

The Student Experience of Online Problem Based Learning in Sport and Exercise Science

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Abstract

Problem-based learning (PBL) has long been used as a means to foster motivation, critical thinking and independent learning in students. Recently, there has been an increase in the nature and use of interactive media which has subsequently been used in the form of online PBL as a means to enhance the student learning experience. However, little research has investigated the student experience of online PBL, particularly in groups of students who are new to both PBL and online learning. This paper documents the student experience of a Year 2, undergraduate module within the University of Derby's BSc Sport and Exercise Science course delivered using online PBL in a cohort of students new to both modes of learning. Following completion of the module students participated in focus group interviews. These revealed that students believed online PBL to offer greater autonomy, was more vocationally relevant and enabled them to engage in a more student centred form of learning compared to traditional didactic face to face delivery.

However, although online PBL was received positively by the students, there was a degree of anxiety regarding the use of online learning which prevented students from engaging fully in the online learning tasks. In addition, students who were actively involved in the online tasks were critical of students who 'lurked' during these activities despite the potential benefit lurking may have. These results indicate that online PBL can be effective in enhancing the student learning experience but, on initial presentation, online PBL may need to be implemented carefully to avoid student anxiety and ensure active participation in online tasks.

Keywords: Wiki, Web 2.0, Blended Learning, Constructivism

Introduction

Problem-based learning (PBL) has long been used within the context of medical education as a means to foster motivation, promote problem solving abilities and to encourage student interaction and independent learning (Willis, Jones, Bundy, Burdett, Whitehouse, & O'Neill, 2002; Camp, 1996). More recently there has been an increase in the use of PBL within teaching in Higher Education in a range of subject areas in general (Savin-Baden, 2003) and sport and exercise science specifically (Duncan, Lyons & Al-Nakeeb, 2008; Duncan & Al-Nakeeb, 2006). In the research by Duncan and Al-Nakeeb (2006), students engaged in four problem scenarios, over ten weeks, as part of a final-year undergraduate module related to exercise physiology. The students worked in teams to provide theoretical (i.e., written) and practical (i.e., laboratory based) solutions to each of the problems with one of the solutions forming part of the assessment of the module. The students who took this module reported greater enjoyment, engagement and the development of a critically evaluative stance compared to traditional, lecture-led delivery. However, the students taking this module were new to PBL and reported that the timescale in which they had to complete all of the problem scenarios was too short. Duncan and Al-Nakeeb (2006) therefore suggested this be taken into account in future studies of this nature. Despite this, a PBL approach has several advantages compared to other teaching methods. This is possibly due to the ability to build on previous knowledge, the immediate application of knowledge to construct solutions to specific problems and to the team based learning environment that facilitate student learning and independent thinking (Camp, 1996). PBL is also consistent with current philosophical views on student learning in higher education and, in particular, constructivism (Savery & Duffy, 1995; Savin-Baden & Howell-Major, 2004).

Constructivism posits that understanding comes from interactions with the environment, cognitive conflict stimulates learning and knowledge is developed when students negotiate particular situations and evaluate individual understanding (Savin-Baden & Howell-Major, 2004). Courses employing a PBL approach enable students to construct knowledge based on their prior understanding and enable learners to make comparisons with their peers' knowledge and to refine their understanding as they gain experience in dealing with the problems they confront (Camp, 1996). A PBL curriculum should include problem scenarios as a central component and allow seminars, lectures or laboratory practical to feed into the module(s) and allow students to construct their

own knowledge and understanding of a particular problem (Savin-Baden & Howell-Major, 2004). This in turn can allow the development of a deeper approach to learning (Biggs, 1999), greater criticality and thinking skills in students who participate in this type of learning.

