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Expert *vs.* Non-Expert Tutor in Undergraduate Medical Education: A Critical Review

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Abstract. The objective of this review article was to critically analyze studies discussing tutor subject matter expertise and its effect of students' collaborative learning and performance in undergraduate medical education. The debate regarding tutors' subject matter expertise and its effect on students' learning puzzled educators. Problem based learning model-advocates were concerned that tutors, having subject matter expertise, would revert back to familiar lecturing habits and interfere with students' collaborative learning. Others showed beneficial results reflected on learning and academic achievement. A Medline and PubMed databases literature review was conducted. Out of 88 relevant articles, 15 of them that compare expert and non-expert tutors were identified and reviewed critically. Literature was not decisive on whether tutors expertise provided beneficial effect(s) on students' learning. Few factors played an important role on these conflicting results. Definition of expertise was not unanimous among articles and measures of effectiveness were different. Medical schools' increasing demand for more Problem-based learning tutors drove the direction of research into biased route and underestimated related to non-expert tutors. Viewing the literature critically, tutor subject matter expertise displayed

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advantages that were reflected on students' learning sessions and afterwards. Disadvantages of non-expert tutoring should be highly scrutinized before replacing expert tutoring. Educators should focus mainly on developing clinicians' skills to become better teachers/facilitators and nothing else.

Keywords: Tutor, Problem based learning, Collaborative learning, Tutor expertise.

Introduction

The role of the teacher in a problem based learning (PBL) curriculum is different from a traditional one. Previously, the teacher lectures to a large number of students allowing little time for students' inquiries. In PBL tutorials, the teacher "known as tutor" facilitates and guides students' own learning[1]. A complete change in the role of the teacher, which is why advocates of PBL model were concerned that teachers would revert back to familiar lecturing habits and interfere with students' collaborative learning *i.e.*, self-directed learning. In 1987, Howard Barrows, one of the leaders in PBL medical education at the time, suggested that facilitation skill is more important than subject matter or content expertise[2]. This notion was followed by studies warning from having a tutor with content expertise[3,4] or showed no benefit of having one on students' academic achievement[5,6]. On the other hand, other studies have shown contradictory results[7-9].

In the past few years, King Abdulaziz University underwent a major change in curriculum, shifting from didactic lectures to a student centered learning. I was asked to tutor a subject unrelated to my expertise, and therefore, stimulated me to search if tutor subject matter expertise had any positive or negative effect on students' collaborative learning. The purpose of this review was to critically analyze the papers discussing the effect of tutor expertise in comparison to non-expert tutors on students' learning. The word "expertise" in most studies, and in this paper, refers to content or subject matter expertise unless otherwise indicated.

Materials and Methods

A Medline database search using keywords “expert Tutor”, “content expert”, “subject matter expert”, “student tutor”, “peer tutor”, “tutor strategy”, and PBL was carried out. The literature search was limited to undergraduate medical education, problem based learning, and English language. The search was mapped to subject heading. The citation lists of articles were read to sort out relevant articles discussing tutor expertise. A PubMed database search was also carried out to ensure inclusion of relevant articles. After removing duplicates, a total of 88 abstracts were reviewed. All 15 original articles comparing expert and non-expert tutors were included. Articles in favor of expert tutors (Table 1) and those not in favors (Table 2) were compared. Comparison variables included the judgment criteria for expertise (definition used), sample sizes for tutors and students, duration of tutorial session(s), year(s) of medical school studied, outcome measures used, and results.

Results

Reviewing the literature regarding the effect(s) of tutors’ expertise on students’ learning outcomes showed conflicting results. Earlier studies tackling the effect of expertise on students’ learning and academic achievement depended on tutors’ self-reporting of expertise. Some used a questionnaire[3,6] while others made the distinction of using a single question[4]. It was not surprising, giving this weak definition of expertise, to find that these papers found no differences in students’ academic achievement as judged by their written assessment scores[5,6], or that expert tutors’ performance was rated higher by students[4]. Moreover, based on this definition, studies have concluded that expert tutors behaved in a way that was conflicting with the principles of a problem based learning (PBL) model[3,4]. The reason why these papers used self-reporting of expertise was because they believed that expertise varied according to the unit being taught. In 1993, Schmidt *et al*.[8] looked at tutor expertise as being unit-dependent, but arbitrated it instead by two independent judges. They found a significant correlation between expertise and students’

studying effort and academic achievement. They also found upon questioning students that expert tutors' intervention did not differ

Table 1. Articles in favors of tutor expertise.

