# Implementing Best Practice in Training Problem-Based Learning Tutors

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**Purpose:** In order to implement problem-based learning (PBL), extensive staff training is required. The purpose of this study was to qualitatively evaluate the efficacy of a training programme for inexperienced PBL tutors.

**Methods:** Data included anonymous feedback from programme participants, semi-structured interviews with programme participants, and feedback from students.

**Results:** Data from these independent sources were analysed, resulting in three main themes that painted a comprehensive picture of the success and limitations of the PBL tutor training programme: I) pedagogical knowledge of PBL was obtained but needs to be reinforced by practice; II) the mock tutorial was a relevant experience; III) a written PBL tutor guide supports training efforts.

**Conclusions:** Using diverse sets of data, this study demonstrated that the acquisition of pedagogical knowledge is contextual and partial, and multiple sources of knowledge are required to achieve a complete and interpretable picture of the subject.

**Keywords:** Problem-based learning; staff development; biomedical science education; qualitative analysis

## INTRODUCTION

In biosciences education at the undergraduate level, it is critical for students to develop oral and written science communication skills, with a focus on aquiring and synthesising information from the scientific literature. To achieve this, we elected to incorporate two problem-based learning (PBL) problems selected to align with ongoing research in the Biosciences Department, considering that a PBL problem should cross boundaries between disciplines, i.e. aspects of molecular biology, cell biology, and physiology should be covered in a single problem in biomedical sciences education (Jonassen, 2008). These problems were carefully constructed to present learners with real-life scenarios and allow students to approach a problem with a great degree of intellectual freedom, while remaining embedded within the core curriculum (Hung, 2008). Crucially, PBL provides a cognitive challenge by not providing all the necessary information, thereby driving self-directed knowledge acquisition (Allen, 2011).

PBL tutors provide support to students during the tutorial by using a Socratic style of teaching to draw as much as possible out of the learners through a constructive questioning process (De Grave, 1999). Importantly, the skills needed to effectively run a PBL tutorial need to be in place before implementing this style of teaching. However, very few members of academic staff assigned to carry out PBL in the department had any experience using this teaching style, so a training course for staff was designed an implemented. This was developed as a one-day training session to provide members of academic staff with a pedagogical background on the benefits and limitations of PBL, as well as practical experience working with this method (Walsh, 2005). The emphasis was on teaching academic staff how to guide students through

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the PBL process and to meet their learning objectives in a constructivist way (Savery & Duffy, 2001). Additionally, the course focused on encouraging students to contribute actively to the group. Feedback methods were discussed, as were methods to evaluate the group process. The course concluded with a mock PBL tutorial to observe the process in action, as well as how to spot frequently-occurring problem situations and take adequate action. Upon conclusion, the participants received a certificate of participation and provided anonymous feedback on the training course content.

The purpose of this study was to qualitatively evaluate the efficacy of this training programme based on data acquired from members of academic staff who participated in the training course and who subsequently implemented PBL in their tutorial groups.

This structured enquiry was performed (Servant-Miklos, 2019). Using this approach, interpretations were made based on qualitative data obtained from participants to assess the success and limitations of the training course. Data acquisition for this project used different sources to perform an inductive analysis (Servant-Miklos, 2019). This research comprised three types of primary sources: anonymous feedback acquired via a questionnaire completed by participants immediately after the PBL tutor training course, data acquired via semi-structured interviews with members of staff who completed the training course and subsequently served as a PBL tutor, and feedback from students on the Year 2 PBL module in that same academic year. The data from these three independent sources were analysed to assign meaning to the qualitative data, with the ultimate aim of continually improving the provision of PBL tutor training.

### Acquisition of skills through PBL tutor training

The PBL tutor plays major roles in ensuring that student learning takes place and in providing a positive and informative PBL experience. The primary role of a PBL tutor is to serve as a facilitator during the tutorial, which should be primarily student-led. In an ideal PBL setting, students identify the gaps in their understanding, formulate learning objectives, and assign learning tasks. Smooth progression through these steps requires a tutor who should be able to identify issues within and beyond the context of the problem that may lead to missed student learning opportunities. The tutor should understand the subject matter of the problem before the tutorial starts, establish ground rules within the tutorial group, and monitor both student progression and group dynamics during the tutorial (Chan, 2008).

Ideally, a PBL tutor should be highly informed, well-prepared, and intensely critical. However, becoming a skilled PBL tutor is not as easy as it looks. It requires thorough training, intense preparation, and a great deal of practice to gain any sense of confidence at all (Chan, 2008).

Training PBL tutors is therefore crucial to implementing this type of curriculum change. Training workshops and role plays should be implemented to help staff develop a facilitative-collaborative teaching style in which the tutor fosters critical thinking and encourages students to synthesize information (Nesargikar, 2010). PBL tutors also need to develop a sound understanding of group dynamics, in order to keep the group focused on the task at hand. Finally, the shift from didactic learning, in which the instructor is inarguably an expert on the material, to a situation of facilitated learning may make PBL tutors feel insecure. In fact, a study by Finucane et al. (2001) showed that only a small proportion of staff volunteer to be PBL tutors; interestingly, the volunteer rate is higher in tutors who had previously experienced PBL as a student (Finucane, 2001).

