



DOES TUTOR SUBJECT-MATTER EXPERTISE INFLUENCE STUDENT ACHIEVEMENT IN THE PROBLEM-BASED LEARNING CURRICULUM AT UNITRA MEDICAL SCHOOL?

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Objective. To establish whether or not tutor subject-matter expertise influences student achievement in content-based examinations in the problem-based learning (PBL) curriculum at the University of Transkei (UNITRA) Medical School.

Design. A retrospective study of MB ChB III student achievement in end-of-block modified essay questions (MEQ) examinations in microbiology, pathology and pharmacology for the years 1994 - 1999, inclusive. Pooled scores from the expert-tutored groups were compared with those from the groups tutored by non-experts using analysis of variance (ANOVA) or *t*-test. Subject expert tutors were those with postgraduate specialisation in the given discipline.

Setting. The Medical School, Faculty of Health Sciences, UNITRA, Umtata.

Outcome measures. Whether pooled mean MEQ scores in end-of-block examinations for microbiology, pathology or pharmacology differ according to the subject-matter expertise of the tutor.

Results. There were no significant differences in mean scores obtained for pharmacology (51.1 ± 0.6 versus 52.6 ± 0.7 , $P = 0.109$) and pathology (49.8 ± 0.6 versus 49.9 ± 0.8 , $P = 0.919$). The difference between the scores in microbiology was small (3 percentage points) but statistically significant, with the groups tutored by microbiologists scoring higher than those tutored by pathologists or pharmacologists (54.1 ± 1.0 versus 51.2 ± 0.8 , $P = 0.032$).

Conclusions. These data demonstrate that in the UNITRA Medical School PBL curriculum tutor subject-matter expertise has little or no influence on student achievement in the discrete areas of tutor expertise.

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Despite wide variation in problem-based learning (PBL) medical curricula, most PBL programmes include elements of student-centred, self-directed learning, small group discussion and the integration of basic sciences and clinical problems.^{1,2} The question of whether or not the tutors for the small group tutorials should be content experts remains unresolved, partly because the definition of 'expert' has not been uniform. For instance, some authors consider as experts only those tutors combining clinical and physiological expertise with research and patient focus on one body system.³ Others apply the term only to tutors with an active research interest in the specific topic covered by the students in a specific case;⁴ while still others rely on tutor self-assessment of their expertise.⁵ Eagle *et al.*⁶ considered as expert tutors only case authors and those likely to see that type of case in their clinical practices. Another confounding factor is the lack of uniformity of the endpoints assessed. In this respect, there are reports based on assessment of student satisfaction with the tutorial process,⁴ on the generation of learning issues,⁶ and on student performance on various tests.^{7,8}

The University of Transkei (UNITRA) Medical School adopted the PBL approach for the MB ChB course in 1992. The programme is integrated, community-based, and emphasises co-operative learning skills.^{9,10} The small group tutorial is central to this programme, and all tutorial sessions are compulsory. The academic year is divided into four 10-week blocks, during each of which the students and tutors are randomly allocated to tutorial groups for the entire duration of the block. In the third year (MB ChB III), the focus is on pathology, microbiology and pharmacology. With increasing student numbers, it is not possible to have an expert in each of those subjects in every tutorial group. The groups would become too large for optimal group dynamics, and unattainably large staff numbers would be required to run the tutorials. However, the students have unlimited access to the various subject experts (individual consultations), and each discipline has one 2-hour interactive resource session per week during which problems not clarified in the tutorial(s) are discussed with the relevant subject experts. In addition, the Departments of Pathology and Microbiology offer practical sessions or demonstrations on a regular basis. Student evaluation at the end of each block includes tutorial assessment (weighted at 20%), individualised process assessment (IPA) (weighted at 30%), and a modified essay question (MEQ) examination (weighted at 50%). Each of the three major disciplines sets and marks its own MEQ, with no input from the tutors from other departments, while the other aspects of the evaluation are integrated across the major disciplines. The MEQ examination therefore tests student achievement of core knowledge objectives, as expected by the departments.

The present study is part of an ongoing evaluation of the PBL programme at the UNITRA Medical School. We reviewed MB ChB III achievement scores in end-of-block MEQs for the

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years 1994 - 1999. This study was undertaken partly because of student concerns that being tutored by a non-pharmacologist, for example, may disadvantage one in the pharmacology MEQ, and partly because we wanted to know on which side of the controversy around content expertise and student achievement our programme belongs. The need for review became even more imperative because of the planned expansion of our student intake — we needed to know how spreading our expertise thin might affect student achievement. A preliminary account of this work was presented at the ninth International Ottawa Conference on Medical Education.¹¹

METHODS

We reviewed MB ChB III student scores in end-of-block MEQ examinations in pharmacology, pathology and microbiology from 1994 to 1999. Only those blocks where a substantial number of groups did not have a subject expert tutor were included. Consequently, we reviewed MEQ scores from 9 blocks for pathology and microbiology, and 12 blocks for pharmacology, covering 238 students guided by 32 tutors.

Subject expert tutors were those with postgraduate specialisation in their respective subjects, i.e. pharmacologists, pathologists and microbiologists. In this study the pharmacologist was an expert only in pharmacology, and a non-expert in the other two subjects. Because the inclusion criteria were not uniformly met in all the blocks over the years reviewed (1994 - 1999), the scores from the 9 - 12 blocks were analysed collectively. For the blocks included in the present study, the mean scores in each subject were compared (expert tutor versus non-expert tutor) using analysis of variance or *t*-test, as appropriate. The limit of significance was set at $P < 0.05$.

