The challenge of using problem-based learning online

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Introduction

This chapter explores a number of concerns that relate to adopting PBL-online. The argument of this chapter centres on the notion of unrealised complexity; which is that we do not really know or understand fully what it is we have created in PBLonline. PBLonline is an approach to learning that is both varied and flexible and which introduces questions about what it means to be a problem-based learner in an online setting. This chapter begins by exploring why people have begun to develop PBLonline, moving to examine some of the models, media and environments in use. The second segment of the chapter examines the interrelationship of technology and pedagogy and suggests that this relationship still requires considerable exploration. The final section examines issues related to facilitation and learning in teams and suggests that PBLonline creates new kinds of learning space that prompt dialogic learning.

The nature and processes of online learning have changed considerably over the last few years. Britain and Liber have noted that considerable effort has been expended on the development of managed learning environments rather than the pedagogy of such development (Britain and Liber, 2004: 8). There also continues to be debate at both local and global levels about what counts as problem-based learning and what does not. In comparison with many other pedagogical approaches, problem-based learning has emerged relatively recently, being popularised by Barrows and Tamblyn (1980) following their research into the reasoning abilities of medical students at McMaster Medical School in Canada. Problem-based learning is an approach to learning where curricula are designed with problem scenarios central to student learning in each curricular component (modules/units). Students working in small teams examine a problem situation and, through this exploration, are expected to locate the gaps in their own knowledge and skills in order to decide what information they need to acquire in order to resolve or manage the situation. Lectures, seminars, workshops or laboratories
support the inquiry process rather than transmit subject-based knowledge. The starting point should be a set of problem scenarios regardless of whether a module or a whole programme is being designed. The scenarios enable students to become independent inquirers and help them to see learning and knowledge as flexible entities. Problem-based learning has expanded worldwide since the 1960s and, as it has spread, the concepts associated with it have changed and become more flexible and fluid.

**Why use problem-based learning online?**

The objective of combining problem-based learning and online learning is in itself complex. Terms such as ‘computer-mediated problem-based learning’ and ‘online problem-based learning’ have been used to define forms of problem-based learning that utilise computers in some way. This terminology is problematic since it offers little indication about the ways in which computers are being used, areas where students interact, which tools are used, how learning materials are selected and applied and the extent to which any of these fit with problem-based learning (see for example Barrow’s (2002) discussion of distributed problem-based learning).

As mentioned in the Introduction, we have agreed with the authors across this volume to adopt PBLonline as a generic term since it captures the vast array of ways in which problem-based learning is being used synchronously and asynchronously, on campus or at a distance. Further, it represents the idea that students learn through web-based materials, including text, simulations, videos, demonstrations and resources, chat, whiteboards and environments that have been purpose built for problem-based learning. Yet at the same time PBLonline has many of the hallmarks of the original problem-based learning models developed in the 1960s. It is more than a linear approach to problem solving where problem scenarios or case studies are used as prompts for learning in online environments.

Despite this, many of the concerns raised by delegates at problem-based learning conferences around the world include whether PBLonline will:

- affect the existence of face-to-face problem-based learning since PBLonline will be seen as being more cost effective
- destroy some of the original aims of problem-based learning since some forms of online problem-based learning tend to focus on solving narrowly defined problems that fail to encourage students to be independent inquirers who own their learning
- reduce the impact of learning in teams, in terms of students learning to work through team difficulties and conflicts in the way required by face-to-face problem-based learning.

At the outset it is important to realise that PBLonline is an approach that does not focus on replacing one form of learning with another, but is about complementing and developing what is already in existence. In terms of
queries about the original aims of problem-based learning there are already a number of variations – both face to face and online. For example, since the popularisation of problem-based learning, many have continued the attempt to define it in some way and thus the early approaches developed by Barrows and progressed by Boud and Feletti (1997) have been both supported and superseded by others (for example, Duch et al., 2001; Evensen and Hmelo, 2000; Savin-Baden, 2000). However, there is still confusion about the models, media and environments being used to support various kinds of problem-based learning that use technology in some way. A summary is offered in the following section.