Study	Definition of Expertise	Sample Size (Student)	Sample Size (Tutor)	Group/Duration	Outcome Measure	Results
Eagle 1992	Wrote simulated scenario or sees such cases in clinical practice	70	17	Final pre-clinical year 12 simulated patients with multi-disciplinary problems	1. Number of learning issues raised 2. Study time outside tutorial time	Tutor expertise doubled learning issues raised in tutorials and lead to doubling of study time outside tutorial session
Davis 1992	By 2 independent judges based on clinical or research experience on topic	156	21	2nd year students Microbiology course (4 sessions, 38 hours)	Questionnaire Behaviour coding	Expert led students' had higher levels of satisfaction and higher scores
Schmidt 1993	Relative to unit content judged by 2 independent judges	1,120	152	Four curricular years 336 tutorials	100-150 true/false questions, Short essay Self -study time	Significant correlation between expertise and students' achievement and self-directed study time (effort)
Schmidt 1995	Staff *vs.* student	1800	411 (152 staff, 259 student)	4 years of health science curriculum 98 course each 6-week long	Questionnaire MCQ or short essay	Students tutored by experts scored higher throughout curricular years Peer contribution was rated higher in the first year as judged by students but not by tests. Subject matter expertise became more important during subsequent years
Hay 2001	Clinical training and research in the area of eating disorders Both tutors were psychiatrists	118	2	4th year med students 18 tutorials (1.5 hours each)	5 short answer questions 20-item questionnaire on 7-point scale	Non-experts rated higher in management skills Expertise results in significantly higher test scores
Matthes 2002	Expert=Passing board exam = senior staff Study included senior, junior staff, and peer tutoring	787	111 29senior 49 junior 33 peers	3rd year Pharmacology course	End of term exam (20 MCQ & 10 short essays)	No difference in exam results Expert tutors made PBL more enjoyable to students, ranked significantly higher in performance by students, and stimulated more learning time and less exam preparation time than non-experts
Groves 2005	Expert = Clinician Compared to basic scientist and social educator	702	40 26 basic scientist 8 clinicians 6 social educator	1st year med students 11 week term	Questionnaire 39 items about use of Knowledge of Subject Matter Skill in Facilitation	Clinicians (experts) tended to have higher scores on all scales than non-clinicians (use of subject expertise, cognitive congruence, and test orientation. Authority, role congruence, and cooperation orientation)
Stevenson 2005	Expert = Clinician *vs.* basic scientist	188	74 for 1st year 46 for 2nd year	1st & 2nd year 564 tutorial sessions	Questionnaire	Year 2 students rated clinicians higher in several content expertise-linked areas: preparedness, promotion of in-depth understanding, and ability to focus the group, and down-rated the basic scientists for demonstrating overspecialized knowledge

from non-expert ones, contradicting previous studies[3,4]. Students' felt that expert tutors showed deeper understanding of subject's

objectives, were more knowledgeable about the subject needed to be mastered by students, and used their expertise to help students in a more relevant way than non-experts.

Table 2. Articles advocating against tutor expertise.

Study	Definition of Expertise	Sample Size (Student)	Sample Size (Tutor)	Group/Duration	Outcome Measure	Results
Silver 1991	Self-reported	Not clear	4	First year medical students 8 tutorial sessions	Tutorial process	Experts used more tutorial "air time" Raised more agenda items Answered more directly
Moust 1994	Staff *vs.* Student	407	22	First year Law school 2 consecutive courses in one year	Achievement test in law + Questionnaire	No significant difference in achievement test but in the second course, students guided by experts (staff) scored higher Student did not feel that expertise was important for their learning
Dolmans 1996	Self -reported	600	119	4 curriculum years 135 tutorial sessions	150 true/false questions	No effect of tutor expertise on student scores No interaction found between expertise and curricular structure or students' prior knowledge
Kaufman 1998	Self-reported	168	88	First 2 years 1500 tutorials	Questionnaire	No difference in performance between tutors as rated by students but expert tutors tended to explain content more as their expertise increased
Zakowski 2002	Specialist *vs.* Generalist	288	66	Pre-clinical Second year 69 tutorials	OSCE results Questionnaire	No difference in OSCE scores or in questionnaire rating Specialist were less confident in tutoring some topics outside their expertise
Park 2007	Specialist *vs.* Generalist	206	Not clear	Third year dental students Four tutorial groups over 6-month duration	Tutorial session Mid-term exam Final exam Pre clinical lab Overall cumulative course grade	No effect of tutor expertise on those outcome measures except final exam grade
Peets 2010 RCT	Specialist board certified Or In training for certification Or sub-speciality certified	151	71 (60 content, 11 process Experts)	First year 12 week long cardiovascular-respiratory course	MCQ scores Questionnaire	No difference in MCQ scores Student on a 5 point scale rated process expert significantly higher overall than content experts (4.78 *vs.* 4.62)