There has also been an increase in the process and nature of interactive media over recent years which has led to media based forms of PBL being employed in various contexts within higher education (Savin-Baden, 2007). Although terms such as 'computer-mediated PBL' and 'online PBL' are starting to feature in pedagogic literature there is a lack of clarity about the extent that the teaching and learning activities described are 'online', the ways in which students interact online and the nature and experience of students engaging in this form of learning (Savin-Baden, 2007). As a result it is not clear whether the experience of online PBL differs between student groups who have prior experience of PBL and/or online learning and those that do not. Online PBL has therefore been used in a generic sense to describe a variety of ways that students use PBL synchronously, asynchronously, on campus or at a distance (Savin-Baden, 2007). This has comprised use of a range of media and software packages including chatrooms, discussion boards, wikis, blogs with synchronous online PBL employing webinars or, more recently, web 2.0 environments that have been employed specifically for online PBL.

Online PBL has been employed across a range of subject areas using different approaches. For instance, Luck and Norton (2004) used online PBL in an early years distance learning course where students engaged in five problem scenarios over 12 weeks. This was primarily achieved through asynchronous discussion boards with supplemental videos of lectures. Asynchronous discussion board use, as described in the aforementioned study, involves an individual posting comments on a discussion board. However, only one individual can post/comment at one time. Thus, the discourse surrounding the problem resolution does not occur in real-time. This is in contrast to synchronous online learning where all members of a PBL team can comment in real time and at the same time (if they wish). Jones, Miller, England & Bilham, (2006) used five (one/two hour) online discussions, with a mix of synchronous and asynchronous forum use, as a form of virtual clinic in a postgraduate sports medicine programme. The students who participated in this module reported that the virtual clinic PBL experience

enabled them to engage with a wider range of material and that working in an online group provided an effective way to share ideas and reflect on different ways of approaching problems. Other similar studies by Lee (2006) and Lycke, Stromso, & Grottum (2006) have employed online PBL effectively in distance learning courses. In part due to the success of online PBL in distance learning courses, it has gained popularity as a teaching tool on campus based courses because of its potential to develop student independence whilst offering flexibility and a student-centred learning approach (Savin-Baden, 2007).

As stated above, to date, a variety of vehicles have been used to facilitate online PBL. However, most of the current research relating to this topic has used institutional virtual learning environments (VLEs) as the main point of contact for students undertaking this form of learning. In respect to Web 2.0 technologies, these may offer considerable advantage in developing and enhancing the student learning experience when employing online PBL (Savin-Baden, 2007). Web 2.0 technology comprises a range of interactive tools such as blogs, wikis and virtual environments that provide an opportunity for both students and academic staff to become their own content or knowledge producers (Savin-Baden, 2007). This form of technology can engage individuals in learning which reflects social networking, allows learners to construct their own knowledge based on their own understanding of a topic or issue whilst also receiving feedback, support and building new knowledge based on virtual social interaction with their peers.

One specific form of Web 2.0 technology has been identified as a tool that may be particularly useful in enhancing student learning (Parker & Chao, 2007). A wiki is a web-based communication and collaboration tool that can be used to engage students in learning with others in a collaborative working environment. It is particularly applicable to PBL and constructivist paradigms as it involves learners in construction of their own learning (Boulos, Maramba, & Wheeler, 2006), engages students in interactions and exploration of learning material and enables integration of new ideas with prior knowledge to make meaning (Parker and Chao, 2007). However, although the wiki was introduced more than ten years ago, its use in teaching and learning is in its infancy (Chao 2007). Higher education has only recently begun to explore the potential value of wikis to promote a deeper approach to learning (Chen, Cannon, Gabrio, Leifer, Toye, & Bailey, 2005). Despite this, wiki use in higher education is gaining popularity but there is

still a need to explore the value of this mode of learning in enhancing the students' experience of higher education. Some studies have explored the usefulness of wikis in icebreakers, online learning aids to share information (Augar, Raitman, & Zhou, 2004) and even as a way to construct an online textbook (Evans 2006). Parker and Chao (2007) have commented that social software such as wikis and blogs may provide students with skills for the future but, there is a need for research examining the use of wikis and other web 2.0 technologies as teaching and learning tools in order to make these effective and to explore what works well and what works badly.

