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# Opportunities and Challenges of Interactivity in Blended Problem-based Learning

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## Abstract

Interaction continues to be one of the most hotly debated constructs in the realms of distance and e-learning, instructional design and academic development to name but three fields of study in higher education. For technology-mediated learning, interaction is undoubtedly a key value proposition. It continues to be perceived as the defining attribute for quality and value in a blended learning experience. A recent study into interaction within a blended problem-based learning (PBL) module in a higher education academic programme is the focus of this paper. Mapping interactions in blended PBL onto learner centric pedagogy is useful because it is an important step towards the understanding, formalizing and discussing how teachers can transform their learning and practice in an online and face-to-face PBL environment. Specific aspects of interaction (technical, peers, content and the learning experience) within blended problem-based learning tutorials have not previously been analysed within a framework of learner centric pedagogy. At the heart of this study is cognisance of the need for strong and effective interaction between pedagogy and technology to ensure that both are used to best effect in implementing PBL in a virtual environment. The case for the role of learning technologies in utilizing interaction is highlighted.

**Keywords:** academic professional development, blended delivery, eLearning, interactions, problem-based learning, qualitative research, transformative pedagogy

## **Introduction**

Although the problem-based learning (PBL) tutorial is the central and key learning encounter in PBL curricula and the integration of technology has increased in practice in recent years, surprisingly very little research has been done on what actually happens in the backward and forward momentum between virtual and face-to-face problem-based learning. There is currently little evidence of any comprehensive studies into patterns of interaction in blended problem-based learning in academic development, with critical research to date being epistemic at best. Similarly, academic developers are seeking to understand the complexities of education in an age where learning technologies are constantly reshaping and redefining our accepted notions of what it means to teach and learn in a higher education environment.

Recently, Reinmann et al. (2007) in providing evidence from qualitative studies of blended learning in practical situations, including PBL in higher education, draws on tutors' and students' perspectives to argue that the introduction of blended learning requires clear decisions to be made on a number of key areas; these include the distribution of learning content, didactical approaches and interactions, ways of communicating and characteristics of learning environments.

In the midst of the current wave of enthusiasm for blended learning in higher education, consciousness should be raised about the criticism in recent years about blended learning environments that fail to create effective settings for learning. Informed by such studies as Noble (2001) and Oliver & Herrington (2003), it is important to be aware of the ubiquitous debate about the ongoing relationship between pedagogy and technology. Contemporary commentators have voiced concerns with the speed at which technology has been proceeding at the expense of pedagogical advances. This study is taking cognisance of the need for strong and effective interaction between pedagogy and technology to ensure that both are used to best effect in implementing PBL in a virtual environment.

This paper outlines the background, rationale and findings on a qualitative study on blended problem-based learning within the context of academic development in higher education. This two year study with teachers on a higher education postgraduate programme in higher education emerged from experience as an academic developer and tutor on the programme. This current study is important because the role of blended learning within a pedagogical approach such as PBL has been gaining international recognition among practitioners and academic educators alike. Whilst research into the concepts, tools and methodologies of both eLearning and PBL have certainly increased momentum in recent years, Panda & Juwah (2006, p. 207) note that the increased use of the web for learning and teaching has "necessitated a re-examination of some of the issues with eLearning and the professional development of teachers engaged in an online facilitation role".

The study represents the convergence of three major activities in higher education today: the teaching of teachers in higher education through provision of a postgraduate module, the blending of the technologies within eLearning and the pedagogy of problem-based learning. There have been many practice-based studies in each of these fields, but arguably each remains under-researched in their own right and engaging in critical debate in this converging research area is much needed. Generally, there have been unexamined actions and initiatives that have entrenched the issues of PBL, eLearning and this form of academic development and made each more intractable and less open to reasoned debate.

## **Researching Interaction in Blended Learning Environments**

Based upon extensive empirical research in higher education in recent years, Savin-Baden (2006) has concluded that the objective of combining PBL and eLearning is in itself complex. She also recognises that the terminology is problematic since it offers little indication "about the ways in which technology is 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 PBL" (p. 4). It is useful here for the context of the study to make explicit definitions of the key principles involved: problem-based learning and blended learning. There are many definitions currently existing for blended learning, however, the definitions seem to converge around

the idea of synthesizing eLearning with the more traditional forms of teaching and learning, drawing together the ‘e’ with the classroom, the laboratory, the seminar and the tutorial setting. Problem-based learning is an educational strategy that involves the presentation of significant, complex and “real-world” problems to students that are structured in such a way that there is not one specific correct answer or predetermined outcome.

For the purposes of this study, interactions are defined as reciprocal events that require at least two objects and two actions. Interactions occur when the objects and events mutually influence one another. A number of schools of thought have emerged in the last two decades that explore interaction in the context of technology-mediated learning. There are two commonly held beliefs. Firstly that the perceived quality of a learning experience is directly proportional to and positively correlated with the degree to which that experience is seen as interactive. Secondly, if technology-mediated learning designs are to have any significant impact on current and future pedagogical practices, then learning design decisions need to maximize the benefit of interaction.