Models, media and environments

Some forms of online learning are difficult to marry with types of problem-based learning that seek to provide opportunities for the students to challenge, evaluate and interrogate models of action, knowledge, reasoning and reflection, such as problem-based learning for critical contestability (Savin-Baden, 2000). In such models, tutors seek to provide higher education that offers, within the curriculum, multiple models of action, knowledge, reasoning and reflection, along with opportunities for the students to challenge, evaluate and interrogate them. Students therefore will be expected to examine the underlying structures and belief systems implicit within a discipline or profession itself, in order to understand not only the disciplinary area but also its credence. Knowledge is thus seen as being constructed by the students, who begin to see themselves as creators of knowledge and who become able to build on and integrate previously learned knowledge and skills with material that is currently being learned. Difficulties in attempting to marry diverse types of problem-based learning and online learning tend to occur because some approaches are overly managed through the online environments. Thus, in some cases, undertaking PBLonline is more about managing knowledge and information and developing a virtual space to deposit such knowledge, than actually engaging students in a collaborative online process.

Computer simulation in problem-based learning

There are a number of computer simulations that have been developed for use with problem-based learning, some of which are being used in blended forms of problem-based learning. For example, Rendas et al. (1999) introduced a computer simulation that was designed for problem-based learning in order to motivate learning, structure knowledge in a clinical context and develop learning skills for medical students, at a stage in the programme when they had had little contact with patients. It was also designed to evaluate how students reasoned and learned in each session. The problem situation
provided all the information about a patient in a predetermined sequence and students, working three to a computer, were expected to find out further information by asking one question at a time, seeking justification for the hypothesis they had put forward and being encouraged to identify learning issues. The answers provided by the students were logged and later analysed with a tutor. The difficulty with this particular model of computer simulation is that it offers students little opportunity for creativity and personal responsibility and in many ways resembles some of the earlier forms of guided discovery. What is really occurring here is that problem-solving learning is being used to guide students to the right answer or diagnosis.

To promote problem-based learning it would seem better to locate simulations within problem-based learning rather than using them as a mechanism or strategy.

**Multimedia resources for problem-based learning**

Multimedia resources in problem-based learning tend to mirror the Content + Support model of online education (Mason, 1998), in which course content is, in general, separate from tutorial support. Content is provided for the students either on the web or as a package of material, whereas tutorial support is given via email or computer conferencing and usually represents no more than 20% of the students' study time. This is a result of using multimedia resources largely to support existing course material. In some virtual learning environments (VLE) resources are accessed as an integral part of a learning package but to date the inclusion of videos, small-scale simulations and lectures is primarily the extent of what has been done. Although there have been many developments in recent years, the relationship between pedagogy and technology still seems to be lacking in this area. Furthermore, off-campus access for students, although growing, can be problematic with material that takes time to download causing students to view it as both costly and time consuming.

**Virtual learning environments in problem-based learning**

VLEs are learning management software systems that are not intended merely to replace the classroom online, but rather to offer learners a variety of options for learning. Many advocates of these environments see in them the potential for allowing student-centred learning to be incorporated into teaching in new and innovative ways. The use of terminology relating to these environments tends to be predominantly pedagogically driven, but the term 'virtual learning environment’ is used here to include learning management systems and online learning environments. Thus VLEs are
learning management software systems that synthesise computer-mediated communications software, such as email and online course materials.

While the number of systems available is large, many of them have similar features and although they are, in general, designed to promote varied and effective teaching styles there are a number of limitations that apply to collaborative forms of learning. Most systems are capable of supporting content-driven online education, but there are few data that indicate which systems can support problem-based learning effectively. This is why new environments, such as eSTEP and POLARIS described in this volume, have been designed specifically to support problem-based learning.