### The process of developing the training workshop

Based on the pedagogical literature concerning PBL tutor training programmes and development, five levels of training are required (Price, 1997):

Level 1: An introduction to PBL as a learning model, along with the theoretical underpinnings of PBL as a constructivist, student-centred model of learning. This step allows participants to understand the benefits and limitations of PBL, as well as expectations on the part of the tutor.

Level 2: Observation of a mock PBL tutorial conducted by an expert tutor (the course instructor), including observation of the tutor role, the process of formulating learning objectives, and the presentation of researched material. This step helps to foster understanding of the tutor and student roles in PBL.

Level 3: Acquiring hands-on experience as a tutor, followed by a critical evaluation of the tutor role. In some cases, the best way to learn is by doing!

Level 4: Practising the tutor role in a number of academic cycles. This allows tutors to continuously develop their PBL tutor skills and reflect on this process.

Level 5: Ongoing review, reflection, and modification of the PBL curriculum. This involves interactions between tutors to share best practice, reflections on the delivery of PBL and learning outcomes, and modifying practice as necessary.

The PBL tutor training course covered Levels 1 and 2 of this paradigm, wheras feedback was obtained after participants had achieved Level 3 learning. The morning session (Level 1) included a lecture and small group activities on the process of PBL and the support for using this teaching method in the literature. The

afternoon session included a mock tutorial (Level 2) in which course participants observed the PBL process in action. This was a somewhat contrived setup the first two times the course was run, as the tutorial group was comprised of previously briefed graduate students who had rehearsed the entire scenario. Based on comments from participants, this was changed in the third iteration of the course to using the participants as the tutorial group, providing an active rather than passive PBL experience; this received highly favourable feedback. Participants also received a PBL Tutor Guide and some literature on the use of PBL in biomedical science education.

**Level 1: Pedagogical concepts in PBL**

Based on current philosophical views of human learning, knowledge is not absolute, but is rather constructed through interactions with the environment (Dolmans, 2002). A learner who constructs new knowledge based on a real-life scenario is thus at the centre of the educational process; this educational approach is called constructivism (Savery & Duffy, 2001). PBL embodies the constructivist approach to learning since PBL tutors do not simply disseminate information to students, but instead provide students with the opportunity and tools to answer their own questions. In this way, PBL tutors are in fact teaching the ability to learn, an important skill that has the potential to impact the student's life beyond the PBL tutorial.

PBL can be seen as a type of cognitive apprenticeship (Hmelo-Silver, 2004), since PBL contextualizes learning using complex, relevant problems. Tutors make key contributions via their expertise on the subject matter, demonstrated by asking questions that provide a scaffold for student learning. This role is critical, since the tutor must continually monitor the discussion, guiding students away from unnecessary tangents and ensuring that the recommended learning objectives are met. As students become more experienced with PBL, the tutor can provide progressively less scaffolding and guidance, until finally the students master the PBL technique and can carry out the process with minimal tutor guidance (Hmelo-Silver & Barrows, 2006).

Tutors need to provide feedback to students on multiple aspects of learning by assessing tutorial participation, knowledge acquisition, and written work. Importantly, tutors should also receive feedback from students on their ability to lead the tutorial, and continually improve their teaching practice over multiple rounds of PBL (Vogt, 2017). My goal in designing this aspect of the training course was to not only teach PBL as an educational method, but also to motivate tutors to promote the learning process using PBL in a way that benefits students and staff equally.

**Level 2: Running a tutorial and managing group dynamics**

The goal of a PBL session is for the students to investigate a scenario presented to them that provides some but not all of the necessary information (Maudsley, 1999). They then follow the seven-step PBL process:

1. Identify the main problem to be solved, i.e. "Why did X cause Y to become ill?"
2. Determine which aspects of the problem require explanation by brainstorming their ideas as a group. The aim in this step is to develop a mind map that allows the students to generate hypotheses and analyse concepts in the scenario.
3. Investigate previous knowledge by suggesting explanations for the scenario and appraising what they believe to be relevant.
4. Formulate learning objectives by identifying gaps in the students' understanding of the scenario and identifying what needs to be pursued. Each student is then assigned one learning objective.
5. Research the assigned learning objective between sessions.
6. Explain the essence of the learning objective by synthesising information prior to the tutorial and sharing this new knowledge with the group during the tutorial.
7. Critically evaluate the acquired material via a group discussion, and come up with a cogent perspective of the issues raised in the scenario.

Finally, all group members reflect on and evaluate their performance by discussing the group process and learning, as well as personal contributions and achievements; this assessment should always include the tutor.