Although Web 2.0 technology offers considerable potential to enhance student learning relatively few studies have documented the student experience of online PBL in this way and the impact of wikis and blogs on the student learning experience remains relatively under explored (Savin-Baden, 2007). Pedagogically this is an important topic and although there are published examples of how Web 2.0 can be used to enhance learning (Savin-Baden, 2007), the published literature has not fully explored student experiences of this form of learning, particularly in those new to PBL. This is potentially a useful source of information that can be used to enhance development of online PBL. With advocates of this technology suggesting that staff and students sharing their knowledge in a social domain is a key tenet of successful online PBL, it would seem prudent to explore the student experience of this form of learning. Therefore, the aim of this paper is to explore the student experience of wiki based, online PBL with a group of learners new to PBL.

Method

The impact of PBL on students' learning experience was examined using a single module, blended approach (Savin-Baden, 2007) on a second year module titled 'Exercise and Health' within the institution's BSc Sport and Exercise Science course. Thirty students aged between 19 and 31 were enrolled on the module (13 male, 17 female) and the students had no prior experience of PBL as it had not been used on their academic programme prior to them taking the module in question. All modules that the students had previously undertaken were taught on-campus and the students had no prior experience of distance learning. The module ran both on campus and at a

distance and was congruent with guidelines for single module blended online PBL (Savin-Baden, 2007). The module was designed using the model suggested by Boud (1985) and advocated as one model for online PBL by Savin-Baden (2007) and employed one problem scenario as the central component of the module. A team wiki was used to facilitate the learning process with face to face lectures and seminars used to feed in and around the PBL activity at an appropriate time. A team wiki is simply a wiki space that is completed by a pre-determined team of individuals rather than one individual or a large group of individuals unilaterally adding web content.

The main problem scenario was introduced in the form of a formal letter from the city council inviting teams to submit a tender presentation to run a 'health-enhancing intervention' in the city's main shopping centre. The letter was presented in a face-to-face manner by the module tutor in sealed envelopes. The letter also identified the date for presentation of the bids, the time allocated for presentation (ten minutes) and highlighted that the city council were interested in evidence based practice. This essentially provided a case related to a business/organisational problem. The problem scenario was also matched to the actual current activities of the council in question, so sought to explicitly match the university learning environment with actual practice specific to the students' degree course. In this way, we tried to incorporate different constellations of PBL online within the one scenario and in particular PBL for practical capability and PBL for critical understanding (See Savin-Baden, 2007 for a full outline of PBL constellations).

In the context of the problem scenario presented in this module, practical capabilities and critical understanding were incorporated as they were seen as key to successful working in the exercise and health field. In regard to PBL for practical capability, students develop the ability to interpret situations within given frameworks and so, this constellation of PBL is important for developing thinking skills for the workplace. Likewise, in PBL for critical understanding learning becomes a way to bridge the gap between models of thinking and actions. As such, learning here is seen as knowing and understanding knowledge from the disciplines but also recognising interrelationships between them (Savin-Baden, 2007). The problem scenario employed in the present study required students to develop some form of exercise/activity intervention for health benefit. This necessitated students interpreting the scenario within given frameworks (e.g., behaviour change theories/frameworks) whilst also applying this to a workplace

scenario. At the same time students may have needed to utilise information from a variety of disciplines (e.g., psychology, social policy, exercise physiology, environmental management) whilst recognising that there might be interrelationships or overlap or disparity between them.