**Blended PBL**

The term ‘blended PBL’ tends to be used to reflect the idea that students learn through the combination of online and face-to-face instruction (Graham, 2004). For example, students learn through web-based materials that include text, simulations, videos, demonstrations and resources. This type of blended PBL tends to focus around a particular site through which students are guided by the use of strategy problems, online material and specific links to core material. While at one level the use of the site is student led, the materials provided necessarily support the learning they undertake in face-to-face problem-based learning groups. An example of such a site is the SONIC project (Savin-Baden and Gibbon, this volume).

**PBLonline**

This conception of problem-based learning places it pedagogically in a collaborative online environment and thus it has a number of advantages over models mentioned earlier. While many of the current models of online education focus on teacher-centred learning, PBLonline needs to be focused on team-oriented knowledge-building discourse.

PBLonline is defined here as students working in teams numbering 8 to 10 on a series of problem scenarios that combine to make up a module. Students are expected to work collaboratively to solve or manage the problem. Students will work in real time or asynchronously, but what is important is that they work together. Synchronous collaboration tools are vital for the effective use of PBLonline because tools such as chat, shared whiteboards, video conferencing and group browsing are central to ensuring collaboration within the problem-based learning team. Students may be working at a distance or on campus, but they will begin by working out what they need to learn to engage with the problem situation. This may take place through a shared whiteboard, conferring or an email discussion group. What is also important is that students have both access to the objectives of the module and the ability to negotiate their own learning needs in the context of the
given outcomes. Facilitation occurs through the tutor having access to the ongoing discussions without necessarily participating in all of them.

It is important to realise, however, that the forms of environments on offer, whether created specifically for problem-based learning or adapted to be used with it, all seem to have a strong management genre in terms of the forms of authorship used. The design of such digital spaces could be seen as being authored (in both the sense of authorial design behind the web and the authors of the written text in front). While the authoring of text (whether inked or virtual) and the authoring of design can be seen as very different functions, it seems that both could be seen to ‘impede the free circulation, the free manipulation, the free composition, decomposition, and recomposition of fiction’ (Foucault, 1988: 209). This would seem to introduce questions about the extent to which constructive approaches to learning can be authored and managed. Further, as Ravenscroft (2005: 139) has argued: ‘We need to investigate, examine and where possible, design appropriate learning communities if we want to support effective e-learning discourse.’

Technology and pedagogy

There has been much criticism in recent years about blended learning environments that fail to create effective settings for learning (Noble, 2001; Oliver and Herrington, 2003; Reeves, 2002). One reason for this has been that the focus in blended learning environments has been on technological rather than pedagogical design. There have been suggestions that there is a need for a reengineering of the concept of learning design rather than just a simplistic repackaging of the course content into blended learning formats (see for example Collis, 1997; Mason, 1998). Yet Cousin (2005) has argued that the ‘pedagogy must lead the technology’ perspective has become something of a mantra, a mantra that she argues against. Conversely, Cousin suggests the medium is the pedagogy. While this appears to be a convincing argument, she risks denying the difficulties inherent in putting technology in the lead. It seems that many of the difficulties about the relationship between pedagogy and technology stem from a failure to ask what might appear to be some fairly straightforward questions, such as:

- What do we mean by pedagogy in online learning?
- What is the technology to be used for?
- What is the relationship between the type of pedagogy to be adopted and the type of pedagogy currently being used?

