

Trends in research on the tutor in problem-based learning: Conclusions and implications for educational practice and research

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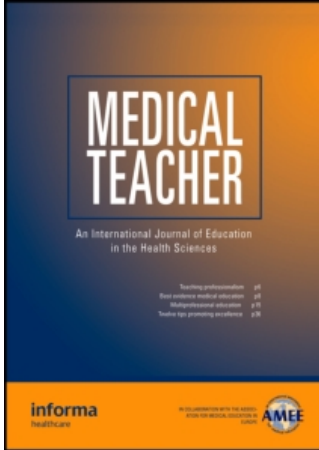
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Trends in research on the tutor in problem-based learning: conclusions and implications for educational practice and research

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SUMMARY *The tutor role in problem-based learning (PBL) has attracted the interest of many researchers and has led to an abundance of studies. This article reports on major trends in studies investigating the tutor during the past 10 years. Three major trends were observed by the authors while analysing the studies conducted: studies on the differential influence of content expert and non-content expert tutors on student achievement, studies on process variables, and studies on the relationship between tutor characteristics and differential contextual circumstances. The aim of this article is to summarize the main findings of the studies conducted so far within the three trends observed, to provide directions for educational practitioners and policy makers, and to suggest directions for future research questions. The studies included were selected by conducting a literature search in medical journals, which was complemented with the personal archives of the authors. The results of the studies conducted within the three trends of research have led to advanced insights in tutoring. The outcomes revealed that content expert tutors tend to use their subject-matter expertise more to direct the discussion in the tutorial group, whereas non-content expert tutors tend to use their process-facilitation expertise more to direct the tutorial group. Furthermore, a tutor's performance is not a stable characteristic but is partly situation specific. It is concluded that a tutor should both know how to deal with the subject matter expertise and should know how to facilitate the learning process. Faculty and policy makers should put substantial efforts into designing curricula and cases and developing tutors' skills by faculty development strategies that stimulate reflection. The research agenda should be driven more by modern educational theories of learning in which tutoring is a process aimed at stimulating constructive, self-directed, situated and collaborative learning by students. Furthermore, more qualitative studies should be conducted to gain better insights in teachers' conceptions about the tutor role and student learning to better understand their behaviours.*

Introduction

In the mid-1960s problem-based learning (PBL) was adopted as a new approach to medical education at McMaster University in Canada, and somewhat later at other universities, such as Maastricht in The Netherlands, Newcastle in Australia and New Mexico in the United States. Many schools followed thereafter. As Camp (1996) argues, PBL was the right response for the time in which it gained a foothold in medical schools. Faculty were

disappointed because too many students memorize, forget, fail to apply or integrate knowledge, and resist further learning. The underlying problem was that the curricula were based on a view of knowledge in which teachers were expected to tell students the 'truth' about what is known about medicine and science. This truth was primarily delivered by lecturing.

Current philosophical views of human learning are, however, based on a view in which 'knowledge' is not absolute, but is constructed by the learner based on previous knowledge and overall views of the world. Learning is a process that results from interactions with the environment. It is the learner who constructs new knowledge and who is at the centre of the educational process. This view is called constructivism (Savery & Duffy, 1995). PBL is consistent with the constructivist view on human learning. In PBL, teachers do not primarily disseminate information to students, but teach students to find answers to their own questions, facilitate students' learning process and provide students with feedback. PBL tutors are teaching students to learn and, as such, prepare them for a fast-changing world in which they must constantly acquire new skills and knowledge (Williams, 1992). PBL tutoring emphasizes the importance of student-centred instead of teacher-centred education.

Since most teachers in medical education have had primarily lecture-based experience, they have had hardly any role models for tutoring. They have expertise in the discipline in which they have been trained and have had limited training in how to teach students. They are prepared as lecturer or subject-matter expert with much knowledge about scientific truths or discipline-specific mechanisms and are assumed to be able to deliver this knowledge to students by lecturing. With this background it is understandable that they feel uncomfortable with the tutor role in PBL. Some of these tutors, when being confronted with this new role, assume that a tutor should be passive and follow the student-centred model so rigidly that they, as tutors, become totally uninvolved (Williams, 1992). In contrast, a tutor should encourage specific kinds of cognitive activities, such as making connections, providing feedback and helping students to monitor their own learning. This implies that tutoring requires other

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skills than lecturing. This change in the teacher's role has not only led to uncomfortable feelings in those who practise it, but has also attracted the interest of PBL researchers who realized that it would be necessary to investigate how teachers serve in this new role. As a consequence, an abundance of studies has become available, each dealing with various issues in tutoring.