Interaction in education is a complex phenomenon. The literature identifies several taxonomies that classify various types of online interactions; however, Moore’s (1989) seems to be the most well known taxonomy in the field of online education where he described three types of interaction: learner-content, learner-instructor, and learner-learner, which were later extended by Hillman et al. (1994) to include learner-interface interaction. Many other definitions of interaction exist (Weller 1988; Merrill, Li & Jones 1990; Wagner 1994; Carlson & Reepman 1999; Hirumi 2002; Sims 2003; Yun 2005) and all provide a variety of reasons why interactivity in an online course is important. Wagner (2006) has discussed the concept of interaction in relation to blended learning and it is considered that this adequately serves as a demonstration of the breadth and vitality of the field. He contends that interaction should be viewed less as a theoretical construct and more as a variable that needed to be exploited, accommodated, leveraged or managed when crafting blended learning designs. Interactions have been researched in terms of four dimensions: transactions (interpersonal, academic, collaborative), outcomes, social presence and experience.

Each of the four dimensions of interaction provide very different views on the value that interaction brings to a learning experience. They also share a number of similarities. Firstly, each perspective is shaped by some degree of technology-mediated learning and is looking for a way to transcend distance. Secondly, each assumes some degree of self-regulation and independence on the part of the learner. Thirdly, each acknowledges the value of facilitation by a tutor. In the context of this present study, this suggests that interaction strategies, regardless of their theoretical bases, can help improve the relevancy of blended PBL experiences for the participant. Table 1 depicts the variables of blended learning interactions central to this study in terms of their attributes and function; they have been considered for the work as they are central to the social and communal constructivist approach adopted in the module.

Variable	Attributes	Function	Contribution of my Study: Theory into Practice
Interactions as transactions	Learner collaboration	is the degree and quality of engagement with others	<ul style="list-style-type: none"> <li>- Creation and sharing of ideas</li> <li>- Critiquing ideas</li> <li>- Deciding and agreeing to collaborate on an issue</li> </ul>
Interactions as outcomes	Interaction for participation	Provides learners with a means of engaging with one another	Articulating one’s interest in assuming leadership responsibilities in a group
	Interaction for communication	Offers the ability to share information and opinions or to influence intentionally the	Teaching others in the group

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		opinions or beliefs of others	
Interaction negotiation	for	Involves the willingness of another individual to engage in a dialogue, come to consensus or agree to conform to terms of an agreement	<ul style="list-style-type: none"> <li>- Initiate dialogue with peers or the tutor</li> <li>- Dialogue on how they will agree on an issue</li> </ul>
Interaction teambuilding	for	This is necessary to ensure that individual members of a team/group actively support the goals of the group	<ul style="list-style-type: none"> <li>- Recognition and acceptance of individual differences</li> <li>- Expression of respect for the group as well as for its members</li> <li>- Effective listening</li> <li>- Shared sense of responsibility</li> <li>- Confirmation of expectations within the group</li> </ul>

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Table 1 Blended Learning Interactions Central to this Study

Interactivity is the core of learning, and is evident at all levels of engagement. However, the term *interactivity* is used so loosely that in the fields of e-learning and blended learning, it has become almost synonymous with the notion of learning itself. This paper discusses that by bringing the concept into sharper focus, real insight will be gained into the nature of interaction. Interaction in the context of this study will be explored at three levels: interaction with concepts, tasks and people (peer learners and tutors). These three levels have been previously represented in a popular framework for interactive learning by Mayes & Fowler (1999). However it is suggested that a case can be made for proposing a new dimension of interaction that focuses on the blended interaction activity experience. The decision for this was based upon recognition that blended PBL is a complex process of interaction between people, the tools they use and the context in which they are embedded.

Gredler (2005) in his consideration of learning and instruction, suggests that the role of technology in learning remains an issue for theory development and research. Specifically, yet to be developed are learning principles that address teacher-student interactions, student-to-student communication and student-to-subject-matter interactions for various uses of computer technology. There seems to be much evidence in the literature that as Internet-based teaching and learning have proliferated, researchers, theoreticians and pedagogues have recognized that an educationally-viable environment requires students to interact with content and with each other. Within this, a number of outstanding issues remain to be addressed, including the nature of questioning, the character of informative feedback, the scheduling of reinforcements and the structuring of information for students.

There has been much work conducted into interaction within groups of learners. Foulkes & Anthony (1984) examined the social view of group interaction taking places at different levels. Indeed there is a sociological understanding of one of the dimensions of interaction for describing groups, coined by Wagner (2006) as interactions as transactions.

Bruner (1966) viewed interaction between tutor-student, intuition and skill learning, among others, as core elements to constructivism. Dewey's theory of learning (1938) provided the basis for social constructivism. Learning is contextual and experiential; it is an active construction of social and individual meaning, which involves interaction, motivation and development. This study is informed by this notion in so far as

interaction is regarded as crucial for the development of the blended PBL group and because enhanced motivation was expected to result in the improvement of the participant's learning experience.

From a constructivist viewpoint, studies on web-based learning environments have shown that a critical component to interaction online is an interpersonal, social component; this occurs when learners receive feedback from the instructor or peers and colleagues in the form of personal encouragement and motivational assistance. Social interaction can contribute to learner satisfaction and frequency of interaction in an online learning environment. Indeed, Grabinger & Dunlap (2000) have reported that without the opportunity actively to interact and exchange ideas with each other and the instructor, learners' social as well as cognitive involvement in the learning environment is diminished.

Today, educators have more choice than ever when it comes to selecting types of interactions to include in their blended courses; unfortunately they often do not even know the potential of the tools that are available to them or how to use them effectively. To further confound the situation, the use of interactive technologies alone does not ensure meaningful interactions will occur in a blended course. All decisions regarding types of interaction in a blended course should be driven by pedagogical principles and grounded in research.