Module Structure

In accordance with suggestions for running online PBL and, as the students were new to both PBL and online learning the first two sessions of the module were constructed as warm-up activities (Savin-Baden, 2007). The first session of the module comprised a module introduction and the onset of the warm-up activity. In this session students were shown the wiki spaces they would be using throughout the module, were given time and space to 'play' with the wiki while the tutor was available to assist in any technical issues that arose. At the end of this session students were split into teams of six students and allocated a team wiki space. They were then allocated a short warm-up task centring on inequalities in health estimated to take approx 60 minutes of online time. Following this, during the third session, students were presented with the main problem scenario described above. They were then left to investigate the problem in their wiki groups for the following six weeks of the module. During this time several face-to-face sessions were scheduled which comprised lectures and seminars focusing on the following issues: coronary heart disease and exercise, metabolic syndrome obesity, and the environment and physical activity. These were student led in that students could decide which topic they wanted to discuss at which point in the module and although the topics were relevant to the module title, care was taken to ensure any information presented by the tutors was not explicitly related or linked to the problem scenario they were working on. Throughout this period students worked via their wikis collaboratively.

The face-to-face sessions were employed to help centre student discussion and focus wiki activity on aspects of exercise and health that could feed into each group's resolution of the problem scenario. Typically, following a seminar or lecture there was increased wiki activity usually focused on some of the content that had been discussed in the face-to-face session. On completion of each group's wiki, there was a diversity of posts ranging in length from one sentence to two or three paragraphs. There was regular use of weblinks to journal abstracts and government websites or documents.

The average number of posts for each group was 115 with a range from 68 to 148. The nature of these posts developed as the use of the wiki matured. Initial wiki posts tended to be shorter with greater use of weblinks and statements explaining what the links were. In the early stages of wiki use there were lots of use of terms such as 'maybe there could be' or 'it might be'. Later posts tended to be more expansive and were more assertive offering definite suggestions for exercise interventions. These also seemed to be based more on a range of literature rather than a solitary weblink or journal article.

The tutor facilitated the online PBL by listening and lurking positively and by providing supportive, non-leading interventions as suggested by Savin-Baden (2007). Lurking refers to a person(s) who reads online content but does not contribute. Tutor intervention was generally online in nature other than minimal face-to-face interventions provided at the onset of the PBL task. The frequency of such interventions differed depending on the different groups' involvement at various points in the learning period. Typically, greater intervention occurred in the first week of the problem scenario where the module tutor perceived a need to foster self-efficacy in student wiki use.

The final session of the module comprised formal presentations of each team's tender bid. The final tender bid was presented in front of the module tutor and another invited guest. The guest was used to pose as the writer of the initial tender bid letter. In this way the module sought to mimic the form of tender presentation that would occur in the workplace.

Assessment Tasks

The assessment task used in the module adhered to guidelines for the assessment of PBL (Macdonald & Savin-Baden, 2003). As a result the final tender bid presentations were used as the formative assessment task for the module. This adhered to the guidelines proposed above as the assessment was based in a practice context (i.e., it replicated a real scenario taken from the workplace), it assessed process based activity (i.e., it focused on what practical steps could be taken and what procedures could be employed in the context of the scenario) and it necessitated working with people in a way similar to that they would experience in the workplace. The objectives, learning outcomes and teaching methods were aligned accordingly.

Marking criteria were presented to the students at the beginning of the module and in accordance with the suggestions of previous authors (Savin-Baden & Howell-Major, 2004; Savin-Baden, 2003) in respect to traditional PBL. Likewise, the presentation did not simply assess the students' ability to provide knowledge but rather assessed the students' application of evidence, their ability to reflect on problem solutions and their ability to evaluate the way in which they came to their solution with emphasis on the specific context/environment in which their problem was set. In this way it was hoped that students could integrate a diverse and amorphous body of information to provide a cohesive solution to the problem. The presentation took the form of formative assessment. This did not directly contribute to the final grade for the module but directly fed into the module's summative assessment. The final summative assessment consisted of a poster presentation detailing a physical activity intervention that could be run in a university campus. As the research study was seeking to pilot online PBL it was felt this would be a more time and labour effective first step before rewriting/validating a new module delivered using online PBL.