Schmidt *et al.*[8] along with his group at the University of Limburg in the Netherlands used medical students to serve as non-expert tutors. In 1994, they found that students' guided by expert tutors scored higher in a 5-open ended questions, three of which were reasoning questions. Peer guided students were found to spend more time on self-study. Students' questionnaire did not favor any of the

tutors. This study was in law school and was over 2 consecutive courses[5]. A year later, Schmidt *et al.*[9] published a large-scale study over four curricular years, which favored having an expert tutor over peer tutoring. Results showed that students tutored by experts received significantly higher marks throughout curriculum years. Peer contribution was rated higher in the first year as judged by students but not by tests. Students liked the fact that peers, as tutors, displayed an understanding of how they think and express themselves. Subject matter expertise became more important during subsequent years[9].

Matthes *et al.*[10] also compared peer tutoring to the expert one. Unlike Schmidt's group, they found no statistical difference in written assessment results, but they directed attention to some important tutor behavior. They found that expert tutors made PBL more enjoyable to students, ranked significantly higher in performance by students, and stimulated more learning time and less exam preparation time than non-experts.

A number of studies looked at physicians as tutors and studied the effect of being a specialist, considered as an expert, versus being a generalist, considered as non-expert, on students' academic performance[2,10-12]. Outcome measures in those studies included Objective Structured Clinical Examination (OSCE) and Multiple Choice Questions (MCQ) assessment formats at the end of courses. All studies showed no statistical significant effect of expertise on students' scores. Interestingly, when students' grades were followed beyond the course i.e. mid-term and final exam scores, a significant difference in the final exam grade was found in favor of expert lead students[2].

Eagle *et al.*[7] made a clear differentiation between specialists and generalists. They gave the example of a complex trauma case with orthopedic surgeons or emergency physicians being experts while an internists being non-experts. This differentiation was based on real life experience where internists rarely got involved in a trauma case and barely applied trauma principles in their careers. This is clearly

different than comparing internists to pulmonologists in tutoring basic respiratory examination session[12]. The applied knowledge gap between tutors in these two examples is incomparable. Eagle *et al.*[7] with their definition of expertise found great benefits of having expert tutoring on issues raised during tutorials and on students' self-study time.

In 2005, two papers considered clinicians to be experts compared to basic scientists or social educators in regards to first year subject matter expertise[1,13]. In their point of view, an expert tutor in problems with integrated clinical scenarios should be a person with relevant subject matter knowledge and clinical skills, and not just someone who mastered factual knowledge or theory of tutorial subject. In fact, Stevenson *et al.*[13] reported that students down-rated basic scientists for demonstrating overspecialized knowledge. In addition, students rated clinicians higher in several content expertise-linked areas *i.e.* preparedness, promotion of in-depth understanding, and ability to focus the group. Also clinicians were rated higher in their use of subject expertise, cognitive congruence, test orientation, authority, role congruence, and cooperation orientation[1]. In conclusion, although basic scientists had more expertise in factual knowledge than clinicians, the later showed more expertise in linking knowledge to clinical problems.

It is hard to judge the effectiveness of teaching on learning. Many variables work in conjunction and at different levels at different contexts. Inter-individual variability of learning behavior may be quite high but can be reduced by aggregating data at the learning group level[10].

Studies that used written assessment tools to measure effectiveness measured retention and to a limited extent measured understanding of factual knowledge[5,6,8-10,12]. It was not surprising to find conflicting results. The difference between expert tutors guided group and non-experts' guided one was fairly small in both ways.

Likewise, added lectures, students' effort on self-study, validity, and reliability of assessment tools all can affect students' scores.