As mentioned above, this aspect of the training course was first carried out through a prearranged mock tutorial (in the first and second workshops); based on participant feedback, this was changed to a more active, spontaneous mock tutorial in the third workshop, using course participants as the tutorial group members. In its current iteration, the training course also incorporates video clips as an interactive tool to improve the ability of future PBL tutors to recognize specific obstacles to functional group dynamics and to help them develop effective intervention strategies. Previous research has shown that this this type of tool is well-accepted and can be readily integrated into a PBL tutor training workshop (Bosse, 2010).

An ethnographical approach was taken to consider the epistemology, ontology, and axiology of the methods used to assess the impact of the PBL tutor training course. Westbrook argues for the 'ethnography of current situations', a type of refunctionalised ethnography in which critical reflexivity is used in such a way that self-consciousness is not only deployed as a critique after the

event, but is rather part of the design of the project from the beginning.

A thematic analysis was performed on how well participants felt that the PBL tutor training course achieved two distinct learning objectives: (1) acquiring knowledge of the pedagogical aspects of PBL and (2) mastering the practical aspects of running a PBL tutorial.

Semi-structured interviews were carried out with academic staff who participated in the training course and who subsequently implemented PBL in their tutorial groups. These interviews focused on two specific themes related to the implementation of PBL, i.e. the principles of PBL (pedagogical background, roles of group members, group dynamics, use of Bloom's taxonomy (Bloom, 1956), the formulation of learning objectives) and the implementation of PBL (leading a PBL tutorial, providing support to students, delivering and providing feedback on assessments).

# METHOD

### Data collection

Data were obtained through anonymous feedback forms collected immediately after the training course and through semi-structured interviews with members of academic staff in the Biosciences Department at Aston University. All interviews were recorded in audio and subsequently transcribed and a thematic content analysis was performed on the transcripts. Based on a theoretical framework, a list of topics (pedagogy, mock tutorial, and tutor guide) and codes to guide the initial analysis was prepared and data were encoded. Subsequently, the grouping of codes was carried out based on the thematic areas. Recordings were destroyed after the transcript was checked for accuracy. Student feedback from the 2018-19 cohort of the PBL module was also included in the analysis.

The scope of this study was delimited to members of staff who took part in one of three PBL tutor training workshops in June/July 2018 and who acted as a tutor for the PBL module in the 2018-2019 academic year. The course participants covered a broad range of academic and pedagogical experience, including the Head of Department, the Programme Director and other professors, as well as more junior members of academic staff (Lecturers, Senior Lecturers, and PhD students with a teaching role). Staff who attended the training course but who did not teach on the module, and PBL tutors who taught on the module but did not attend the training course were not included in the study. From a pool of 22 eligible participants, interviews were completed with 10 participants, which provided a representative sample of this group and achieved data saturation.

### Data analysis

The output from the semi-structured interviews (10 interviews, each averaging 12 minutes in duraiton) was evaluated thematically with the objective of modifying the tutor training workshop to provide an improved learning experience for academic staff. By collecting, evaluating, and implementing this feedback, my primary aim was to transform my teaching practice and enhance my ability to provide pedagogical instruction to my peers.

As the instrument used in this study has not previously been used to assess the outcomes of PBL tutor training in this context, this study should be considered a pilot study; efforts will be made to establish the reliability and validity of the instrument. The output from the semi-structured interviews were evaluated qualitatively with the objective of modifying the tutor training workshop to provide an improved learning experience for academic staff. By collecting, evaluating, and implementing this feedback, my primary aim was to enhance the provision of pedagogical instruction to members of academic staff. (Table 1)

### Ethical considerations

The study was carried out in accordance with the principles of the 1975 Helsinki Declaration. Consent was obtained from the Aston University Ethics Committee prior to the collection of data in the form of semi-structured interviews. Participation was voluntary and written consent was obtained from all participants prior to commencing the interview. Participant confidentiality was highly prioritised and thoroughly maintained; only the researcher had access to the data. All results were documented and recorded without any possibility of tracing individual participants.

As a limitation to this study, members of academic staff may not have felt comfortable describing perceived failures in their delivery of PBL. Likewise, participants may have been hesitant to criticise the efforts of a colleague. To mitigate the chances of this study inducing psychological harm to participants and to the investigator, a debriefing document was provided to all participants with information on where and how to obtain mental health counselling.

# RESULTS

### Anonymous feedback

In the anonymous feedback forms collected after the training course. Feedback was generally positive (Very Good) or highly

**Table 1.** Instrumentation: Interview questions

| |
|---|
| **Theme 1 – The principles of PBL** |
| Q1. Do you feel that you have gained adequate knowledge on the seven-step PBL model? |
| Q2. Do you feel that you have an adequate understanding of the participant roles in PBL (i.e. Chair and Scribe)? |
| Q3. Do you feel that you were well-prepared to manage group dynamics in a PBL setting? |
| Q4. Do you feel competent in using Bloom's taxonomy in the formulation of learning objectives? |
| **Theme 2 – Implementing PBL** |
| Q5. Did you find that the mock tutorial was an effective component of the tutor training course? |
| Q6. Did you feel adequately prepared to lead PBL tutorials? |
| Q7. Did you feel adequately prepared to implement self and peer assessments in the PBL tutorials? |
| Q8. Did you feel confident in assessing student performance during PBL tutorials (professional behaviour, contribution to process and contribution to content)? |
| Q9. Did you feel that you were well-prepared to deliver the assessments for the PBL component of the Year 2 Key Skills module? |
| Q10. Did you feel that you were well-prepared to provide feedback on these assessments? |