The aim of this article is to analyse the outcomes of studies on the tutor conducted during the last 10 years in order to signal trends in tutor research. Conclusions are drawn and the implications for educational practice and research are discussed. When analysing the studies, the authors observed three trends in tutor research. The three trends are closely correlated with general trends in educational research and evaluation, as will be outlined below.

Trends in tutor research

Studies on the differential influence of content expert and non-content expert tutors on student achievement are taken to characterize the first trend in tutor research. This trend is closely correlated with the behavioural objectives model of Tyler in general educational evaluation research in which the typical question addressed is related to whether students are achieving the objectives. Within this tradition of educational evaluation research, there is a near exclusive reliance on studying outcomes (Shadish *et al.*, 1991). The ultimate goal of education in this perspective is student performance, which implies that educational research and evaluation studies should focus upon evaluating student achievement. The changes in the teacher role in PBL as described above made PBL researchers investigate the influence of tutor characteristics on student achievement.

In time, the scope of educational evaluation research broadened from an exclusive reliance on outcomes to measuring the educational process itself. These studies are closely correlated with the process evaluation model of Stakes. Within this tradition, studies are conducted that focus upon the educational process itself. Studies investigating the educational process itself are assumed to provide better understanding of how particular educational activities contribute towards student achievement. In this respect, PBL researchers also started to investigate the differences between tutorial groups guided by content expert tutors versus groups guided by non-content expert tutors from a process perspective, rather than an outcome perspective. The underlying idea was that the contradictory findings in the studies focusing upon outcomes could perhaps be explained when focusing upon process variables. Thus, the second trend can be characterized as studies focusing upon process variables.

The shift in educational evaluation research from an outcome orientation towards a process orientation led ultimately to studies focusing upon the interaction between process variables and outcome variables. The idea underlying these studies is that education takes place in a complex dynamic environment in which different variables influence each other mutually. In studies on the tutor role, this shift led to studies investigating the relationship between the tutor's characteristics and other curricular

variables (Schmidt, 1994; Dolmans, Wolphagen & Schmidt, 1996). The idea behind this third trend in studies is that a tutor's performance might not be a stable and uniform teacher characteristic, but may be situation-specific as well, as initially postulated by Wilkerson (1994). This third trend can therefore be characterized as studies investigating the relationship between tutor characteristics and differential contextual circumstances.

This article is divided into three parts covering the three areas of studies just mentioned. The findings within these three areas have led to advanced insights in tutoring. For each part, the results and conclusions that can be drawn from these studies are described. Attention will also be paid to the shortcomings of these studies. In the conclusion section at the end of this article, the implications of these findings for educational practice and policy makers are discussed and directions for future research are suggested subsequently. First, how the studies were selected will be outlined.

Method

The aim of this article is to bring together the conclusions of those tutor research studies that cover the three trends already discussed:

1. studies on the differential influence of content expert and non-content expert tutors on student achievement;
2. studies on process variables;
3. studies on the relationship between tutor characteristics and differential contextual circumstances.

The studies that are included in this article were restricted to the three areas mentioned. A literature search was conducted on CD-Rom databases: ERIC, Psyclit, Medline and Current Contents. Six journals that publish articles in this area on a regular basis were included in this search analysis: *Medical Education*, *Academic Medicine*, *Medical Teacher*, *Teaching and Learning in Medicine*, *Education and the Health Professions* and *Advances in Health Sciences Education*. This implies that almost all studies included were conducted on a medical or health sciences curriculum. Since PBL has a longer tradition in these professions, it is not surprising that most studies on PBL were conducted in the context of these professions. The key words that were used for the search were: PBL, tutor expertise, tutor evaluation, tutor assessment. The period from which the studies were selected covers the last 10 years. The literature was complemented with the personal archives of the authors of this study, in so far as they were not covered by the formal search. These remarks about how the literature was selected indicate that the studies included in this article might not completely cover all studies conducted on tutor research in PBL and that there might be a danger of a certain bias in the selection of studies (although we believe that the most important studies are included that deal with the three identified trends in tutor research). Furthermore, it should be mentioned that, although the studies selected were not sorted according to any criteria for rigour, the findings are certainly based on studies with at least a sufficient level of methodology.