In a study where objective structured clinical exam (OSCE) was used as a clinical assessment for tutorial learning, no significant difference was found in students' scores based on tutoring expertise[11]. The subject of tutorial sessions was on basic clinical examination for junior medical students and, not surprisingly, both groups scored better than 93%. This may explain why only decimal difference between groups was found. When the subject of the tutorial was complex multidisciplinary simulated cases, expert tutoring showed significantly superior results[7].

Silver and Wilkerson[3] looked at the effect of subject matter expertise on the tutorial process but unfortunately ignored the content aspect of the tutorial. They concluded that tutor expertise endangered the development of active, self-directed student learning. Their conclusion was based on audiotaping tutorial interactions. They reported that expert tutors were more direct in answering students' questions and allowed fewer students to comment. Other negative attitudes, such as tutor taking up tutorial "air time", were based on a 2-second difference in length of tutor comment and 11% more in talking time, which was statistically significant but is considered minute in reality. Although expert tutors in this study raised more topics for discussion than non-experts (69% *vs.* 11%), it was considered as a negative attitude and was viewed as taking over students' role in directing own learning [3].

Eagle *et al.*[7] studied the effect of tutor's subject expertise on the number of learning issues raised during tutorials and study time outside tutorial time. Students in their study were described as high achieving, with excellent grade average. In addition, the majority of students was holding university degrees (77%) and those with Masters or PhD degrees (17%). The effect of tutor expertise on this cohort was judged in regards to twelve simulated patients with multidisciplinary problems. Results showed that expert tutors doubled

groups' learning issues (13.4 *vs.* 6.3) and study hours thereafter (14.3 *vs.* 7.8) compared to non-expert tutors. These finding were statistically and clinically significant[7]. In this study raising more agendas for discussion was considered as a positive attitude towards students' learning.

Although questionnaires have their limitations, students' opinion on the debate of effect of expertise is very important. Yet, the year of medical students and their familiarity with PBL system should be taken in consideration when analyzing questionnaire results.

Questionnaire by first year law students indicated that students felt they acquired the intended information and understood what the focus of learning activities was regardless of tutor expertise[5]. Yet, in another questionnaire by first year medical students, students' felt that expert tutors were superior in their use of subject matter expertise as well as being more superior in the tutorial process[1]. When questioning first year students to compare subject matter expertise against process expertise, the later was more important in their point of view[12]. This is not surprising as first year students are entering a new system of learning and they appreciate guidance in adapting to this new environment. Results of students' questionnaire favoring non-experts' management skills indicate to educators that expert tutors need faculty development skills in management; a fact that does not justify replacing them by non-experts.

Schmidt *et al.*[9] showed that first year students' favored non-experts but when second year students were questioned; results were in favor of expert tutors. It may be that in the second year, students started to appreciate content more once they were familiar with the process of learning. This may imply that content knowledge may be important, as students advance in their studies, in order to challenge their minds and stimulate thinking[9].

In a study by Kaufman and Holmes[4], second year students felt that expert tutors explained content more frequently as their expertise

increased[4]. Yet in another study over four curricular years, expert tutors used their knowledge differently according to the year of curriculum indicating that experts intervened when necessary and that intervention was not just a habit of expert tutors[9].

There are some disadvantages of having non-expert tutor, which should not be overlooked. Silver and Wilkerson[3] alluded to the fact that non-expert tutors raised significantly fewer topics for discussion (11% *vs.* 69%). Yet, it wasn't viewed as a disadvantaged but rather considered a behavior against PBL principles.

Eagle *et al.*[7] pointed out that non-expert tutor's skew learning issue to fit their expertise. In their further analysis of learning issues raised by non-expert tutor, they found a disproportionate number of learning issues to be in the area of tutor's expertise. They gave the example of an infectious disease tutor tutoring on alcoholic liver disease; a large number of learning issues were related to infectious liver disease. This behavior is very alarming as it deviate the discussion from the learning objectives[7].

Matthes *et al.*[10] data on process assessment by students and on their learning times suggest that groups facilitated by non-expert tutors took shortcuts in the learning process. Students did not even perceive this as a negative attribute of the tutor. These shortcuts may re-direct the learning activity towards exam-related objectives.

Hay and Katsikitis[14] demonstrated that if a tutor lacked appropriate clinical knowledge then learning outcomes are very poor, even if this tutor had higher ratings on teaching performance. A few papers agreed with this notion suggesting that large gaps in content knowledge cannot be bridged by process expertise alone[9,12], and that lack of knowledge may fail to address relevant and stimulating questions.