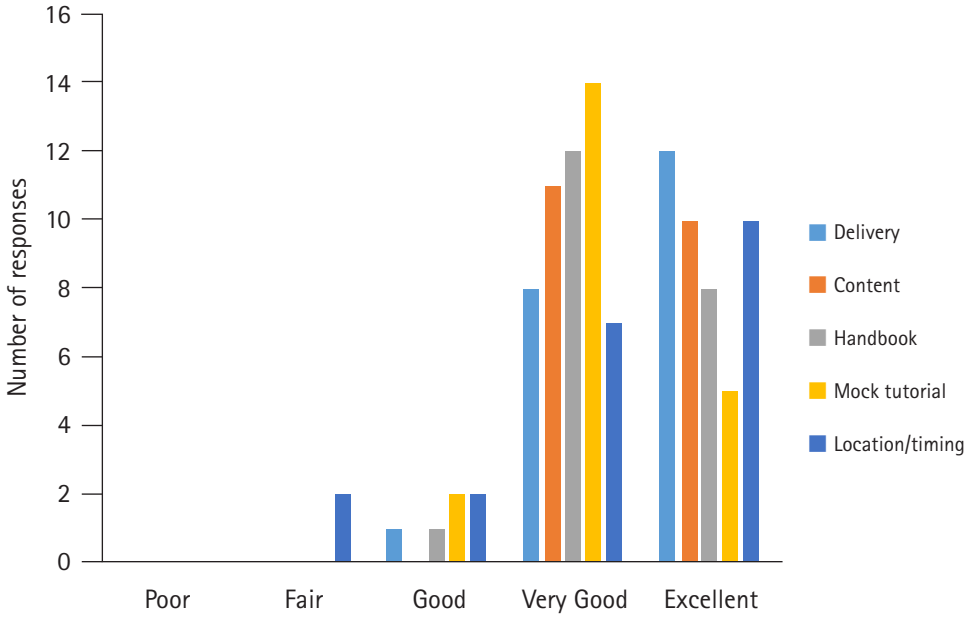


**Figure 1.** Analysis of data derived from anonymous feedback collected immediately after the PBL tutor training course. Participants were asked to assess the quality of the training course in terms of the delivery, content, handbook, mock tutorial, and location/timing. Attributes are scored on a five-point Likert scale as poor, fair, good, very good, and excellent. In total, 21 responses were received.

positive (Excellent) when participants were asked to comment on the delivery, content, handbook, mock tutorial, and location/timing of the training workshops (Figure 1). Some improvements were suggested with regard to the handbook (improving pagination) and the mock tutorial. Specifically, major issues were raised by participants regarding the mock tutorial, particularly in the second session, as it was felt that this had been over-prepared and did not reflect a real tutorial situation. Based on this feedback, the mock tutorial was changed in the third session to a more spontaneous format, with training course participants taking part in the mock tutorial themselves.

*Outstanding idea, well evangelised and explained! Should be rolled out as widely as is practicable. Training day was well-designed and mock tutorial run-through was a great idea. Very sensible and effective to do it on one day to provide an immersive experience. Splitting it into multiple shorter sessions would lessen the impact. Participant, session 1*

*Delivery and content really useful as I haven't done much PBL. Mock tutorial was useful to see, including some amber (slightly problematic) behaviour. Makes sense to run the course on one day rather that prolong it. Participant, session 1*

*Really nice to see a mock tutorial, but it felt a bit staged (because they did it before). Participant, session 2*

*Only suggestion would be to use 'less groomed' students for the mock tutorial to make a more accurate experience for how it might work for real, as a way to show what would happen. Participant, session 2*

*Mock tutorial was very informative and gives a good idea of what to expect. Participant, session 3*

**Semi-structured interviews**

From a pool of 22 eligible participants, I achieved data saturation after completing 10 interviews. The characteristics of participant responses during the interview are detailed in Figure 2, with data coded as a positive response to the question (green), a mixed or negative response (amber), or a negative response (red).

For the most part, participants agreed that they had learned a retained a good part of the material presented in the tutor training course. Participants were provided positive feedback on knowledge transfer on the roles in a PBL tutorial and how to run a tutorial, on the use of peer- and self-assessments, and in the use of Bloom's taxonomy (Bloom, 1956). More mixed feedback was obtained on questions pertaining to the seven-step PBL model, gauging student engagement, how to guide students through the PBL assessment, and on the utility of the mock tutorial. The highest number of neutral/mixed responses was obtained for the question on managing group dynamics in a PBL setting – five out of ten participants did not feel that this had been adequately covered by the training course. Taken together, these data demonstrate that participants were quite comfortable with the more straightforward concepts covered in the course, but more complex issues concerning interpersonal relationships should be dealt with in more detail in future iterations of the course.

