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Embedding Interaction within a Blend of Learner Centric Pedagogy and Technology

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Abstract

This paper explores the concept and practice of interaction within a blended problem-based and eLearning module for academic professional development in higher education. A qualitative study spanning two years of the lived experiences of 17 academic staff in a module entitled 'Designing eLearning' was considered likely to provide a much-needed analysis of current thinking and practice on the potential of interaction. Relevant constructivist theories are applied to face-to-face problem-based learning (PBL) tutorials, online discussions, focus group interviews and reflective papers. For designers and tutors in blended PBL, it is important to seek best practices for how to combine instructional strategies in classroom and computer-mediated environments that take advantage of the strengths of each and avoid their weaknesses. Specific aspects of interaction (technical, peer, content and the learning experience) within blended PBL tutorials are explored to provide research-based information about the realities of delivering a PBL module using a variety of relevant and authentic learning technologies.

Keywords

computer-mediated communication; cooperative/collaborative learning; interactive learning environments; learning communities; pedagogical issues

1. INTRODUCTION

Interaction has been and continues to be one of the most hotly debated constructs in the realms of e-learning, instructional design and academic development. The ability to interact - with tutors, students, content interfaces, features, code, channels and environments - can be argued to be analogous to being connected. Whilst this may appear simplistic, for technology-mediated learning, Wagner (2005) argues that interaction is undoubtedly a key value proposition and 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 a blend of online and face-to-face environments based on the principles of PBL. Specific aspects of interaction (technical, peers, content and the learning experience) within blended problem-based learning tutorials have not previously been analyzed within a framework of learner centric pedagogy to the best knowledge of the author. At the heart of this study is cognizance of the need

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for strong and effective interaction between pedagogy and technology to ensure that both are used to the best effect in implementing PBL in a virtual environment.

The paper begins with a discussion of interesting studies into interaction within the realms of learning and instruction. Theoretical considerations are then acknowledged and thereafter the case for the role of learning technologies in utilizing interaction is highlighted. A detailed description of the study into interaction within blended PBL is then provided.

1.1. Researching Interaction in Blended Learning Environments

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 (Černá, 2009). Wagner (2006) contends that there are two commonly held beliefs about interaction. 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 found to be somewhat limiting and 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. Moore's earlier research on interactions (1989) have been extended by Wagner (2006) in terms of four dimensions: transactions (interpersonal, academic, collaborative), outcomes, social presence and experience.

Each of the four dimensions of interaction provides 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, 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.

Table 1. Blended Learning Interactions Central to this Study

Variable	Attributes	Function	Contribution of the Study: Theory into Practice
Interactions as transactions	Learner collaboration	is the degree and quality of engagement with others	- Creation and sharing of ideas - Critiquing ideas - Deciding and agreeing to collaborate on an issue
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 opinions or beliefs of others	Teaching others in the group
	Interaction for negotiation	Involves the willingness of another individual to engage in a dialogue, come to consensus or agree to conform to terms of an agreement	- Initiate dialogue with peers or the tutor - Dialogue on how they will agree on an issue
	Interaction for teambuilding	This is necessary to ensure that individual members of a team/group actively support the goals of the group	- Recognition and acceptance of individual differences - Expression of respect for the group as well as for its members - Effective listening - Shared sense of responsibility - Confirmation of expectations within the group

Interactivity is the core of learning, and is evident at all levels of engagement (Juwah, 2006). 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 interactions and student-to-subject-matter interactions for various uses of computer technology. Knowlton (2005) argues that there seems to be much evidence 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. According to Vygotsky's (1978) social development theory, learning does not happen in isolation. A number of respected scholars including Ramsden (1988), Garrison (1990), Entwistle & Entwistle (1991) and Wagner (1994) have reported that increased levels of interaction have been shown to increase motivation, positive attitudes toward learning, higher satisfaction with instruction, deeper, more meaningful learning and higher achievement. Owsten et al. (2006, p.339) believe "sustained interaction between and amongst tutor and students leading to knowledge construction and validation requires an opportunity to share and test ideas in a secure environment and with a manageable number of students".

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 or how to use these tools effectively (Prince-Cohen, 2005). To further confound the situation, the use of interactive technologies alone does not ensure meaningful interactions will occur in a blended course. Angeli (2006) believes all decisions regarding types of interaction in a blended course should be driven by pedagogical principles and grounded in research.