Interaction comes in many forms, not just learner and tutor, but also learner-to-content, learner-to-learner and learner-to-infrastructure. From the perspective of the instructional designer and tutor of academic programmes, there can be a particular sense of freedom provided by the relief of not having to "cover" basic information or design a course structure, but instead being able to concentrate on interaction with individual students and engage in a creative interpretation with each group of the issues and subtleties lying within and beyond content. Valsamidis (2006) suggests that focusing on the delivery of material instead of on the much more crucial interaction of the material with the learner, mediated by a tutor through a rich channel of communication, results in a mismatch in how some academic development is designed.

Yoon (2003) suggests that online interactions which can be stored, retrieved and disseminated anytime, anywhere are still a relatively new phenomenon and awaits greater exploration and coordination. Interaction has long been regarded as the vital ingredient on which success matters in technology-related education. Research studies by Frankola (2001) and Charp (2002) on attrition rates in online courses has provided a rationale for the emphasis on promoting interaction and sound instructional strategies in online courses. More recently, Yun (2005) has concluded that there is evidence that instructional strategies which incorporate various types of interaction can be the key to teaching a high-quality online course that engages students. Student perceptions also provide a reason why interactivity is important in e-learning. A number of studies have shown that students tend to judge a distance education course according to their perception of the instructor-student interaction (Abbey 2000; Flottechmesch 2000; Lynch 2002).

## **Research Context**

Informally enthusiasm among teachers for eLearning continues to grow and where explicit institutional policies are lacking, pressure on lecturers to engage with new technologies is coming from students and from their own peers. Alongside this, new pedagogical approaches emerge on the educational scene to support complex, flexible and integrated learning and the development of professional competencies. Although not new, PBL is one which appears to have captured the imagination and support of teachers; there has been a growing interest in the last few decades, particularly on the collaborative construction of knowledge through active learning and the importance of higher-order skills such as problem solving. Given our increasingly networked society, interest has grown in such new educational methods and in where and when to teach them.

The challenge facing this research arose from the need to develop an effective means to introduce academic colleagues to PBL and blended learning in order to extend a more effective way of delivering instruction in both in the host Institute and the other institutions represented by participants in the study.

As it is important to incorporate capacity development in formal courses on higher education (Segrave et al. 2005), the entire postgraduate programme was developed in 2001, and has over 100 graduates today. The focus of the research reported here is a particular Postgraduate Diploma module entitled ‘Designing eLearning’ which carries ten ECTS (European Credit Transfer and Accumulation System) credits. The module is delivered online and face-to-face over a period of ten weeks.

The institution in which the study took place is a large multi-campus, multi-discipline organization, with subjects offered within Applied Arts, Built Environment, Business, Engineering, Science and Tourism and Food. The current and emerging higher education environment in the Institute, as elsewhere, is seeking solutions to problems of changing paradigms of learning and the influx of learning technologies.

The nature of these teachers’ varied work responsibilities today is complex, with demands on their time (ranging from lesson preparation, student support and research, to staff meetings, curriculum development) pulling them in many directions. As a result of all the pressures teachers face in today’s higher education environment, Donnelly & O’Farrell (2006) have argued that for their own professional development, they need to be provided with streamlined learning experiences which deliver essential topics and learning materials in readily accessible formats. It is believed a central challenge here is to create and sustain quality learning environments of enduring value for teachers. It has already been reported by Donnelly & O’Rourke (2007) that the teachers who have participated in the Institute’s postgraduate programme have anecdotally and in general displayed a much better awareness of how to adapt eLearning into their practice. However, this in the main has been limited to the transfer of content online. In my experience as an eLearning academic developer, over a number of years, there have been a significant number of teachers who have been inducted and trained to set up the basics of operations in technologically mediated learning environments across the Institute, but few who have been developed further in terms of pedagogical training. Indeed, of those staff who have expressed a wish to engage with eLearning, on average more than half of those who attend an initial day-long introductory session do not proceed immediately to employ it as part of their practice, citing time constraints as the main inhibiting factor.

Presenting an opportunity to work with eager members of the teaching community in offering a novel approach to their academic development is important. As all participants on the module are self-selecting and choose to pursue this professional development opportunity themselves, arguably it is a situated reality that participants are motivated and keen to explore the blended PBL approach offered through the module. Table 2 provides the details on the study’s participants.

Number	Attribute
17	part-time postgraduate learners in total
9	had completed a PBL module previously
5	had prior experience of blended learning
8	males
9	females
15	subject disciplines in higher education represented: Group 1 (psychology, social science, culinary arts, information literacy, adult literacy); Group 2 (Biology, Apprentice Plumbing, Apprentice Joinery, Apprentice Metalwork, Adult Literacy); Group 3 (Architecture, Marketing, Culinary Arts, Refrigeration, Printing, Fine Art, Chemistry).

Table 2 Sample for the Study

In addition to technological challenges for teachers and academic developers, there are issues that arise during the change process from a traditional delivery mechanism, such as the lecture, to a problem-based educational model. To understand the extent of these problems, the research of Kolmos (2002) is useful for reporting that in spite of an extensive staff development programme to introduce teachers to the new PBL model, the change in the nature of teaching caused problems with retention and curriculum. She urged academic developers to be aware of the need to facilitate the change at individual, culture and organisational levels, which is a comprehensive challenge in itself.