Discussion

Many factors explain why the literature was inconclusive regarding the effect of tutors' expertise on students' learning [15]. These factors included differences in defining subject matter expertise, methodological, and sample size issues[15]. Other factors included the number of cases discussed in the tutorial, the difficulty and complexity level in the topic discussed, and the familiarity of students to PBL system. For example; the expertise allocation to specialists in Zakowski *et al.*[11] study could be argued as specialists were asked to tutor sessions outside their expertise. In fact, specialists rated themselves less confident in tutoring some of the basic clinical examination sessions outside their specialization, eluding to the fact that generalist might be the real experts in this context as they performed those examination more often in their clinical practice. In other studies where specialists only taught their specialty[2,11], one can argue the small gap in content expertise between specialist and generalist, especially in teaching basic clinical skills.

The role of the tutor in a PBL curriculum is to facilitate students' learning but this learning has to follow the objectives of the tutorial session. Tutors should direct students' attention to fulfill these objectives when they deviate from them. Knowledge and experience on the tutorial topic are helpful pre-requisites to stimulate critical thinking and fulfill the tutor role.

There are many advantages of having an expert tutor on students' learning. Content experts are more aware of knowledge gaps among student-group. Therefore, they know when to stop students at critical points, and ask for elaboration and explanation why certain questions are being asked[7]. Knowledge of concepts and subject principals, especially when the case is more complex, enable content-experts to probe students and stimulate critical thinking to challenge hypotheses related to these principals and concepts. Research has shown that expert tutors raised more learning issues in number, validity, and allowed students to spend more time on these learning issues plus it generated more congruent learning issues[7,14]. The effects of tutor expertise on learning were extended beyond the tutorial session.

Students led by expert tutors were shown to spend more time in self-directed study and score better on achievement tests than non-expert led students[5,8,16].

The disadvantages of non-expert tutors should not be taken lightly and educators should think carefully before replacing expert tutors with non-expert ones[14]. Non-experts were shown during tutorial sessions to take shortcuts, redirecting students toward exam objectives[10]. Non-experts were observed skewing learning issues to fit their expertise[7]. All these behaviors reflect poorly on students' learning outcomes[14]. When there is shortage of expert tutors, educators should perhaps reserve those tutors for tutoring advanced medical students in tackling complex medical issues[7,9]. When tutoring junior medical students in basic tutorial topics where clinician-tutors face in their practice, sub-specialized knowledge is not that important[12].

Process and content expertise are not necessarily contradictory but rather complementary. The focus of this review was on content expertise, however knowing how to teach a small group setting is as important as knowing what to teach[5,12]. In fact, knowing what to teach may help enriched the teaching process, stimulate students' metacognition and critical thinking, and eventually reflected on students' learning[1,7,9,10,13,16]. Current research looked at skills necessary for tutorial process[17] but future research should aim at studying the effect of content and process "dual" expert on students' learning[12,18].

Conclusion

The literature was inconclusive regarding the effect of tutors' content expertise on students' collaborative learning. Differences in defining subject matter expertise, methodological, and sample size issues may have contributed to this dilemma. When looking at the literature critically, tutor subject matter expertise had many advantages that were reflected on students learning during PBL session. Expert tutors raised more learning issues and increased study

time afterwards, especially in more complex clinical scenarios that required higher cognitive thinking and reasoning skills. The disadvantages of non-expert tutoring should not be taken lightly and educators should think carefully before replacing expert tutors. What educators should be focusing on is developing clinicians' skills to become better teachers/facilitators and nothing else.

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المعلم الخبير مقابل غير الخبير في التعليم الطبي: مراجعة نقدية

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المستخلص. كان الهدف من هذا البحث مراجعة لدراسات تتعلق بموضوع المعلم ذو الخبرة الطبية و تأثيره على تعلم الطلاب التعاوني وعلى تحصيل الطلاب الدراسي في التعليم الطبي في المرحلة الجامعية. وأجري استعراض لقواعد البيانات الطبية من ٨٨ مادة ذات صلة ومن ثم، تم تحديد ١٥ مادة أصلية لمقارنة الخبراء و المعلمين غير الخبراء. اتضح لنا أن المعلم ذو الخبرة يتمتع بالعديد من المزايا التي انعكست على الطلاب خلال الحصة الدراسية وبعدها. ينبغي للمربيين التركيز على تطوير مهارات الأطباء التعليمية ليصبح معلماً أفضل وليس العكس!