Evaluation of Online PBL

In order to examine the student's experience of the module focus group interviews were conducted in groups of six students (i.e. in their wiki teams) at the end of the module. Focus group interviews were chosen as they provide a more naturalistic data collection method compared to interviews or questionnaires (Wilkinson, 2004). They also allow respondents to build upon the responses of other group members and the relatively free flow of talk can provide an excellent opportunity for hearing the language and experiences of the respondents' (Wilkinson, 2004). The students taking this module were also asked to complete a short, reflective questionnaire as part of end of module review. Data from the focus group interviews were analysed using thematic analysis following guidelines recently proposed by Braun and Clarke (2006) and, in this way, sought to describe patterns within the module (Braun & Clarke, 2006).

Results

The results from the focus group interviews and end of module questionnaires revealed a number of themes within the student experience of PBL. Consistent across all focus groups were engagement with a more student-centred approach to learning, relevance of the learning experience to future employment, issues surrounding collaborative learning and wiki use/wiki anxiety.

A more student-centred approach to learning

In regard to the theme of a more student centred approach to learning, the students felt that the use of wiki based PBL within the module allowed them greater autonomy, enabled them to engage with a wider range of literature, develop greater engagement in the learning process in comparison to traditional lecture-led teaching. For example, students reported the following:

It puts the onus on us, like we are in charge so you end probably end up looking through more stuff, reading more, chatting more either on the wiki or to people directly than with normal lectures but because of how its done I felt I could push the topic in the direction I wanted so it was almost, like always at my level and that was the best thing about it all, I decided what I wanted to learn (Student D)

This was then followed by the comment: 'It was good that we could modify when we got specific sessions from the tutor though, that made me feel like I could control what and when I got the information I needed, that was good (Student E)

And in regard to engaging with a wider range of literature and becoming more engaged in the learning process the student experience in probably best summed up by the following two quotes from students:

With this type of thing, you know, you had to go out and think of an idea, actually go out and look for something and then if there was no research on what you had decided to base your idea on you had to go back and relook at it, I suppose I ended up doing more work in this module than in some of the others I am taking but then I feel like I have learnt more here, I get what you and the other lecturers mean now when they go on about evidence based practice because I think this is what we were doing really (Student A)

And:

It put more pressure on me, felt like I learnt more too but at first you think you can maybe get away with sitting in lectures, copying some notes and then using them for the coursework but you've really got to get into it and you do so you put more effort into it (Student K)

Relevance to future employment

In respect to relevance to future employment, the students consistently commented that the PBL task had clear application and use in terms of careers after they had completed their university course. For example, Student A reported:

I can see it will link to working life, I guess that's what you wanted anyway but it helps to focus you on what you might want to do when you finish [the degree]

This was then supported by Student L who added:

I liked the task you have to think outside of this academic university box a little bit so it was like a real world task you could see that people in the city council or primary care trust would be doing the same kind of thing so that was ace, it made it realistic and put a background story into the work we were doing so it felt like it was important to do it properly

Collaborative Learning

The results from the focus group interviews also raised several issues related to collaborative learning. This was the first time these students had used a wiki and was also the first time they had experienced PBL. This appears to have created some issues whilst also prompting some positive aspects to this experience. In terms of the positive aspects that students raised about wiki based online PBL, the students seemed to think that using the wiki for collaborative learning was useful for sharing of information, speeding up the process of information acquisition and for reflection/idea generation. To illustrate this, Student L stated the following:

I agree its good for that cos its not like we all think the same way so you get to see different people's perspectives on things and that's useful cos you might be sitting there reading comments or about to add a comment and then you read something and go oh that's interesting I never thought of that and then you go away or think for a minute and it maybe changes what you were going to add or write

Likewise, Student A commented:

When we got the letter I was like whoa this is a nightmare, like you know the whole thing was like where do you start, at first I just thought yeah id look at stair climbing or something, I knew about it before so I started to look round that and put something up on the wiki, then it just spiralled someone put something else up that got me thinking differently, so then I put something up and it ended up like 3 of us bouncing ideas off each other