To counter this, the blended PBL module itself strives to be both proactive and responsive to the changing needs of all teachers from across the Institute, and other institutions of higher education in Ireland.

## Research Design

There were two research objectives set for this study:

1. To establish, in a PBL tutorial setting, the facets of interaction that govern the success of blended problem-based learning;
2. To design a coherent and comprehensive professional development and support provision for higher education institutions.

The aim of this study was to develop understanding of blended approaches to PBL and to contribute to institutional planning for learning and teaching in the future. The intention was to support the academic development function by investigating whether a selection of teachers in higher education considered a blended approach to problem-based learning facilitates enhanced interaction on a number of levels. This study recognises that there is still confusion about the models, media and environments used to support PBL that use technology in some way, and is particularly concerned with illuminating current knowledge on PBL group-oriented interaction.

A naturalistic, interpretative, qualitative approach was used to analyse the data collected for this study. The open-ended, exploratory, qualitative approach taken in this present study can help document how learners in real PBL situations and contexts, addressing both broad themes and micro-issues helps us understand the complexity of learning and teaching in blended PBL environments and offers insights that can be useful in developing our practice as academic developers. As a research approach, it has presented a series of “slice-of-life” episodes during the blended PBL tutorial process and afterwards, revealing the range of applications and use of the knowledge in professional teaching practice.

The research methods employed to collect face-to-face and online observational data from three PBL groups with a total of 17 participants in this two year study on a blended PBL module were participant observation, online discussion logs, open-ended focus group interview and self-reflective papers to capture the participant’s own thoughts and experiences of the blended PBL approach. Each method was chosen for the opportunity it could offer to explore interactions which were central to this study. The approach taken to the collection of data of blended PBL groups was multi-faceted. A main concern has been to provide meaningful and accessible insights into the practice of blended PBL based on the analysis of real-life situations. There were two levels taken to the analysis of the data. Level One was descriptive in nature and through video observations explored the interactions between the peers, the tutors and the content of the blended PBL tutorial. Level Two was a thematic analysis of interactions in blended PBL and through a combination of online logs, focus group interviews and participant self-reflective papers, categories and themes emerged to inform the findings of the study and implications for practice. Being engaged with the events as they happened in the field and attempting to bring holistic attention to the practices as constitutive of a distinct culture was important to this study. As suggested by Hine (2000, p. 20), this study has examined those

enduring practices through which the blended PBL groups have become meaningful and perceptible to participants.

While the Blackboard VLE which was used in the module technically organized the online environment of the PBL groups, actual interactions took place through the actions and reactions of the participants to the PBL learning setting, module materials and activities, to tutor and guest tutor directions and to peers' ideas and actions.

In order to establish in a PBL tutorial setting the factors that govern the success of blended problem-based learning, the literature suggested the need to identify key interactional indicators. Therefore, the first analytical framework was formed from a conceptual framework based upon the literature on interactions in blended learning. Three types of categories were included for exploration of the interactions in blended PBL: technical, academic and peer. For each category a set of indicators of learning were developed, some more appropriate than others. For example, within the category of *technical interactions*, adapted from the 4-E Model developed by Collis & Moonen (2001), enumeration, environment, effectiveness, ease of use and engagement were used. Academic staff must learn how to use e-learning effectively, including highly popular VLEs on the market today. However, aspects of the pedagogical and design components associated with how best to use online tools, how to facilitate interaction using these tools and what content and interactions are best delivered online vs. face-to-face are arguably more important.

The category of *academic interactions* looked at indirect and direct tutor influence on participant learning and within this, specifically at participant interactions with the concept and content of the PBL problem. The third category of *peer interactions* included responsive, initiative and unrequited peer discussions. To assist with the formation of categories, it was helpful for each indicator of learning to develop a definition, criteria and keywords to look out for in the transcripts from the data. The analytical frameworks were useful for then examining examples from the participant observation sessions.

The categories for analysis were formed for academic and participant interactions based on reading of relevant literature (for example, Medley & Mitzel's, 1963 study on applying systematic observation to classroom interactions) in an attempt to understand the learning dynamics between them in the classroom PBL group setting. *Academic interactions* used two indicators of learning, *indirect* and *direct tutor influence*. The tutor's indirect influence on the blended PBL tutorial can be evidenced by them accepting and building upon the tone of the participants in a non-threatening manner (their tone may be positive or negative); praising or encouraging participant action or behaviour; using humour to release tension; positive body language (in the face-to-face tutorials only) or developmental comments. The tutor's direct influence on the blended PBL tutorial can be evidenced by them asking a question about content and concepts of the PBL problem or the learning process with the intent that a participant answer; clarifying the participants' queries; or giving facts or opinions about process or giving directions (commands to which a participant is expected to comply). In the online PBL discussion forums, evidence was sought for how often threads were woven by tutors or peers (similar or linked messages or threads); how the tutors quoted text from other messages to build dialogue and to pick up on key messages and provide advice and summaries.