RESULTS

Table I summarises the mean scores obtained for 9 blocks in pathology and microbiology, and 12 blocks in pharmacology. There were no significant differences for the pathology scores between the expert- and non-expert-tutored groups (49.8 ± 0.6 v. 49.9 ± 0.8 , $P = 0.919$). Similarly, for pharmacology there was no significant difference between the expert-tutored and the non-expert-tutored groups (51.1 ± 0.6 v. 52.6 ± 0.7 , $P = 0.109$). In microbiology, however, the mean score for those tutored by a microbiologist was significantly higher than the score for those not tutored by a microbiologist (54.1 ± 1.0 v. 51.2 ± 0.8 , $P = 0.032$).

DISCUSSION

Our results show that tutor subject content expertise has little or no effect on student achievement in content examination. Whereas the difference in the scores for microbiology reached statistical significance, it is only a 3% difference, the

Table I. Effect of tutor subject-matter expertise on student MEQ scores in pathology, pharmacology and microbiology

Group	No. of students	MEQ marks (mean \pm SEM)
Pathology		
Expert tutor	263	49.8 ± 0.6
Non-expert tutor	181	49.9 ± 0.8
Pharmacology		
Expert tutor	256	51.1 ± 0.6
Non-expert tutor	258	52.6 ± 0.7
Microbiology		
Expert tutor	128	54.1 ± 1.0
Non-expert tutor	265	$51.2 \pm 0.8^*$

* $P = 0.036$ compared with the microbiologist-tutored groups.
SEM = standard error of mean.

consequence of which could well be more apparent than real. Some early proponents of the PBL medical curriculum believed that subject-expert tutors would facilitate the tutorial process more effectively and more efficiently than non-experts, since such tutors were supposedly more comfortable tutoring in areas of their expertise.^{12,13} Subsequent studies on the influence of tutor subject expertise have yielded contradictory results, with some reporting a positive influence^{4,14} and others not finding any measurable effect.^{7,8,15} These discrepancies may be explained by different definitions of the term 'expert tutor', different forms of PBL curricula studied, and different forms of student assessment employed from study to study, including such subjective endpoints as student satisfaction.^{3,8} Moreover, some studies were restricted to a single unit or even a subunit of the course, and the tutors involved differed in terms of their experiences with PBL.¹⁶

The present study attempted to avoid the confounding factors cited above. Our definition of 'subject expert tutor' is simple and unequivocal, the PBL curriculum is integrated and well-structured, all the students covered the same cases and tasks throughout the block, the areas of student assessment were discrete and matched the areas of tutor expertise, and the dataset analysed was for 6 years (1994 - 1999). In addition, our tutor pool did not change significantly over the years covered by the study, and all tutors go through yearly training and reorientation workshops together, as well as attending regular meetings/feedback sessions.

Our study is similar to those from the University of Limburg in Maastricht^{8,14} in terms of datasets and the integrated nature of the curriculum, though it differs in the definition of 'expert tutors' and type of student assessment. Interestingly, an earlier study from Maastricht¹³ found a positive correlation between tutor expertise and student achievement, while a later one,¹⁴ like ours, found no such difference in student test scores. The latter authors¹⁴ emphasise structured curricula and students' prior knowledge as being more relevant to student achievement than tutor 'hyper-expertise', a conclusion that is also suggested by our findings.



The apparent positive influence of tutor subject expertise on student scores in microbiology MEQs is not readily explicable, but could have arisen from the fact that there were fewer microbiologists in the tutor pool than pathologists or pharmacologists. The microbiologists may, consciously or subconsciously, have tried to address this imbalance by being more directive on microbiology learning goals in the groups they tutored. Secondly, unlike the other departments, the Department of Microbiology supplied the students annually with detailed booklets on each subdivision of the discipline (bacteriology, virology, parasitology, immunology). The microbiology tutors may have more readily directed the students in their groups to these internal resources, on which the microbiology MEQs were probably also based. Furthermore, the differences in student scores in microbiology were not repeated in every block or in every year analysed, and whereas the overall difference is statistically significant, it is only 3 percentage points, which is not dramatic. Notwithstanding these possible explanations, the observed difference may be a reflection of yet unidentified factors, and therefore there is a need to investigate this finding further lest we overlook some fundamental anomaly.

CONCLUSION

In view of the findings in the present study, we conclude that in an integrated PBL environment such as at the UNITRA Medical School, the tutors' expertise does not influence student achievement in the subjects of tutor expertise. The UNITRA medical PBL programme is well structured and the tutors are well prepared. Our data support the notion that what matters more is a tutor well prepared for the role of facilitator, rather than one who is a subject expert.^{2,14} The students therefore need not feel disadvantaged by being tutored by a non-expert in a particular discipline.

On a final note, these findings are reassuring to the UNITRA Medical School as it implements the expanded student intake. Since the subject expertise of the tutors does not affect student achievement of core knowledge objectives, the UNITRA Medical School ought to cope with the expected increase in student numbers without there necessarily being a commensurate increase in subject experts in the basic medical sciences.

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