Student E also commented:

I think it was really clever, you know set around where we all know but it was difficult cos the Westfield [The Shopping Centre in the PBL Scenario] its so different in terms of size, floor spaces and with a clean slate to start from it made me work hard at first to generate something sensible that could be backed up, but then once I had the idea I had to find research to back it up and that ended up being the best thing for me, people on the wiki ended up doing the literature review but for me, I could discuss ideas on it but I also got to ask people about research papers and they helped with my literature search

However, although these comments appear positive, there were also some less positive issues surrounding the use of the wiki for PBL. These tended to centre around students being disgruntled at members of the group who did not contribute greatly, students who were more lurkers than contributors and suggestions that ownership of what was put up on the wiki was also important. To illustrate this, Student A suggested:

'what really annoyed me as well was not the people who just tried to avoid the wiki but the people who just logged on and looked at what we were adding, its like voyeurism for a degree

This statement was then supported by another student who added: 'it's not like they couldn't add anything cos it's so easy to use as well, just like facebook' (Student B) Student A then replied;

it was a bit annoying though because I had worked and read stuff and then thought through something that would be useful for the group and then there were others who you could see had viewed the stuff but didn't add anything so I felt like they were using my stuff to help them and that made me more reluctant to add more

Some students also suggested that the actual wiki contribution should form part of the assessment rather than simply the presentation which was the central element of the

online PBL scenario. One student was particularly strident in their view on this and stated:

yeah make the wiki assessed not just the presentation if you gave people a grade for what they put down they would have to contribute instead of just looking at other peoples stuff then stealing it and making out that it was their idea too (Student L)

Finally, a minority of students (three) did make comments regarding a preference for more traditional didactic delivery. This is summed up by the following comment from Student C:

Honestly, I would have just preferred that you tell us what we needed to do given us the lectures and I would've gone and done it, it was so much harder to do this, not that I cant do it, its just you had to contribute

Wiki use and wiki anxiety

This aforementioned issue was echoed by a number of other students in various focus groups and although these comments broadly relate to the concept of collaborative learning they might also overlap with comments made around the concept of wiki use and wiki anxiety. Issues surrounding this were a particularly strong theme across all the focus group interviews. This is understandable as the students were new to wiki based PBL, the comments that were raised do offer an interesting insight in terms of introducing students to wiki based PBL. Overall, the wiki was received well and students commented about positive aspects of its use. For example:

yeah but at least with this you could do it from home, do it when you wanted, its like of I've got an idea and instead of trying to remember it for a set time you could just type it out and then other people would give you like feedback (Student C)

Another student compared the wiki to a working out area for an exam paper:

It was like a maths exam paper, you know where you have a paper with your maths answers then a paper where you can do your workings out, the wiki is like the working out paper, you can try things, see if they work and then the presentation is like your final maths answer (Student G)

One student also suggested that the wiki enabled more equitable group work. They commented:

It's harder for people to dominate this too with a group meeting or face to face session you always get one or two people who want to tell everyone else what to do. With the wiki its easier for everyone's voices to be heard so you can state your position and no one can interrupt until its on the screen (Student H)

Despite these positive comments, students did outline a number of issues broadly relating to wiki anxiety, or anxiety about the evaluation of others based on what is posted on the wiki. This seemed particularly pertinent to initial usage of the wiki. The following comments from one of the focus group interviews illustrate this issue well:

it was like I don't want to put the first bit of information on in case everyone else slates it (Student C)

This was followed by Student D who noted;

That was the worst bit you put something up and then you know other people might like make a judgement about you based on what's up there because they can see who added the comment so you don't want people to think you are thick

This was supported by a further comment from Student K who reported;

but you know some people might have found it hard to do, personally it was a bit foreign to me, I hadn't really used a wiki and didn't even know what one was. I don't think this type of distance learning has been used in our modules before and it took me a while to, not get the courage to contribute but, you know because its up there and the other members of the group will judge it

Interestingly, some students also commented on the wiki interface, suggesting that the software embedded in the VLE might have been a poorer version of the social networking sites they currently use. A number of students suggested that in future the institution should 'do it by facebook.'