A sub-analysis was performed to assess if experience level had an effect on the depth of learning on the PBL tutor training course. Responses from junior members of staff (P4, P5, P7, P8)

Legend: Positive opinion Neutral/mixed opinion Negative opinion

| Question | P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 | P9 | P10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Q1. Do yot feel that you have gained adequate knowledge on the seven-step PBL model? | | | | | | | | | | |
| Q2. Do yot feel that you have an adequ ate understanding of the participant roles in PBL (i.e. Chair and Scribe)? | | | | | | | | | | |
| Q3. Do you feel that you were well-prepared to manage group dynamics in a PBL setting? | | | | | | | | | | |
| Q4. Do you feel comletent in using Bloom's taxonomy in the formulation of learning objectives? | | | | | | | | | | |
| Q5. Dis you find that the mock tutorial was an effective component of the tutor traning course? | | | | | | | | | | |
| Q6. Did you feel adequately prepared to lead PBL tutotials? | | | | | | | | | | |
| Q7. Did tou feel adequately prepared to implement self and peer assessements in the PBL tutorials? | | | | | | | | | | |
| Q8. Did you feel confident in assessing student performance during PBL tutorials (professional beheaviour, contribution to process, and contribution to content)? | | | | | | | | | | |
| Q9. Did you feel that you were well-prepared to deliver the assessments for the PBL component of the Year 2 Key Skiils module? | | | | | | | | | | |
| Q10. Did you feel that you were well-prepared to provide feedback on these assessments? | | | | | | | | | | |

**Figure 2.** Coding of data derived from semi-structured interview transcripts. Participants were recruited to participate in this study by answering a series of ten questions on different aspects of the PBL tutor training course, with a specific focus on pedagogical knowledge transfer (Q1-Q4) and the acquisition of practical skills (Q5-Q10). The study was conducted with the approval of the Aston University Ethics Board and carried out in accordance with the Declaration of Helsinki. Green: positive opinion Amber: Mixed/neutral opinion; Red: negative opinion.

were somewhat different to those obtained from more experienced members of academic staff (P1, P2, P3, P6, P9, P10). Specifically, the more junior participants seemed to acquire knowledge more readily and retain it better, with a higher proportion of positive responses compared to staff members (85% vs. 77%, respectively).

Overall, the participants were forthcoming with their answers, providing elaborate responses to most questions. The thematic analysis resulted in three main themes that paint a comprehensive picture of the success and limitations of the PBL tutor training course. The themes were: I) pedagogical knowledge of PBL was obtained but needs to be reinforced by practice; II) the mock tutorial was a useful and relevant experience but requires improvement and; III) the PBL tutor training guide was a useful resource and should be retained in future training efforts (Figure 3).

*Theme I. Pedagogical knowledge of PBL was obtained but needs to be reinforced by practice.*

This theme describes how well training course participants acquired and retained knowledge on the pedagogical support for PBL, according to the work experience of the participants. This theme sheds light on the efficacy of Level 1 of training course, in the context of staff who had also completed Level 3, i.e. acquiring hands-on experience as a tutor, followed by a critical evaluation of the tutor role. In order to better understand how this response was affected by different factors, four sub-themes were delineated, focused on understanding the purpose of using PBL, the steps of the PBL model, the different roles in a PBL tutorial, and the quality of knowledge transfer.

Participants seemed to clearly understand the importance, impact, and pedagogical support for the use of PBL.

I think the training course was a good introduction to the model, but I think actually going to the first tutorial with the students kind of really consolidated that. But I think going through that training course and knowing the background a bit gave me a bit more confidence in that first tutorial to at least appear to the students that I knew what I was doing. P2

I didn't know anything about it beforehand, so the training was quite helpful and the handbook was really helpful because it was