Trend 1: Studies on the differential influence of content expert and non-content expert tutors on student achievement

There are quite a few studies on the influence of tutors' subject-matter expertise on student achievement. In most studies comparisons are made between content expert faculty tutors and non-content expert faculty tutors, whereas in some studies faculty tutors and student tutors are compared.

Research comparing student achievement of tutorial groups guided by either content expert faculty tutors or non-content expert faculty tutors shows ambiguous results. No differences in achievement were found by De Volder & Schmidt (1981); Swanson *et al.* (1990); Davis *et al.* (1994); Regehr *et al.* (1995) and Dolmans, Wolhagen & Schmidt (1996). Differences in students' performances in favour of students guided by content experts were found by Davis *et al.* (1992); Schmidt *et al.* (1993) and Schmidt (1994). In a study by Des Marchais & Black (1991) mixed outcomes were shown. These authors found no differences emerging on multiple-choice tests, but significantly better results by students guided by content-expert tutors on an essay test.

Research comparing students' performance guided by faculty or student tutors also shows mixed results. Studies by de Grave *et al.* (1990), Gruppen *et al.* (1992) and Moust (1993) revealed no differences. Differences in achievement in favour of students guided by faculty tutors were found by Moust *et al.* (1989) and Schmidt *et al.* (1994). No differences in one course and differences in favour of faculty-guided students in another course were found by de Volder *et al.* (1985) and Gijsselaers *et al.* (1987).

In conclusion, the studies on the differential influence of content expert and non-content expert tutors on student achievement reveal contradictory findings, i.e. some studies reveal that tutorial groups guided by content-expert or non-content-expert tutors led to equal student performance, whereas other studies reveal that students guided by content-expert tutors have better test performance than students guided by non-content-expert tutors. Some explanations for these contradictory research findings are given by Schmidt *et al.* (1993); Moust (1993); Schmidt (1994) and Regehr *et al.* (1995). One reason may be related to the poor definition of the concept 'subject-matter expertise of the tutor'. Some researchers (e.g. Davis *et al.*, 1992, 1994) used an extremely stringent definition of what constitutes content expertise; other researchers (e.g. Schmidt *et al.*, 1993) used rather broad qualifications to discriminate content-expert tutors from non-content-expert tutors. These differences in defining what constitutes a subject-matter expert or non-content-expert tutor may partly explain different research outcomes. Other reasons for these mixed outcomes may be found in methodological differences, including differences in the magnitudes of the samples used (some studies focused on one brief course, others included a whole curriculum), the number of cases that were discussed by students in the tutorial groups (some studies used two cases, other studies offered the students 20 or more cases per course), the number of students involved (studies varied from 160 to 2600 students) and the extent to which students are

familiar with problem-based learning (in some studies students had little experience, in other studies students are well acquainted with this learning approach). Finally, the sample size of some studies could be so small that differences in students' achievement influenced by the level of tutor content expertise could by its very design never be found. In summary, it may not be surprising that researchers decided to shift their attention from outcome-oriented studies to more process-oriented studies. The findings of these studies are described in the following paragraph.

Trend 2: Studies on process variables

Several studies were conducted that focus on differences between content-expert and non-content-expert tutors from a process perspective. Only a few investigations were conducted focusing upon the influence of tutors' characteristics on the quality of the interaction in the tutorial group. Silver & Wilkerson (1991) observed tutorial groups in action. They noticed that in tutorial groups content expert tutors took a rather directive role. Content-expert tutors spoke more often and for longer periods, they were quicker at providing direct answers to students and suggested more items for discussion in the tutorial group than the non-content experts. In content-expert-guided groups, student-student discussion occurred less often, and tutor-student interaction prevailed. Davis and his colleagues conducted two consecutive studies in which the interaction in the tutorial group was analysed. In the first study they did not find significant differences in the percentage of student-initiated and teacher-directed activities between tutorial groups led by experts and those led by non-experts (Davis *et al.*, 1992). In the second study they found that a significantly larger percentage of the time was devoted to teacher-directed activity in the expert-led groups than was devoted to it in the non-expert-led groups (Davis *et al.* 1994). In this study the case offered to the students was more structured and the tutors received long and extensive preparation. Regehr *et al.* (1995) conducted a study in which no differences were found between content-expert-versus non-content-expert-led tutorial groups on mean number of tutor and student verbalizations. As a potential explanation for finding no difference it was mentioned that in fact all tutors were content experts, because all the tutors were physicians. In general the studies on the quality of interactions in the tutorial group demonstrated that tutors who were more familiar with the subject matter to be discussed seemed to take a more directive role in the tutorial group.