*Peer interactions* used three indicators of learning: *Responsive participant talk*, *Initiative talk of participant* and *Unrequited*. The rationale for this is that the validation of what and how a learner understands is considered to be rooted in communication – critical discourse – when learners are encouraged to challenge, defend and explain their beliefs, evaluate evidence and reasons for these beliefs and to judge arguments. Accordingly this form of learning is a social rather than a solitary process. Responsive talk referred to instances where the tutor initiated the contact or solicited participant statements and the participant responded directly back to the tutor. *Initiative talk of participant* refers to all instances where they initiated the discussion themselves. Unrequited refers to instances of *silence or confusion*, which could include pauses, short periods of silence and periods of confusion in which communication could not be understood by the participant observer.

The use of direct quotes is used in this section to provide evidence of both the shared enthusiasm for the blended PBL process and also some real concerns voiced by the participants. Whenever possible by using the words of the participants themselves, key issues will be highlighted. Pseudonyms were used and for inclusion of all participant quotes, the following applies:

FG = Focus Group Interview (either indicated by 1 or 2 for the first or second interview)

RP = Reflective Paper (numbered 1-17 for each participant)

PO = Participant Observation (the date of each observation is provided)

F2F = face-to-face (abbreviation used in participant quotes)

## Findings

Two interlocking themes are apparent within interactions in the blended PBL tutorials: patterns in the PBL group interactions and techno-pedagogical (Technopedagogy) interactions.

### Patterns in the PBL Group Interactions

Social interaction and cognitive presence in the blended learning environment may be a more complex phenomenon because the participants were engaging in both face-to-face and online communication. The findings show that there were a number of complexities to the interactions in the module and different patterns of interaction between participants in the PBL groups in the blended environment: problem-focused, peer-focused, tutor-focused, group-focused, technology-focused. Tutor, peer and mentor support provided invaluable interactions and opportunities that enabled the participants to achieve transformation in their learning.

Conflict in groups has been researched in face-to-face settings, but the management of virtual conflict is still largely under-researched. The findings in this study have indicated that conflict which occurred early for one group online was the result of lack of communication face-to-face which became magnified in the online environment and caused a degree of conflict amongst group members. The change in communication modality from oral in the face-to-face tutorials to written in the online space, resulted in frustration for some and appreciation of the strengths that each environment can bring:

*Well I must say that I wouldn't have survived on this module without the f2f. I would not have been here at the end of the module as my frustration with the technology did not fully dissipate.*  
(Maeve, FG2)

*I think that the differentiation between f2f and online conversation and discussion is quite enlightening and illustrates the way we as participants in a collaborative problem solving process had moved back and forth between the two as we proceeded through the various stages of the problem.* (Ronan, RP2)

Myers Kelson & Distlehorst (2000, p. 167) have pointed out that common sense and personal experience tell us that “people often find themselves in groups with highly dissimilar individuals or working on problems far removed from individual purposes or expertise.” There were indications of experiencing chaos and upheaval in the early weeks of the module, however, there was a turnaround and this manifested itself in a number of participants taking lead on the direction of the problem after week 3. The creation of ideas within all groups began in week 4 after first 3 weeks of chaos and upheaval.

Messages and reflective entries containing emotional content were commonly initiated by participants in the first three weeks of the module, who described their feelings about the PBL problem, their studies, plans and progress. In specific terms, participants expressed ‘hindering’ emotions of anxiety, worry, frustration, confusion, stress, lack of confidence, a sense of ‘going round in circles’ and feeling stuck. In the early weeks, far less common were expressions of energizing emotions such as excitement about new ideas and being ‘on a roll’.

*There was so much going on in the first few weeks, that it was week 3 for me that the chaos receded a bit. Once we had decided what specific context we were developing the problem in. (Dervla, FG1)*

*I found the first few weeks very confusing and as a result, stressful for me, and I didn't enjoy it. I now find myself very surprised in saying this but I actually enjoyed the module as a whole. I feel this comes from chaos in the learning early on for each individual learning in their own time. Each person was coming to an understanding at different times. (Sorcha, FG2)*

*You are dealing with both the f2f and the online sessions and it is quite hard to go from a PBL tutorial and then go straight into online and start to discuss things as a student; the blended learning approach means one minute you are in class and the next minute you are online and for me it did take 3 weeks moving from one to the other, to get used to it. (Caitlin, FG2)*

The process of learning in PBL groups is interactive, non-sequential, random and often seems chaotic. Savin-Baden (2006) proposes a link between this and the process of learning with technology and draws the same analogy as Brown (2000) that such mirroring of interaction between technology and pedagogy seems to represent a new learning ecology. She takes the concept further by suggesting that it is an ecology that is transforming our online and face-to-face pedagogic identities.

There was an important distinction between proactive and reactive blending, with a shift from reactive blending to proactive blending in the module. The initial excitement and trend internationally was toward putting everything online. However educationalists rapidly discovered that does not work. It is important also to caution that blended learning can simply be a crutch for a poorly designed eLearning solution. An initial reaction was if problems were experienced with eLearning, just blend around it. That has been called reactive blending. The alternative is proactive blending, which means taking into consideration the strengths and weaknesses of technology-mediated learning.

Without blended learning, it may be difficult to overcome technology dissonance in eLearning materials. Well-designed blended PBL settings can provide the forms of teacher support and peer scaffolding that many participants will need to more effectively engage in student-centred and problem-based tasks. A blended learning approach also provides the forms of assistance learners need to overcome any initial difficulties and uncertainty with the technology.