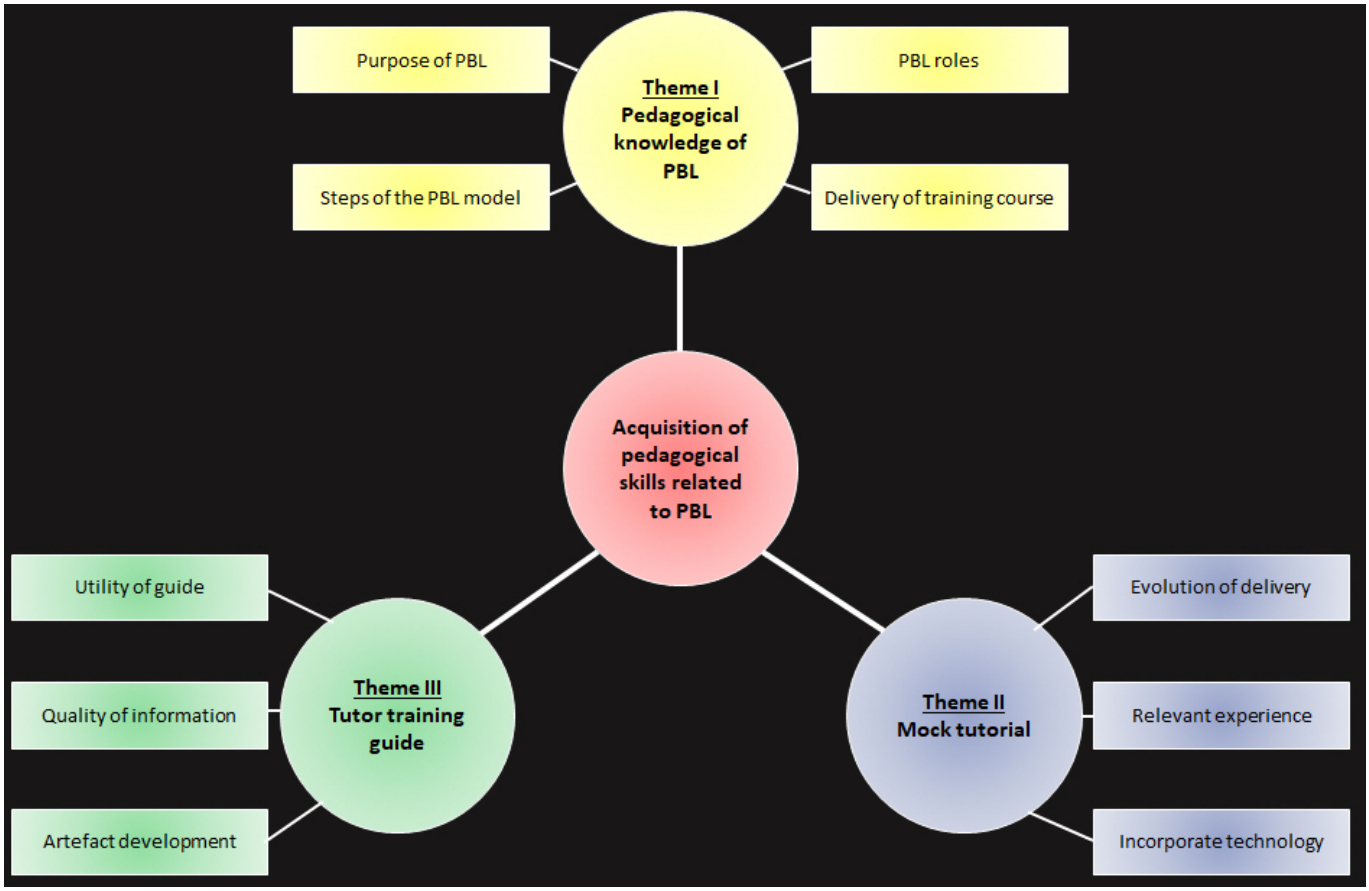


**Figure 3.** Thematic analysis of the PBL tutor training programme. Three major themes arose: The themes were: I) pedagogical knowledge of PBL was obtained but needs to be reinforced by practice; II) the mock tutorial was a useful and relevant experience but requires improvement and; III) the PBL tutor training guide was a useful resource and should be retained in future training efforts.

a period of time in between the two. I think I understood the concepts and why we were doing it. P6

I think the training was very clear and it was all laid out very well. P7

I think I've gained adequate knowledge, it's just a question of practicing it. I understand what needs to be done, it's just critical to implement in practice. P10

Most participants mentioned that they understood the seven-step PBL model and noted that this was clearly described during training and in the PBL tutor training guide, but some participants mentioned difficulty in remembering the steps in detail after some time had passed.

I think so. In the training session that you ran, you basically laid out all the different stages very well, and having that handbook really helped. I left that a bit, "oh my god, this is a lot to take in", but then you take time to process it and then look through everything and actually it's pretty straightforward. I thought I came out having done that better, I mean it all made sense to me. P8

I don't think I could repeat them back to you now. P5

Could I remember them now, no, but I understand the process. P3

Many participants shed light on the importance of understanding the roles in PBL, but there was some doubt regarding the responsibility of the tutor in filling these roles, particularly the Chair role.

I think the training course and the booklet that you gave out as part of that training course very clearly defined those roles. P2

Yes, I [understand]. Definitely the Scribe. Chair, I think I do. I was sometimes a bit confused if it's a student who has to be the chair. I don't think they're quite up to it yet. P10

Following the completion of the training course, most participants felt adequately prepared to run the PBL component of this module, but some aspects of how to assess PBL performance could be clarified further.