In parallel with these studies, two investigations were conducted to examine the effects of tutors' level of subject-matter expertise on student-generated learning issues and time spent on self-study. In a study conducted by Eagle *et al.* (1992), it was found that groups guided by content-expert tutors produced twice as many learning issues for self-directed learning than students guided by non-content-expert tutors. Moreover, they found that tutorial groups guided by content-expert tutors spent approximately twice as much self-study time per case in overcoming identified learning deficiencies. Another study, by Schmidt *et al.* (1993), showed similar results. Students

guided by content-expert tutors spent significantly more time on self-directed learning than students guided by non-content-expert tutors. Moust (1993), investigating differences between faculty tutors and student tutors, also found that groups guided by faculty tutors spent significantly more time on self-directed study than students guided by student tutors. However, an attempt to replicate this finding in another course yielded no differences. An explanation for the findings that groups guided by content-expert tutors generate more learning issues and spent more time on self-study might be that content-expert tutors suggest more items for discussion in the tutorial group, as shown in a study conducted by Silver & Wilkerson (1991).

From the majority of studies investigating differences between content-expert and non-content-expert tutors described so far, it can be concluded that the content expertise of a tutor in PBL groups leads to more teacher-directed activities at the cost of student-initiated activities. Content expertise seems to result in a more directive role on the part of tutors and in fewer student-student interactions. The results of these studies also correspond with a study conducted by Kaufmann & Holmes (1998). These researchers found that tutors who rated themselves as content experts found it difficult to maintain the facilitator role and tended to present and explain case material more frequently than tutors who had less content expertise. Although the majority of studies demonstrate that content-expert tutors tend to use their expertise more in order to help students, several studies focusing upon facilitative behaviours demonstrate that non-content-expert tutors maintain the facilitator role better and tend to initiate more activities in the tutorial group to stimulate activities dealing with group dynamics. These studies are summarized below.

Schmidt and his colleagues (1993) found that in the students' opinion content experts used their subject-matter knowledge more frequently in order to help students, whereas non-content-expert tutors evaluated the groups' functioning more often. A recent study aimed at investigating differences between tutors in terms of different tutor-intervention profiles also demonstrated that some tutors can be characterized as relying more on the use of expert knowledge, whereas other tutors can be characterized as relying more on their abilities to stimulate the learning process in the tutorial group (De Grave *et al.*, 1998, submitted). Thus, both content-expert tutors and non-content-expert tutors tend primarily to initiate activities in the tutorial groups they are most familiar with, i.e. content-expert tutors suggest topics for discussion and non-content-expert tutors evaluate the tutorial group process.

In the studies described so far, faculty content-expert tutors were compared with faculty non-content-expert tutors. However, several investigators made comparisons between faculty and student tutors. These studies showed, in general, similar outcomes. Schmidt *et al.* (1994) found that faculty tutors made more extensive use of their subject-matter knowledge than student tutors, whereas student tutors evaluated more extensively than faculty tutors did. Moust & Schmidt (1994) also reported differences in the behaviour of faculty and student tutors. The results of their study showed that faculty tutors were

proved to use their expertise more frequently. Student tutors, however, displayed significantly more 'cognitively congruent behaviour' in a tutorial group. Cognitively congruent behaviour means that the tutor is able to place him/herself in the students' way of thinking and interacts with the tutorial group members at, or right above, the students' level of knowledge. Student tutors were better able to understand the nature of the cognitive problems students were faced with in attempting to master the subject matter.