Discussion

Overall, the student experience of wiki based online PBL appears to be positive with all students reporting that online PBL offered a different learning experience compared to traditional, lecture led teaching. In particular, wiki based PBL appears to have offered a more student driven approach to learning that better facilitated skills such as information retrieval, development of an evidence based stance and collaborative learning strategies that could also be used in other areas of study. These findings are consistent with research from other studies on the impact of traditional PBL (Kolkhorst, Mason, DiPasquale, Patterson, & Buono, 2001; Palmer, 2003; Myers, & Burgess, 2003; Duncan, & Al-Nakeeb, 2006) as well as online PBL (Lee, 2006; Lycke, Stromso, & Grottum, 2006). It is also interesting that all the focus groups of students highlighted the move to a student centred form of learning as an important aspect of PBL. For the most part this was seen as a positive feature of their learning experience in the module, students seemed to enjoy this level of autonomy and the challenge of wiki based PBL. However, for some students more attention was focused on the assessment of the module or passing the module compared to their peers.

Although there seemed to be an acknowledgement that online PBL required them to engage more with the subject, there seemed to be resistance to this with some students expressing a preference for lecture-led delivery as it provided them with the information that the tutors or markers expected back from them in any assessment task. This issue seemed to be conveyed most within the 'Collaborative Learning' theme with some students seeing lecture-led delivery as more positive in achieving the goal of passing the module. This is an important consideration within the implementation of online PBL. The current study was trialled with a group of Year 2 undergraduate students who had no previous experience with PBL or online delivery of module content (other than PowerPoint slides being posted on their VLE). It may be that by the second year of an undergraduate degree, students are more assessment driven, are more likely to have picked up 'bad habits' and have developed a strategic approach to learning. A number of studies on PBL and enquiry-based learning (Duncan & Lyons, 2008; Duncan & Al-Nakeeb, 2006; Kolkhorst, Mason, DiPasquale, Patterson, & Buono, 2001) have all reported student difficulties in engaging with student centred learning because it has

been the student's first experience of this form of delivery and it has occurred in the second or third years of study.

The findings of the current study are consistent with constructivist perspectives of learning and the concept of social justice in learning (Savin-Baden & Howell-Major, 2004). By enabling students to engage with the module material at their own level, PBL automatically differentiates between the specific needs of each student whereas traditional lecture-led delivery does not. In addition, by using a problem-based assessment task students were placed in a position where they had to investigate a particular issue and construct their own understanding based on their own knowledge and skills base. The use of the wiki was key in developing this aspect of the students' learning as it allowed integration of the student's own ideas with those of their team and build up individualistic understanding of the given topic. For example, later on in the problem resolution period, an individual student would add an idea for an exercise intervention, usually backed up by a prior scientific study. This then tended to be commented upon by another student who had used the original post to construct or further their suggestion and would provide either an alternative intervention idea or a modification to the one proposed, again usually supported with references. In this way, wiki use to resolve the problem became an evolving patchwork of ideas, literature searching and evaluation that arrived at a group consensus. This could then be used by the students individually in the summative assessment of the module. This experience is congruent with prior reports on the usefulness of wikis in higher education (Parker & Chao, 2007).

Students also seemed to develop a sense of ownership of the information they posted on their wiki and seemed happy to support other contributors to the wiki but were more negative regarding students who remained as lurkers or when they felt their contribution would be used by students without reciprocal information being passed back to the group. This is clearly an important issue for practitioners when employing this form of learning and anecdotally, was challenging for the tutors to manage in some instances. However, the feelings expressed by students in this case are not uncommon for collaborative learning in general (Lea, 2001) and online based learning activities in particular (Savin-Baden, 2007). Future scrutiny of online team dynamics might be interesting in terms of elucidating the underlying issues here to a greater degree. It is also important for students using online PBL to understand that lurking can arise for a

number of reasons including fear of judgement from the group, fear of technology or even as a learning activity in its own right (Savin-Baden, 2007). It is possible that actually assessing wiki posts, as suggested in the focus groups, could overcome these issues although further research would be required to ascertain whether this would address the cause of these issues and whether this would be an effective and equitable form of assessment in online PBL.