I was adequately prepared, but I think the students struggled a little bit with the peer assessments. I think we could get them to do more honest peer assessments earlier. We do some peer assessments like 'rate the person in your group' and they all put 5 out of 5 because they're all their friends. I think I was fine with it. Self-assessments are interesting as well. I think all the students are all I would say quite harsh on themselves but generous to others. I think they see room for improvement in themselves but they're not very good at being critical of others. P1

I thought the handbook alongside the training course gave me everything I needed to know to run those tutorials. P2 It's one of those things, isn't it? You're as prepared as you can be, and then it's about having that experience and knowing how to manage a room. P4

I think a few more guidelines on what the criteria are, as in what constitutes professional behaviour, would have been helpful, but I just read between the lines and kind of figured out what it was. P2

*Theme II. The mock tutorial was a useful and relevant experience but requires improvement.*

Several participants elaborated their answers on the challenges inherent in staging a performance of what would normally be a spontaneous event, while others provided broad non-detailed answers. The sub-themes that were generated were: the best format for the mock tutorial is to have training course participants act as the tutorial group, the mock tutorial provided a relevant real-life experience, and the implementation of technology would improve participant preparedness for the PBL tutorial setting.

Participants in the first two PBL tutor training sessions felt that the mock tutorial felt somewhat contrived, particularly those who attended the second session. The mock tutorial had initially been carried out by a number of graduate students under the direction of the course instructor as Chair, and certainly by the second time around, the students had become comfortable with their set roles in the group, leading to a somewhat rehearsed delivery. Based on anonymous feedback from course participants and the generous support from one particular colleague (P2), the mock tutorial was redesigned for the third set of trainees, in which the course participants experienced a PBL tutorial for themselves; participant P2 served as a 'plant' in the group and provided a brief presentation on a learning objective selected from the PBL problem. This was met with varying degrees of enthusiasm (bolstered by the provision of biscuits) but, in my opinion and the opinion of some course participants, made for a more relevant and valuable learning experience.

Yes. It gave us a chance to see real students doing it and to see what kind of problems may come up as well. It was useful. P7 – session 1

Yes, because it was really nice to see it in practice. The only downside was of course they were all really good at it, and I feel like it might have been useful for when they don't want to say anything have a bit more idea of how to coax it out of them. P6 – session 2

I think it could have been better, because some of the students had done it before for another session, hadn't they? So, if it was more fresh, I think it would have been better, because they knew already what the failures in the previous go had been, so it seemed a little bit rehearsed, if that makes sense. So, if it had been new students each time, I think it would have been better. P9 – session 2

It definitely helped, but because it was staged, it didn't really

prepare you for real life as well as I would like. P10 – session 2 I don't know if there is any other way to do it…you've got to have a demonstration on how it works. We did it in two different ways. The first one when I was trained was when we had graduate students mocking up one and then in the second one I actually did a bit of a presentation. I think it was useful to see it but also to participate in it to see how it works. It's something that sounds conceptually complex but it's not, once you actually get down to do it. I think it's good to sort out timings as well, because you've got this list of things to do, and you're like, 'will that work in an hour?' and then it does. P1 – session 2

Yes, I did. I think I learned then about firstly the order in which to do things and exactly how those worked because it's a model and it's never a perfect system in every situation, it's going to be different. So, it was interesting to see how that worked from a tutor point of view but also being in the tutorial and having that experience of how I fit in that tutee dynamic. I think being on that side of it helped. P4 – session 3

Participants reported that the mock tutorial provided effective preparation for PBL tutorials with students, but the issue of managing group dynamics was raised, particularly with regard to dealing with quiet or apprehensive students.

I think it's good doing it in tutorial groups where you already know the students – with second year students you've had them in first year, so you know you their perceived strengths and weaknesses, you know the ones who you think you can rely on to be chatty and talk about things and the ones you need to push more. If you went blind into a group, it would be more difficult to gauge dynamics to start with. It would be nice to have some interaction with them before you try and do PBL I think. P1

I'm not sure the training course can prepare you for all scenarios. I was expecting silence from the students and actually I kind of got the opposite, where they were rather vocal and it was reining them in. But I don't think that you can prepare for that in a training scenario, because you never know what you're going to get in the real situation. P2

I think you provided something as much as possible to prepare us for what the tutorial was going to be like, but the unknown is what the group dynamics are, how many people are going to turn up on the day, how keen students are. My sessions were at 9 o'clock in the morning, and probably they're not the most awake and the most motivated to do things. Not that there's anything you can do about that. There's so many factors. I think by the time we got around to the second one, they'd got into what was expected of them. P5

I think it helped me in terms of what the dynamic would be like and how to actually run the session, but my particular students really struggled with that. They weren't very cooperative let's say, so it was a lot of me having to lead everything. Nobody really wanted to be the scribe or the chair and it was, "I'm just going to sit here and look at you". P8

*Theme III. The PBL tutor training guide was a useful resource and should be retained in future training efforts.*

Many participants mentioned the value of the PBL tutor training guide as a resource for late consultation, especially given the span of nearly four months between the training session and the first PBL tutorial.