In PBLonline it seems that, in most cases, the pedagogy did emerge first. The result has been the development of a number of innovative approaches designed to match the pedagogical challenges of problem-based learning (see for example those cited by te Winkel et al., this volume). While there are those (such as Cousin) who rail against statements made by funding bodies who suggest, for example, ‘that the technology should follow the learning
and teaching objectives’ (HEFCE, 2003: 11), there is a sense that the difficulty connected with the philosophy of ‘learning and teaching objectives’ has been forgotten along the way. The use of such language is problematic; whether or not that particular funding council meant ‘objectives’ in the narrowly defined way in which they are used worldwide in curricula, or whether they meant ‘objectives’ to be used in a much looser sense is unclear. Stenhouse suggested that we must be wary of believing that the objective model of education was the solution to larger curricular problems and argued: ‘We do not have objectives: we choose to conceptualize our behaviour in terms of objectives – or we choose not to’ (Stenhouse, 1975: 71). Stenhouse’s work is interesting in that many of the important points he made about designing curricula have been discounted. The result has been an increasing move toward outcome measures and performance, so that students must behave and learn in particular ways rather than be seen as people who live and work in context and in relation to one another. Furthermore, it seems that in many undergraduate programmes, and particularly with the increasing use of benchmarking standards, the issues of the morality of such educational practice come into question: ‘From a moral point of view, the emphasis on behavioural goals, despite all of the protestations to the contrary, still borders on brain washing or at least indoctrination rather than education’ (Kliebard, 1968: 246). The issue then is how we can develop curricula that allow for the moral initiation of students into the appropriate culture of the profession or discipline, while also inducting them into knowledge in ways that avoid indoctrination and promote democracy and creativity. The suggestion that ‘education as induction into knowledge is successful to the extent that it makes the behavioural outcome of the students unpredictable’ (Stenhouse, 1975: 82), will be uncomfortable for many course leaders and managers in the current higher education system and yet, to a large extent, this is precisely what does occur in many problem-based curricula.

It is important to remember, as Cousin (2005) points out, that technology is not just lying there waiting for pedagogues to put it to good use. The chapters across this volume indicate the need for strong and effective interaction between pedagogy and technology to ensure that both are used to best effect in implementing and enacting PBLonline. Many of the authors here imply an underlying argument that suggests that there is little point in designing PBLonline if, like with a box of chocolates, no one is prepared to either open it or consume it. Additionally, narrowly defined pedagogies, whether virtual or face to face, can prevent students from engaging in meaningful learning.

Yet there are a number of contradictions between the arguments occurring about the nature and process of the pedagogy and technology in PBLonline. For some tutors there are concerns that there is a danger that PBLonline could become increasingly instrumental. It might be that, as facilitators become more familiar with the approach, they become more teacher centred than learner centred and PBLonline falls into the performativity
trap. Nonetheless there are other hidden similarities between the pedagogy of problem-based learning and the increasing use of the internet for learning. Problem-based learning and surfing the internet share similar qualities, for example the process of learning in problem-based learning teams is interactive, non-sequential, random and often seems rather chaotic. Students of the net generation who are observed surfing and using the ‘fast click’ to access information (Savin-Baden and Gibbon, this volume) seem equally non-sequential and chaotic; yet in both cases this does not mean that learning is not occurring (although it must be acknowledged that there are nomadic learners who wander across the problem-based and internet desert losing themselves in the sandstorm of available information). Such mirroring of interaction between technology and pedagogy in new and emerging forms of PBLonline would seem to represent ‘a new “learning ecology”’. This is not just another addon, but a technology that is ‘transforming our educational institutions and how we conceptualise and experience teaching and learning’ (Garrison and Anderson, 2003: 123). It is an ecology that is also transforming our online and face-to-face pedagogic identities.

Facilitation, dialogic learning and online teams

There have been increasing debates over the years about whether facilitation is just one form of good teaching or whether in fact it is something else. Facilitating problem-based learning face to face is a complex activity which requires that tutors are equipped to be facilitators. For tutors engaged in problem-based learning the transition from lecturer to facilitator demands revising their assumptions about what it means to be a teacher in higher education. This is a challenge to many, since it invariably demands recognition of a loss of power and control when moving towards being a facilitator. Becoming a facilitator can be a daunting experience because, although lecturers may have taught students through workshops and small group sessions, their role as a facilitator in problem-based learning often requires more of them than in these other forms of teaching. For many tutors, this involves letting go of decisions about what students should learn, trusting students to acquire knowledge for themselves and accepting that students will learn even if they have not been supplied with a lecture or handout by their tutor. The conflict for many tutors is in allowing students freedom to manage knowledge, rather than keeping their previous roles and relationships with students as the controllers and patrollers of knowledge.