### **Peer Focused**

Within inter-participant interaction, a number of facets were evidenced: peer tutoring, encouragement, sharing resources, personalization of learning experiences (experiential learning), community development, exemplar demonstration and development of virtual practica. Throughout the online discussions, there was ongoing positive acknowledgment of peer contributions:

*Having completed a traditional PBL module (all f2f) and a blended module, the main difference between traditional PBL and online PBL is how and when the participants engage and interact with each other and give each other a pat on the back every time. (Darragh, RP17)*

Peers taking over aspects of the tutoring role were evidenced by adopted weaving and summarizing tasks after week 5 and participants adopted seeking content clarification from each other after week 5.

*Most people were relying on each other after having just done a PBL module and we felt we were able to do it within ourselves. We took a very humane approach with the problem, everyone was patient and tolerant of each other and I thought that was great and people were willing to offer you handouts and good ideas. (Loirin, FG2)*

The transferal of agency and responsibility to each group did result in a radical change in the relationship and interaction between the tutor and the participants.

*There was one incident where one of our group was very nervous online and she posted a query and all six of us responded to support her which was great.*

(Myra, Participant Verification Session, 05/02/07)

### **Group Focused**

The patterns of online interaction in the groups evidenced were: participating (through sharing experiences, providing positive peer feedback, forming ideas, critiquing peers); lurking (online silence, acknowledging presence only, unrequited postings); and researching (sharing resources, individual work). These are all locations of learning that reflect on issues of participation in and control of the learning community. Others that were not analysed were joining and leaving the discussions.

*I was very impressed at the quality of ideas and quantity of work achieved through interactions amongst the group. (Caitlin, FG2)*

*I do think that is what PBL does – it harnesses the strengths of people in a group. Privately each person identifies themselves what they know and what they need to know. They go away themselves and think about that. The end product is an end product of the strengths of the people and not the weaknesses. So therefore, if I am weak on a technical aspect, which I very much would be compared to you Ronan, you have that strength; so that together there is that combination of strengths. (Loirin, FG2)*

### **Technology Focused**

In this study, technology was integral and also supportive of the social processes of learning in PBL and through the enabling power of online asynchronous communication, the participants were able to actively engage in their own learning.

*The f2f elements were essential. I felt the blended approach with the online activities/ tasks, online reflection, video conferencing, people from abroad coming in, all was important. The blended approach visibly promoted collaboration and interaction. (Ronan, FG2)*

*The video conference definitely as a live link was the way to go because you had the faces and you could see who was speaking and who wasn't and I think that is much better than the chat room. (Ryan, FG2)*

*You could not get into too deep a discussion on the chat but you could organize but I mean we would not have survived on the problem without the chat. (Declan, FG2)*

There appeared to be critical discourse amongst peers, evidenced both by online postings seeking critique of each others' individual contributions in the PBL group and quotes from the focus group interviews and reflective papers. Critiquing ideas amongst the participants was an important feature of their group work.

*Honesty has a lot to do with it. I had no problem saying, I do not understand this, have you any ideas, or if you want to change anything that I have put up on that posting, just change it, or what do other people think, will we just leave it out. I don't think anyone was precious about their own work. (Loirin, FG2)*

In two groups, 'The Apprentices' and 'Cyber Club Seven' all members felt comfortable not to post online if they had nothing to say because they knew each other face-to-face first.

*I think you also need to be able to say I can make a mistake without feeling stupid. Anyone can make a mistake. I love coming into the f2f class and Padraig saying he encountered the same online problem the night before, and I feel great, it's not just me, and being confident to admit that to one another. (Loirin, FG2)*

*People can read a posting and accept it yet do not feel like responding "that's great" at that time; it may have been a great contribution, but it is yet another message saying very little of depth but could be important for peer reassurance online. (Maeve, FG2)*

However, the participants' perception of how they were regarded by others and how others actually perceived them resulted in disengagement by some and online dominance by others. In the 2005-06 data set, there was a case of conflicting social identities between for example, Declan and Ryan in the 'Cyber Club Seven' group.

*I was concerned that I may have been perceived as pushing ahead too fast for some others in the group at one stage; so it was really a concern about how I was being perceived online as opposed to my f2f persona, and wondering how the others were going to react.*

(Ryan, Participant Verification Session, 05/02/07)

In the asynchronous learning context, cognitive capabilities were not as present at the same time online as in the f2f PBL tutorial. Evidence from one participant in a face-to-face tutorial is presented along with an online posting from the same week to illustrate this point.

**Message no. 670** [Branch from no. 669]

Posted by **Sorcha** on Sunday, January 16, 2005 8:25pm

**Subject: Re: Role of the Learner**

I think that we need to structure the content of the module better and we need this at this time.

There are things to explore in relation to assessment and the role of the teacher but because of the short time involved til the 18th jan. at times I feel a bit overwhelmed by what we have to achieve by then and I think a bit of structure will begin to clarify things a bit.

*From my understanding now, the teacher can be more socially present early on by coaching, mentoring and helping the student get through their learning. But thereafter it becomes almost like one-to-one or group or peer learning, and I quite like that. I also liked how we are now looking at assessment holistically, in that we are bringing in both formative and summative sides. (Sorcha, PO, 18/01/05)*

Articulateness and ability to synthesise information online was generally not as forthcoming as the literature on e-learning would suggest. The difference in expressiveness of ideas online in this study contrasts with the research by Ranno et al. (2005) who found that students in their blended course reported positive benefits of online discussion in terms of coherence of discussion reached compared to the face-to-face setting. Similarly, in a study based on a technology course for teacher development, Yeotis (2005) reported that each time participants contributed to the online discussion their responses showed a more fluent understanding of the content area.