Although the outcomes of the studies on process variables reveal some contradictory findings, in general it can be concluded that content-expert tutors tend to use their subject-matter expertise more to direct the discussion in the tutorial group (leading to more time spent on self-study by students, more student-generated learning issues, suggesting more topics for discussion), whereas non-content-expert tutors tend to use their process-facilitation expertise more to direct the tutorial group (leading to more evaluations of group functioning). However, the contradictory findings in some of the studies described so far directly or indirectly provide evidence that the difference between content-expert and non-content-expert tutors is at least more complicated. Contextual circumstances, such as the degree to which tutors are familiar with the subject matter to be discussed and characteristics of the course in which the study is conducted, may as well influence differences in behaviour of content-expert and non-content-expert tutors. The idea that education takes place in a complex dynamic environment in which different variables influence each other mutually made PBL investigators decide to conduct studies in which not only tutors' characteristics were investigated, but also the external circumstances and how these interact with tutors' behaviour. These studies will now be described.

Trend 3: Studies on the relationship between tutor characteristics and differential contextual circumstances

While the studies described so far focus upon differences between content-expert and non-content-expert tutors from a process perspective, the studies described below focus upon the influence of differential contextual circumstances on tutor behaviour. The contextual circumstances investigated so far are: the quality of the cases, structure of PBL courses, link with students' level of prior knowledge, structure of the curriculum and functioning of tutorial groups.

Davis *et al.* (1992) found that students led by experts had higher examination scores. Davis and his colleagues, however, were not able to replicate this finding in a follow-up study in 1994, as outlined earlier. In the latter study, Davis found no significant difference between the students' performance in groups guided by content experts and those guided by non-content experts. As an explanation for this remarkable outcome Davis and his colleagues hypothesized that in the 1994 study carefully designed and highly focused cases were used, which could compensate for the lower level of expertise of a tutor. The focus of the case seems to have a significant impact on the behaviour of the tutors. A similar hypothesis was tested in a study

conducted by Schmidt (1994). In order to provide more insights in the contradictory findings on differences in student performance of tutorial groups guided by content-expert and non-content-expert tutors, Schmidt (1994) investigated whether there is an effect of tutor expertise on test scores under conditions of PBL courses with a low or high structure and curricular materials that poorly or well match students' level of prior knowledge in the Maastricht Health Sciences curriculum. Schmidt (1994) found a differential effect of tutor expertise on student performance, as a main effect and in interaction with the structure of curricular materials and students' level of prior knowledge. He concluded that when the structure of a course is low and/or students lack prior knowledge, the impact of a tutor's expertise on student performance is greater. In other words, a tutor's expertise compensates for lack of structure and lack of prior knowledge. Thus, content-expert tutors are better able to deal with courses that are less structured and fit less with students' level of prior knowledge. Neville (1999), reviewing studies conducted on the tutor role in PBL, also concluded that the degree of tutor content knowledge required for effective student learning is not an absolute quantity, but needs to be tailored to the particular student groups' level of prior knowledge and familiarity with PBL. The idea that content-expert tutors compensate for deficiencies in students' prior knowledge and deficiencies in the structure of the course is congruent with the earlier reported finding that content-expert tutors play a more directive role in the tutorial group and suggest more of the topics for discussion (Silver & Wilkerson, 1991).

Dolmans, Wolfhagen & Schmidt (1996) also investigated whether there is an effect of tutor expertise on test scores under different conditions in the Maastricht medical curriculum. In this study, in contradiction with the Schmidt study (1994), no statistically significant differences were found in performances between content-expert and non-content-expert tutors. The interaction effects between a tutor's level of expertise and amount of structure on the one hand and students' level of prior knowledge on the other turned out not to be statistically significant. An explanation for the discrepancy in the study of Schmidt (1994) and Dolmans, Wolfhagen & Schmidt (1996) might be the range within which the structure of the curriculum and students' level of prior knowledge varies in both curricula that were studied. The structure of the curricular materials in the Dolmans, Wolfhagen & Schmidt study (1996) varies within a smaller range than that in the Schmidt study (1994). Thus, from both studies it could be argued that the effect of a tutor's subject-matter expertise on student performance will interact with the structure of the curriculum. In a well-structured curriculum, a tutor's level of expertise is less likely to be actually 'used' by students or has less incremental value, because students rely on the curriculum or allow the curriculum to do its work.