Yet whether it is in face-to-face problem-based learning, PBLonline or e-moderating, there appears to be an assumption that there are specific roles, attributes and ways of being that characterise some facilitators as being ‘good’ or ‘better’ than others. PBLonline does require that tutors are supported. An electronic moderator is someone who ‘presides over an electronic online meeting or conference’ (Salmon, 2000: 3). In her comprehensive guide to e-moderating, Salmon draws on research from tutor and student
perspectives, offers guidance on training e-moderators and suggests a useful model for teaching. However, it is not yet clear whether facilitating PBLonline is the same as e-moderating. It might be that PBLonline requires more of a silent presence by the facilitator, along with appropriate hinting and prompting, rather than some of the direction and intervention that seems to be evident in much e-moderating. What is clear though is that the skills of face-to-face facilitation in problem-based learning do overlap with those required for facilitating PBLonline. Furthermore, as with students undertaking face-to-face problem-based learning, those students doing PBLonline seem to need less facilitator support and guidance as they become more familiar and skilled with managing the learning approach.

Yet it does seem to be the case that effective face-to-face facilitators do not necessarily make effective online ones. This might be because of the absence of non-verbal cues in PBLonline compared with face-to-face problem-based learning. Rosenberg and Sillince (2000) found that nonverbal cues affected activities such as requesting help and information, getting commitment and recognising the effort of others. The findings of their study indicated that learning media such as computer-mediated communication may make successful collaboration difficult because of the absence of nonverbal cues. In terms of interventions made by facilitators, Wegerif and Mercer (1996) have suggested that successful exchanges in collaborative forms of learning that use problems are more likely to include moves such as ‘exploratory dialogue’. Such dialogue would include explaining, clarifying, challenging and justifying. However, the idea that facilitation is a specific kind of ‘role’ remains problematic. It appears that there is a need for some tutors to construct a false identity in order to prevent themselves from becoming too subjective and too involved with students and their learning. Bayne’s work to some extent illustrates such perspectives. Bayne (2005a) found that tutors in online environments (although not problem-based ones) tended to construct for themselves a teacher identity, so as to both feel and be in control; to be an authority figure in the online space.

While there is a growing body of research exploring what occurs in problem-based learning seminars (for example Barrett, 2007; Wilkie, 2004) it is interesting to note that there is still relatively little research that has explored what it is that students do when they go online. There are accounts of tutors’ and students’ experiences of engaging with particular online environments (Bayne, 2005a, 2005b; Donnelly, 2004; Salmon, 2000), and with discussions about tutor interventions, yet there is still little understanding of what goes on in the minds of tutors and students engaged in PBLonline. Concerns about what and how students learn in teams is an area that has still not been particularly well resolved in online or face-to-face problem-based learning contexts. Work by Ravenscroft (2004, 2005) explored a number of concerns about learning in online communities and McConnell (2000) has researched collaborative e-learning, some of it relating to a loose type of problem-based learning. Facilitators and students influence one another in a whole variety of ways, such as their views about
what counts as knowledge, the interplay of content and process and the ways in which they do and do not deal with conflict in the team. Conflict may emerge because a team member feels a peer is not participating or alternatively if the team perceive that the online facilitator is interrupting rather than interacting. Again, while conflict in teams has been researched in face-to-face settings, the management of virtual conflict is still largely under-researched.

The way dialogue occurs in PBLonline may affect the nature and process of learning that occurs. For example, asynchronous discussion seems to create a reflective learning space whereby the learner is able to respond in a way that is both a reply and a reflection. Extended written commentary such as this rarely occurs in face-to-face problem-based learning where conversation flow is characterised by fast exchanges of short sentences. In asynchronous PBLonline, the students (the authors of the commentary) often seem to be in the process of ‘sense making’ as they speak. Such ‘sense making’ would be likely to affect the quality of the dialogic learning in the team and result in more meta-commenting than would occur in face-to-face problem-based learning.