All three of the PBL groups successfully produced a collective end product of their work on the module, however only two of the groups worked harmoniously ('The Apprentices' and 'Cyber Club Seven'); the third group exhibited anxiety and division and required extra resources from its members in order to sustain itself and produce its collective end product. Anxiety became a major focus for this group, which had the effect of diverting it from effective collaborative working. The findings show that the place of emotion can be central to the effective work of PBL groups in a blended environment. The difference between these groups with respect to this theme and categories is used as a point of departure in order to show how an understanding of the dynamics of blended PBL groups may be of benefit to teachers and students working in this new environment.

Questions 11 and 12 in the second focus group interview related to participants' preferred technologies on offer in the module. They were asked to distinguish the blended media for the module delivery that made a positive impact on them or hindered their learning where tools included video conferencing, asynchronous discussions, synchronous chat sessions, online reflective journalling, podcasting and face-to-face PBL tutorials. Table 3 show findings where participants expressed their favourite three media experienced on the module.

Tools	Group 1: The Apprentices	Group 2: CPD Challengers	Group 3: Cyber Club Seven
Video Conferencing	2	4	3
Discussion Boards	3	3	4
Chat rooms	1	1	3
Online Reflective Journals	5	4	4
Podcasting	0	0	3
Face-to-face PBL Tutorials	4	3	4

Table 3 Preference for Technologies in Blended PBL

Participants had strong feelings about their encounters of the different media blended on the module. The asynchronous discussion forums were seen as positive for supporting reflection but causing frustration in how peers used the threaded discussion structure and yielded information overload. In three instances only, podcasting was seen as more robust than video conferencing and the use of online reflective journals resulted in almost universal support and praise. The synchronous media in the form of video conferencing and chat rooms generated a mixed response on impact and perceived usefulness for practice. The face-to-face PBL tutorial emerged strongly in all groups as a delivery preference for learning.

### Technopedagogy

The medium of video conferencing was received very positively, evidenced both in the participant observation sessions and the reflective papers; when this was explored further through the focus group interviews, it was revealed that it was what the medium was used for that made the biggest single impact on the module: the opportunity to dialogue with a range of international experts.

*The video conference link with the guest tutor from the University of Tampere in Finland was the highlight of the module for me and I believe a marvelous opportunity for the whole group; we had all heard of this technology for teaching before, but no-one had actually taught themselves or had learned previously in this way. (Declan, RP15)*

*Being in a blended community of like-minded individuals was a positive and exciting experience – especially having guest professionals. Experiencing live video conferencing, podcasting and blended PBL tutorials have left me with a great sense of achievement as a learner. (Myra, RP13)*

*It was wonderful to be able to communicate with such knowledgeable academics from halfway round the world. (Caitlin, FG2)*

Bringing internationality into the groups, to discuss the variety of ways of using different media in education, proved highly influential to broadening perspectives for the participants on the module. A preference was established among the participants on the module for live (PBL tutorial and video conferencing) over the computer-mediated (asynchronous and synchronous) components of a blended PBL experience. Any instructional strategy can be supported by a number of contrasting technologies (old and new, low and high tech), but for the instructional strategy of PBL, some technologies have proven to be more effective than others in the context of this study.

In exploring the possibilities that technology tools offer for transformative learning, this study has shown that technical confidence in using WebCT had increased participants' empathy with their own potential online students of the future and had increased their understanding of online teaching and learning. A number of common issues also emerged for some of participants: issues regarding technical skills of online tutors and students; concerns about changing time demands resulting from the move to online delivery; and general apprehension about the move to fully online delivery.

Choosing between communication technologies such as email, conferencing, chat or videoconferencing will depend on what is appropriate to a given learning situation. Information retrieval skills will determine whether the tutor makes good use of the easy access to web resources as well as an ability to evaluate the quality of materials held on remote web sites.

In a qualitative study, with data collected through student postings and interview comments, Huber (2005) reported that asynchronous discussions and problem-based learning are generally perceived by students as being satisfactory, are effective in learning course content and enhance transferability of knowledge to the field. The notion of the passive participant or 'lurker', to use the web-based vernacular, was raised in the findings but increasingly the term itself is becoming outmoded along with any justification for its presence in an online discussion. Savage (2007) has presented it as ROP (Read Only Participant) and Wenger (1998) suggests that lurking is legitimate peripheral participation.

One of the challenges of using online technologies to support professional learning through reflective journal writing is the struggle to legitimize informal horizontal dialogue. The development of self-knowledge and situated understanding, using the tools of dialogue and narrative, were unfamiliar forms of professional development to the participants. Valuing and sharing personal reflection for professional learning was initially seen as a potentially threatening form of exposure to the scrutiny of others. In addition, some participants struggled to move away from posting largely descriptive accounts of their learning on the module and it was not until the introduction of reflective prompts and a structured tutor formative feedback session half way through the module that they began to engage in critical reflection on the blended activities and their broader purpose and context.

Similarly with posting reflective writing on the asynchronous discussion forums, the participants' initial mistrust of perceived public spaces initially presented a barrier to participation for some and influenced the focus and form of discussions. Such online spaces have the potential to offer a disembodied yet sheltered environment within which to assert, explore, question and reformulate responses to professional practice problems. However, technological literacy and a readiness to reflect, enquire and change requires considerable levels of support and time, rather than speedy obligation. The length of time to foster a non-threatening and supportive community should not be under-estimated. If one is aiming for regular and autonomous sharing of ideas and reflective responses, it will take longer than the time available on this current module.