Two other studies have been conducted that provide us with some evidence about the influence of differential curricular characteristics on tutor behaviour. Gijsselaers (1997), investigating the effects of contextual factors on tutor behaviour, concludes that what a tutor does in a tutorial group depends on context-specific characteristics,

such as course features. In 1996 Dolmans, Wolfhagen & van der Vleuten investigated the stability of tutor evaluations across different courses. The results of this study demonstrated that a tutor's performance is relatively stable over different courses. The highly structured cases and the highly structured PBL courses are again assumed to lead to fewer differences in evaluations of tutor behaviour across courses. Thus, from both studies it can be concluded that a tutor's performance is not only a stable characteristic but is partly dependent on the structure of the course and the structure of the curriculum.

Further to the studies focusing upon the influence of the structure of curricular materials, a study was conducted in which the influence of the functioning of the tutorial group turned out to be another variable of importance in explaining the contradictory findings in tutor research. In this study conducted by Dolmans *et al.* (1999) it was demonstrated that tutorial groups with relatively low levels of productivity require much more input from a tutor than highly productive groups. Thus, tutor competences may vary across different tutorial groups. In this study, tutors were involved who guide two tutorial groups within the same course. A salient finding was that some of these tutors had discrepancies in their tutor performance across the two tutorial groups. Because the tutor in this situation ran two groups within one course, the tutor's expertise did not differ in relation to the course content nor did the structure of the curriculum alter the relationship. This setting provided an excellent opportunity to investigate inconsistencies in tutor performance. The results demonstrated that for those tutors with a discrepancy in their tutor performance score, a low level of tutor performance in one group corresponds with a low productivity score for this tutorial group, whereas a high level of tutor performance corresponds with a high level of group productivity. This study demonstrates that tutorial groups with relatively low levels of productivity require much more input from a tutor than highly productive groups. Thus, tutor performance may vary with differences in tutorial group functioning.

In conclusion, a tutor's performance is not a stable teacher characteristic, but is rather situation specific. The contextual circumstances that were shown to influence tutor behaviour are the quality of the cases, structure of PBL courses, link with students' level of prior knowledge, and the functioning of tutorial groups. Thus, a tutor's performance may be partly tutor-specific and partly situation-specific, as initially postulated by Wilkerson (1994).

Conclusions

This last section summarizes what educational practitioners and policy makers should conclude from the results of the studies conducted within the three trends of tutor research described in this article. Furthermore, which areas require more research and need further investigation in the future is discussed.

Despite the differential outcomes of some of the studies described, conclusions can be drawn that need to be considered when making decisions about the tutor role in problem-based learning. The outcomes of the studies on

the differential influence of content-expert and non-content-expert tutors on student achievement (trend 1) revealing contradictory findings imply that, based on student achievement, no firm conclusions can be made about the question of whether or not small tutorial groups should be guided by content expert tutors. However, the other studies, indicated in this article as trend 2 and trend 3 studies, led to advanced insights in tutoring.

From the studies investigating differences between content-expert and non-content-expert tutors from a process perspective (trend 2), we learned that content expert tutors tend to use their subject-matter expertise more to direct the discussion in the tutorial group, whereas non-content-expert tutors tend to use their process-facilitation expertise more to direct the tutorial group. Ideally, a tutor should be both an expert in the subject matter under discussion and an expert in facilitating student learning. Thus, a tutor should both know how to deal with his/her subject matter expertise (i.e. his/her behaviour should be cognitively congruent), and how to facilitate the learning process (i.e. by evaluating on a regular basis and establishing a personal relationship with students in the group). Barrows (1988) wrote in this respect: 'Tutors should be experts in the subject matter areas they teach and they should be experts in facilitating students' learning processes as well as in guiding tutorial group processes. There is no question that the ideal situation is for the tutor to be an expert both as a tutor and in the discipline being studied by students' (pp. 43–44). In a study aimed at investigating differences between tutors in terms of different tutor intervention profiles, it was indeed demonstrated that a tutor intervention profile that was perceived by students as most effective showed high scores on both dimensions, i.e. use of expert knowledge and use of process-facilitation skills (de Grave, Dolmans & van der Vleuten, 1999). It will be evident that faculty and policy makers in most situations can not simply select tutors who are good in the discipline being studied and in facilitating the learning process: policy makers should put efforts into professional development training of faculty with weak process-facilitation skills. Training sessions are nowadays common at most PBL schools. During these training sessions tutors learn how to stimulate specific kinds of cognitive activities, such as how to actively engage students, how to scaffold students' learning and how to encourage students' meta-cognitive strategies. In the future, more attention should be paid to faculty-development strategies in which tutors learn to reflect on their conceptions of the tutor role, on their conceptions about student learning and on their actual behaviour as tutors. Training should be offered to teachers in which they learn to reflect on and discuss their teaching ability, for example by means of co-teaching or peer coaching (Orlander *et al.*, 2000). Faculty and policy makers should put more effort into developing faculty-development strategies that stimulate reflection on the tutor role.