Because there was quite a big gap between having the training course with you and the start of the academic year, I had to go again to the documentation and revise it. But that was fine, because you gave us a very nice guide, so I could just go and read through it again. P9

A number of participants noted the good pedagogical practice of providing a dynamic verbal/oral training session in person as well as a static resource for later reference.

Yes, we had a good training session with you and the booklet we got before, which was really useful. With good pedagogy in mind, you had a written thing and an oral delivery thing so you had a balance. The booklet is great to refer back to. P1

Some participants provided a critical appraisal of the contents of the PBL tutor training guide, with useful suggestions on how to provide more complete and comprehensive information to future PBL tutors.

I think the manual was very good and having all the learning objectives there for yourself to see was really useful. But I think perhaps the information was there, but we weren't made aware of it, like the presentations that were given to the students beforehand. So, perhaps something to take into account is to tell all the tutors involved to take a look at those presentations because there's some information there that wasn't in the manual. I think that's the only criticism. P9

One of the overarching themes from the thematic analysis is that while no participants felt completely unprepared for PBL delivery, there remains considerable variability in staff comfort with using this teaching technique and in the delivery of PBL tutorials. This finding was also reflected in student module assessments.

From discussing with other tutor groups, there is sometimes a substantial difference in what they have been briefed in terms of exactly how things are presented or learning objectives etc. I am aware that these are very well teething problems but it made it quite confusing during peer study sessions and helping each other on things when we have been told to do contradictory things... so maybe be more clear between tutors what exactly they are ask-

ing for so there's a continuity between groups. As some have had a lot more information than others etc...other than that, very happy with the module, really enjoyed it, there should be more modules like this especially in terms of putting it into a case study; it makes the scenario relatable and easier to understand and retain. PBL module student, 2018-19 academic year

## DISCUSSION

Based on anonymous participant feedback and semi-structured interviews, PBL training course participants seemed to readily acquire and retain information on the general PBL process and the use of assessments in this style of teaching. The most negative feedback was in regard to the mock tutorial (especially in session 2) and the comfort level of participants in managing group dynamics. As mentioned above, the mock tutorial aspect of the training course was first carried out using a group of previously briefed students (in the first and second sessions); based on participant feedback, this was changed to a more active, spontaneous mock tutorial in the third workshop, using course participants as the tutorial group members. Additionally, the current iteration of the PBL tutor training course has been modified to incorporate video clips as an interactive tool to improve the ability of future PBL tutors to recognize specific obstacles to functional group dynamics and to help them develop effective intervention strategies. Previous research has shown that this this type of tool is well-accepted and can be readily integrated into a PBL tutor training workshop (Bosse et al., 2010).

As part of this thematic analysis, the coding of participant responses was analysed again by separating participants into two groups: junior members of staff with relatively little teaching experience and more experienced permanent members of academic staff. Somewhat surprisingly, participant feedback as provided through the semi-structured interviews was more positive from the junior members of staff, who seemed to be more adaptable and eager to take on a new teaching role, despite the steep learning curve inherent in becoming a PBL tutor. Future analysis in this direction should focus on this aspect of the data by asking more specific questions on the degree of staff engagement with the PBL process as well as on other factors that may influence this, such as time availability and staff stress levels.

Kincheloe and Steinberg theorize that critical multilogical epistemology and connected ontology form the basis of research bricolage. These philosophical notions have infomed the interpretation of the data ontained in this study and allowed for a more sophisticated understanding of the complexity of knowledge production and retention. Such complexity demands a rigorous mode of research that is capable of dealing with the complications of socio-educational experience and avoids the reductionism of many mimetic research methods (Kincheloe et al. 2011). In this sense, the use of semi-structured interviews provided a rich account of the issues related to skill acquisition in an academic environment. Importantly, the topic of this research was not the interview itself, but rather the issues discussed in the interview, with a focus on the successes and shortcomings of a training programme. These interviews were used to gain insight into people's subjective experiences and attitudes while still allowing for depth and complexity in the data and subsequent analysis (Peräkylä and Ruusuvori, 2011).

## CONCLUSIONS

In performing the qualitative thematic analysis obtained from student evaluations, anonymous written feedback, and semi-structured interviews, an interpretive approach of analytical realism was employed, i.e. finding connections in data obtained from the real world in which we live and interact (Kamberelis and Dimitriadis, 2011). Applying the concept of analytical realism was crucial to enhancing the reliability, credibility, relevance, and importance this qualitative research study. Therefore, using diverse sets of data, meaning has been created through interactions with real-life participants in the training course, both immediately after knowledge transfer and following a period of using this knowledge in a practical setting. The results of this study have demonstrated that all knowledge is contextual and partial, and multiple sources of knowledge are required to achieve a complete and interpretable picture of the subject (Kamberelis and Dimitriadis, 2011).

Clearly, there is a need for additional research on the outcomes of the PBL approach, particularly regarding methods of assessment, the need for collaborative practice, and the application of concepts to practice. Future studies in this regard will provide a crucial evidence base for learning and practice, information literacy, as well as reflection on learning and practice that will support the broader implementation of PBL.

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