamwork and collaborative learning. Collaborative learning has been shown to produce greater motivation, better retention and deeper understanding

(McKeachie & Kulik, 1975; Gokhale 1995; Dillenbourg et al., 1996; Springer et al., 1999). The pilot program attempted to encourage collaborative learning through emphasis on discussion and small group activities, within a context that highlighted the need for teamwork in medicine. Positive features of discussion-based learning include hearing different views and perspectives, understanding the complexity of clinical issues, and developing and refining one's understanding by framing one's own response to the discussion question (Brookfield, 1990).

Some students responded in the expected manner. Mark spoke of how he found the group learning process useful:

> You could lean on others at times. You get to understand other people's points of view. Opens up the mind a little bit more.

Once again however, other students perceived this feature unfavourably:

> … It does sort of double your workload, because then you not only have to listen to it, you then have to go and find out and make sure they are right. Whereas if you get it given to you by some lecturer usually it's pretty good information and it relates quite well to a textbook

Possible reasons for the above negative response to collaborative learning may include:
i) Doubtful credibility of information learnt through peers. This issue is related to students' focus on 'right' or 'wrong' 'facts' and relates to their preference for 'receiving' information. Perry (1970) and Belenky and colleagues (1986) have described students at early stages of intellectual development as believing that right answers exist for all questions, that experts are the source of the correct answers and experiencing much discomfort in the absence of definitive answers. Students in this group may be experiencing this discomfort at the lack of definitive answers in discussion work.
ii) Poor teamwork / collaborative learning skills (and insufficient preparation in the pilot program) may also account for dissatisfaction with small group learning. Some project groups divided learning tasks among group members with little subsequent sharing of information or learning from others' areas of research.
iii) Another aspect of poor teamwork skills may derive from students' competitiveness. Medical students tend to be extremely competitive – a by-product of the selection process and one of the reasons for increasing the emphasis on collaboration and reducing competition in the new curriculum. During small group work in the pilot it was clear that some students focused on becoming a leader and gaining personal recognition at the cost of learning. In contrast some students enjoyed the novel social aspects of the group process so much that they neglected the purpose, with little resultant learning. This seems to relate to students' inability to manage group dynamics to enhance learning.

Students who didn't change their approach

The discussion above focused on the students who changed their approaches (either towards more surface or deeper approaches) in response to the pilot program. As opposed to this, six other students persisted with the same approach in both contexts. Two of these students adopted deep approaches in both contexts, and seemed to be able to find and benefit from positives in either context. The other four students adopted surface approaches in both contexts, and were characterised by an overall negativity

and low self confidence. Further discussion of these students was considered beyond the scope of this article.

Conclusions

In this study we have seen how, despite an enormous effort in curriculum design intended to encourage deeper approaches to learning, some students responded by adopting more surface approaches. The new design did not produce the large scale shift to a deep approach that the curriculum designers had hoped for.

A key finding was the manner in which some students responded by adopting deeper approaches, while others turned to more surface approaches. The different responses were found to relate to different perceptions of certain curricular factors, in particular, independent learning, integration of disciplinary content around professional practice, teamwork and collaborative learning. The polarising effect of these curricular features was another significant finding. The differences in perception of these factors also seemed to relate to certain student characteristics and preferences. These curricular features have previously been established in the literature as features which encourage deeper approaches and more effective learning. The findings of this study suggest that these features alone cannot be relied upon to produce a deep approach in all or even the majority of students. It seems likely that individual characteristics such as previous learning experiences, learning preferences and level of cognitive development have as much or more influence on student learning as curriculum design.

The 3-P model of learning (Biggs, 2003, p.19) recognizes the role of student (presage) factors in modulating the impact of contextual factors. While this modulating impact has been recognized, it has been reported as either enhancing or impeding the impact of contextual factors. In our study the role of presage factors has been shown to be so strong as to actually *reverse* the impact of curriculum factors.

While an obvious limitation of this study is that it refers to a pilot program of short duration, we have also found similar patterns of change of approaches in the full scale implementation of the new program and in the clinical teaching years at another university (Balasooriya 2005; Balasooriya *et al.* 2008).

Given these findings, it may be tempting to conclude that curriculum renewal - particularly the introduction of inquiry-based programs and problem-based learning - is not worth the effort. However, we do not feel such scepticism is warranted, as the variation in student response, rather than the design itself, is the factor that needs to be addressed. Our view is supported by the finding that a proportion of students found the design highly motivating. Therefore our primary concern is to find strategies that will increase the proportion of students who respond positively. It would be premature to make negative judgments about the effectiveness of inquiry-based programs based only on the present findings. This is especially so as these new medical curricula, some variant of which has now been introduced in virtually all Australian medical schools, have been implemented for a range of reasons, not just the predicted impact on student approaches to learning. They have been designed to meet additional and different goals from those of traditional discipline-based medical training, specifically in the areas of

self-directed and independent learning, collaborative learning and team-work, and greater integration of the foundational sciences with clinical applications. These goals represent the future of medical practice – there is no question that tomorrow's medical practitioners will be expected to work in teams, take responsibility for continually updating their knowledge and be able to apply evolving scientific knowledge to clinical problems, in a way that has not always resulted from traditional, discipline based forms of teaching. It is also striking that it is precisely these elements which tended to polarise students. The changing nature of medical practice dictates that the goals must remain. The question then becomes 'how can we help a greater proportion of students to master these new ways of learning and working?' Addressing this issue is of utmost importance if we are to optimise the benefits of sound educational design. While inquiry based curricula may have provided us with a sound platform, the full benefits of these curricula may only be achieved if we develop strategies to ensure that a greater proportion of students respond in the intended manner.

Future Directions

This study has highlighted the importance of presage factors – the individual student's learning preferences and previous learning experiences – in determining the impact of educational design. Although new selection procedures for medicine have diversified the student body, many students still come into medicine from a very narrow high school preparation of mathematics and hard sciences, chosen to maximize their high school results and ease their selection into medicine. These students are likely to have most difficulty with the transition into new and less certain areas of learning. Over time, greater awareness of the new selection procedures may lessen the importance of maximising entry marks, but in the mean time curriculum designers must look to more effective ways of scaffolding these students into more self-directed learning, teamwork and integration of science with its clinical applications.

Recently Biggs pointed out that learning contexts which offer students a high degree of freedom and choice in learning activities are best able to cope with student diversity, but as more freedom and choice becomes available to students, more scaffolding and support will be needed for underperforming students (cited in Buckeridge & Guest, 2007).

Much work remains to be done. We seek to find out whether the polarizing effects of radical curriculum change continue with prolonged exposure to the curriculum; whether the introduction of more skills training in areas such as self-directed learning can have a positive effect and whether a greater focus on clinical work in later years will encourage deep approaches to learning in a greater proportion of students.

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