The studies investigating the relationship between tutor characteristics and differential contextual circumstances (trend 3) demonstrate that a tutor's performance is also dependent on the quality of the cases used and the structure of the curriculum. The practical implication is that faculty and policy makers should design high-quality cases

along with developing tutors' skills. The quality of cases strongly influences the PBL process, as demonstrated in a study by Gijsselaers & Schmidt (1990). They developed and tested a causal model of problem-based learning using student evaluation data. Several variables were included, including tutor functioning and quality of cases. It was found that, although the tutor had no direct influence on achievement, he/she had considerable influence on students' subject interest. In a study by Schmidt *et al.* (1995) the model of Gijsselaers & Schmidt (1990) was reconfirmed and again the quality of cases was found to strongly affect the PBL process. Schools should therefore put effort into designing cases and curricula that are well structured and that link up well with students' prior knowledge. In general, educational practitioners and policy makers should not only concentrate on the tutor role that appeals most to their imagination, but also on other PBL variables, such as the quality of cases and the curriculum as a whole (including organizational aspects, such as making use of evaluative data as part of the decision-making process for promotion, tenure and salary). Thus, teachers and policy makers should put more effort into the development of PBL cases and PBL curricula.

Several suggestions for future research can be formulated based on the findings of the studies described in this article. First, future research should focus upon how different key PBL variables interact with each other because it was demonstrated in several studies that tutor characteristics interact with differential contextual circumstances. For example, more research is needed about the relation between tutor characteristics and the tutorial group process. In addition, the studies testing causal models on PBL (such as Gijsselaers & Schmidt, 1990; Schmidt *et al.*, 1995) should be expanded and refined, because they provide us with more insights in how the different PBL variables are related to each other. Second, it can be concluded that the research agenda should be driven more by modern educational theories of learning in which tutoring is a process aimed at stimulating constructive, self-directed, situated or transfer-directed, and collaborative learning by students. Third, instead of focusing upon student test scores, more studies should be conducted in which more qualitative approaches as compared with quantitative approaches are used (such as Silver & Wilkerson, 1991). Qualitative studies should be conducted to obtain detailed and in-depth knowledge concerning teachers' conceptions of the tutor role and student learning. These qualitative approaches provide us with better insights in tutors' conceptions underlying their actual behaviours in tutorial groups. Fourth, future studies should investigate the effects of training on professional development of tutors. Until now, only a few studies have been conducted on the effects of training on the professional development of tutors. However, changes within the universities make these studies indispensable. The increasing demands from today's society for professional accountability (Curry & Wergin, 1993), also raise the pressure on educational institutions to demonstrate that tutor training is an educational enterprise which is worthwhile. Studies on the effectiveness of training on professional development of tutors should become a trend in tutor research.

Practice points

- Three major trends were observed in tutor research during the last 10 years.
- The first trend deals with studies on the differential influence of content-expert and non-content-expert tutors on achievement, revealing contradicting findings.
- The second trend deals with studies on process variables, revealing that content-expert tutors use their subject matter expertise more to direct the discussion, whereas non-content-expert tutors use their process facilitation expertise more to direct the discussion.
- The third trend deals with studies on the relationship between tutor characteristics and differential contextual circumstances, revealing that a tutor's performance is partly situation specific.
- In practice, a tutor should know both how to deal with subject matter expertise and how to facilitate the learning process.
- The research agenda should be more driven by modern theories of learning and more qualitative studies need to be conducted.

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