Dialogic learning (following Mezirow, 1981) is learning that occurs when insights and understandings emerge through dialogue in a learning environment. It is a form of learning where students draw on their own experience to explain the concepts and ideas with which they are presented and then use that experience to make sense for themselves and to explore further issues. This kind of learning, learning with and through others, can encourage students to critique and challenge the structures and boundaries within higher education and industry, whether virtual or face to face. Learning through dialogue brings to the fore, for students and tutors, the value of prior experience to current learning and thus can engage them in explorations of and (re)constructions of their identity. However, synchronous PBLonline seems to reduce the possibility for both dialogic learning and meta-commenting and in some cases would seem to be much more complex an activity through which to learn than face-to-face problem-based learning (see for example the complexities raised by Lycke et al., this volume).

Conclusion: future learning spaces?

The language used in online learning, such as desktops, virtual classrooms and even the names of VLEs, Blackboard, First Class, has similarities with the language used in face-to-face learning. Yet the uses of face-to-face and virtual spaces are quite different. Online learning still seems to be a largely uncomfortable learning space for many students. This may be because there is a sense that in online learning, identities are seen as more boundless and flexible that in face-to-face contexts. However, there do seem to be some enlightening similarities between face-to-face problem-based learning and PBLonline from the students’ perspectives. For example, in face-to-face
problem-based learning students have often reported feeling out of control, fragmented and ill at ease because the experience of learning through problem-based learning is markedly different from prior learning experiences (see for example Savin-Baden, 2000). Problem-based learning can offer students greater autonomy to learn for themselves and opportunities to develop independence in inquiry, opportunities many of them may not have encountered in lecture-based learning. Similarly, students in PBLonline (and in online learning in general) often speak of feelings of loss of control and also of a sense of danger. In online learning, such loss of control and danger seem to relate more to the presentation of identity than to issues about the control of knowledge, something that is so often at the forefront of student concerns in face-to-face problem-based learning. Perhaps it is the case that online learning brings to the fore and prompts students to confront their contradictory identities (Hall, 1992) earlier than in face-to-face learning, where they feel able to hide such contradictions more easily behind the need to acquire and manage knowledge.

Many of the questions and queries raised by those concerned about using PBLonline would seem to relate to wider concerns connected with the relationship between diverse forms of technology and the pedagogies of problem-based learning. For example, Barrows has asked:

Can a communication technology be developed that will mediate PBL yet avoid distorting the PBL process as it is used in face-to-face small group work? It would have to be able to present an ill-structured problem verbally, visually and auditorially as appropriate. It should allow for both synchronous and asynchronous discussion. There should be a whiteboard, operated by a member of the group, to facilitate and record the group’s progress, recording ideas generated, data acquired, and learning issues to be pursued. I am waiting with baited breath.

(Barrows, 2002: 122)

Perhaps Barrows has missed the point of PBLonline. PBLonline is necessarily different from face-to-face problem-based learning at a whole variety of levels: the nature and type of dialogue has changed, the means of giving and receiving information is largely through hyperlinks and facilitation is often about indicating presence and using hinting and prompting exploration than some kind of embodied notion of presence. However, there are still questions that need to be explored about the way in which problem scenarios are designed for PBLonline and the extent to which digital environments can be learner centred and learner driven. Perhaps, too, we need to be asking whether students are allowed to recreate the problems wiki style? Further, if they did, how would this then affect the perceived authenticity and authorship of the problem? Yet despite the fears and concerns about the notions of a disembodied identity raised by both tutors and students, in a number of studies, PBLonline does seem to offer a new learning space for identity (re)construction and formation, with technology that can support new and innovative forms of interactive learning.