The technology facilitated a burgeoning network within the module and beyond with the international guest tutors and this is potentially a positive force for change in practice. The participants themselves believe that digital technologies will progressively extend opportunities to engage in collaborative reflective PBL practice across disciplines:

*For me the video conferencing sessions on the module with the international guest tutor were key activating events; that along with the asynchronous interactions with the Australian tutors. We had things in common with them as fellow educators and they got us to consider big issues as their postings were very deep. We continued to liaise with them for weeks after the module closed and the Australian tutors invited us to participate in their own online courses with fellow teachers from there.*

(Ronan, Participant Verification Session 08/02/07)

Both Somekh (2004) and Webb & Cox (2004) concur that the underlying issue appears to be the same as in the past, namely that in addition to surface level technical issues that need to be overcome, the potential that new technologies afford will only be realised by deep changes to pedagogy, in which ICT is not simply bolted on to existing practices but is used as part of new ways of teaching and of learning. Video conferencing, especially if it takes the form of online desktop conferencing has the potential for affording new ways of learning as it provides a way of widening students' access to learners from different cultural backgrounds and organisations in other countries (Abbott et al., 2005; Martin 2005).

A participant may feel uncomfortable if (s)he is clumsy with handling the technology in the presence of peers. Taylor & Evans (1996) have characterised this as the ‘untechnologised’ lecturer in the literature on learning and teaching with ICT. With initial experiences with new technology, many participants become overly focused on handling it, and cannot at the same time also think about their learning (Collis & Moonen, 2001). Technical difficulties with equipment, including the video conferencing facility and the difficulties of relying on time- and place-dependent media like videoconferencing, invariably requires that technical support be available. However, the participants in this study felt positive about the experience once they overcame their initial concerns about the technology-mediated environment.

## Significance of the Study

McShane (2006) has called for further research into academics’ perceptions of what it is to teach in a student-centred manner in a blended environment. Similarly, Lycke *et al.* (2002) advocate in their ongoing project on PBL and ICTs in Norwegian higher education that up-close studies are needed to answer vital questions such as how academic teachers can promote effective eLearning strategies among their students. This current study fills these gaps and contributes to the converging fields of blended PBL and academic development.

Specific aspects of interaction (technical, peers, content and the learning experience) within blended problem-based learning tutorials have not previously been analysed to any meaningful degree. The findings in this study can be regarded as a response to changes required in higher education today. It is believed that blended learning has emerged in response to the global and educational changes experienced by HEIs. Arguably it has also emerged as an alternative to fully online programmes. As a result, research continually calls for an emphasis on pedagogy to drive the design of blended courses today.

To see the inadequacies of short term workshops as a model of professional development, one has to realize that they often focus on general topics rather than deep knowledge of the subject matter and pedagogy, are inattentive to teachers’ individual interests, are disconnected from specific classroom practices and isolated from ongoing support by academic developers and colleagues. Such formal professional development activities are often the antithesis of what is known to promote effective learning. To counter this, an intensive, yet flexible module such as in this study is offered as an effective way for academic staff to experience, discuss and reflect on issues related to PBL and eLearning in a blended environment. It is suggested here that the need to encourage engagement amongst teachers with regard to their eLearning and pedagogical professional development opportunities has never been greater. This could thereby enable them to relate their understanding and practice to appropriate educational principles and key institutional policies.

## Conclusion

In general terms, Dewey (1938, pp. 44-45) had anticipated the importance of interaction when measuring ‘*the educational significance and value of an experience*’. This paper has suggested that the benefits of interaction in the PBL tutorial are achieved through small-group work. The literature widely mentions a communicative approach and cooperative and collaborative learning as methods that encourage an active and constructive learning and enhance the learner’s autonomy, self-esteem and intrinsic motivation to learn. Collaborative learning here is based on knowledge building that is possible thanks to the opportunities the participants have for real communication between themselves and the tutors in blended PBL.

A naturalistic, interpretative, qualitative approach was used to analyse the data collected for this study. The open-ended, exploratory, qualitative approach taken in this present study can help document how learners in real PBL situations and contexts, addressing both broad themes and micro-issues helps us understand the complexity of learning and teaching in blended PBL environments and offers insights that can be useful in developing our practice as academic developers. As a research approach, it has presented a series of “slice-of-life” episodes during the blended PBL tutorial process and afterwards, revealing the range of applications and use of the knowledge in professional teaching practice. Through highlighting what the selection of teachers

understand of their own learning knowledge bases and how they interact together, the study contributes knowledge which is particularly useful in helping us understand what happens in a blended PBL group.

A number of patterns emerged in the PBL groups' blended interactions, including a chaotic first three weeks where great upheaval was experienced in the blended environment, followed by a more united collaborative working environment. Academic interactions were focused on a number of indicators of learning: the PBL Problem, peer interactions, interactions within the group and engagement with the technology.

The programme on offer to teachers still needs to be integrated with various levels and types of expert and peer practitioner support at faculty and institutional levels, provided both through online and face-to-face encounters. In this way, translating professional development experiences from the module into the lecturers' own environments could become easier, allowing them to work effectively within a blended environment in the future.

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