Furthermore, the use of wiki-based PBL, as opposed to traditional PBL, appears to have offered a number of advantages and challenges in the student learning experience. The students acknowledged that inclusion of an online element to the module added flexibility to their learning, allowed more effective collaborative learning where all student voices could be heard compared to traditional forms of collaboration and that the content posted on the wiki aided their learning. The comment made where online PBL was compared to a maths exam paper with an answer and a working out section appears to be particularly pertinent, with students using the wiki to test out their understanding, make suggestions, 'brainstorm' and reflect based on each other's comments without it influencing their actual assessment. This possibly provides a way for practitioners to scaffold the learning process in a way that offers students freedom to think and construct their own understanding. This comment is indicative of claims previously made about the effectiveness of wikis in student learning (Vigentini, 2008). Yet, although it was noted that the wiki was daunting at first and felt like more work, it had advantages in terms of the shared development of knowledge and spreading workload in terms of reading, critiquing papers and conveying information.

However, although the inclusion of wiki-based PBL appears to have been positive, there were some significant comments centred around the concept of wiki anxiety. A number of students reported concerns or reticence to post initial comments on the wiki for fear of being judged in a negative way by the peers in their teams. In some ways this is not surprising as wiki use was a new experience for all concerned and this form of initial wiki anxiety has been reported previously (Vigentini, 2008). This is obviously an important consideration for tutors who may be thinking of including wiki-based PBL in their teaching. Perhaps there is a need for greater initial scaffolding of students' wiki experiences when they are new to this form of learning. The warm-up wiki activity included in the module in question was included for this purposes but perhaps was not

as effective as is needed to foster a feeling of self-efficacy in wiki use that might be required for truly effective online PBL. This issue might be worthy of future scrutiny with those new to wiki based learning. Strategies to enhance wiki self-efficacy could include use of a greater number of warm-up activities with additional tutor or peer support (both online and face-to-face) at the outset of the module, possible partnering of students who have prior experience of online learning and those that do not or 'drop-in' help sessions for students to get to grips with wikis and other online learning tools at the start of the module.

The current study has attempted to investigate the student experience of wiki-based PBL in students new to both online learning and PBL. This information can potentially be used to enhance the learning experience of future groups of students. However, this research is based on experiences of one particular cohort of students in one module. The findings of the current study raise some interesting issues that need to be further investigated in different contexts with students at different stages of their learning experience (e.g. first year compared to final year students). It is also important to note that the wiki is one of many online learning tools that could be used to facilitate PBL. In the context of the current study, the wiki was chosen as the means to facilitate PBL as it provided a social learning space that prior authors have suggested is easy to use and familiar to the majority of individuals who regularly use the internet (through experience of web content such as Wikipedia) (Parker & Chao, 2007). Few studies appear to have compared the effectiveness of different forms of online learning (e.g. blog versus wiki versus discussion board) although a study of this nature might offer important insight for practitioners in future. Furthermore, clear parallels are evident between comments made by the students in the current study and other research reporting the student experience of traditional campus based PBL (Duncan & Al-Nakeeb, 2006; Willis, Jones, Bundy, Burdett, Whitehouse, & O'Neill, 2002). It might be interesting for future researchers and practitioners to compare the two forms of PBL to elucidate the pros and cons of both in order to effectively advise educators who may wish to use online PBL within a blended learning approach. Inclusion of a pre and post measure of student learning with and without a wiki intervention might therefore be effective in determining the pedagogical effectiveness of wiki based PBL.

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