The core characteristics of e-learning have been reported as: the provision of an authentic context for learning (Herrington et al., 2003); a flexible and useable knowledge-base; its multiplicative communication properties (asynchronous interaction and dynamic control of time and space); multi-dimensional forms of communication and interaction (simultaneous intimacy and distance, multi-representational, hyper-searchable) (Garrison & Anderson, 2003).

It can be argued that interaction is the glue that holds all these pieces together. It comes in many forms, not just learner and tutor, but also learner-to-content, learner-to-learner and learner-to-infrastructure. 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.

Graham (2006) offers up six major issues which are relevant to designing any form of blended learning systems: the role of learner choice and self-regulation, models for support and training, finding a balance between innovation and production, cultural adaptation and dealing with the digital divide and significantly for this current study, the role of live interaction. 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).

2. THE BLENDED PBL MODULE

The focus of the research reported here is a postgraduate programme in higher education learning and teaching which was developed in 2001, and has over 100 graduates today. The 'Designing e-learning' module at the heart of this study is one of a number of ten week modules which carry ten ECTS (European Credit Transfer and Accumulation System) credits. The 17 participants on the module in this study were all either lecturers or educational support staff teaching in varied subject disciplines in higher education. The sample for this study was the total population (17 participants) of blended PBL groups undertaking the PBL module over a two year period. Data was collected in order to explore the lived experience of a heterogeneous population of academic staff in higher education; there were three PBL groups in this study, and all participants completed the module in ten weeks.

The PBL approach in the module at the centre of this study can be summarized as including stages of problem identification, deconstruction, seeking and using knowledge and experience, understanding, thinking, choosing a strategy, acting and then critically evaluating and reflecting on the action. WebCT was used to deliver the online asynchronous and synchronous interaction in the module.

Although there are many variations of PBL that have evolved during its lifetime, a number of core characteristics prevail, which are the essence of the PBL context for this study: student-centred learning occurs in small groups; the teacher acts as facilitator; problems form the organising focus and stimulus for learning and are the vehicle for the development of problem-solving and reasoning skills; and new information is acquired through self-directed learning (Barrows, 1988).

PBL was used in this module because it was identified as a means to facilitate an inter-professional, collaborative approach to working. It was used to bring together participants from

different disciplines and professional backgrounds to work together on solving a particular e-learning design problem which required a range of different professional perspectives. The participants also had an interest in learning more about the pedagogical principles of PBL and indeed Hendry (2009) argues that the most effective way to help teachers become better PBL tutors may be to require their participation in a systematic program of academic development. This study will add to the growing literature in the field as Savin-Baden & Wilkie (2006) have previously discussed the lack of studies of PBL in the field of academic development.

There have been a growing number of useful studies in the PBL online settings literature that informed this present study. A study by ChanLin & Chan (2007) reported on the use of an electronic forum facility to provide support for PBL. Bach et al. (2007) submit that PBL would seem particularly well suited to a blended approach where groups meet initially in a face-to-face setting, to establish social rapport and then move to online contact, such as ongoing asynchronous discussion where they explore the problem and share developing insights and the finding of new, related information.

There appears to be assorted support in the literature for the use of such forms of asynchronous communication for PBL. Some studies, such as Portimojärvi & Vuoskoski (2006) argue strongly from their research-base that online synchronous media best support the group-intensive, spontaneous nature of PBL. This view is shared by Savin-Badin (2006) as she posits that synchronous collaboration tools are vital for the effective use of PBL online because tools such as chat, shared whiteboards, video conferencing and group browsing are central to ensuring collaboration within the PBL group. In contrast, other studies such as Lim (2005) contain some intriguing insights for this study. Supporting the idea of using discussion forums to support PBL in the context of legal education, Lim judges that they have potential to enhance collaboration. This view is supported more widely by Yip (2002), Juwah (2005) and Kaldoudi et al. (2008).

Figure 1 shows the blended PBL model of academic development proposed in this study. Colour is used to show at a glance those components that are face-to-face (outlined in green), those that are fully online (outlined in blue) and the blended components (outlined in purple). The WebCT courseware management system is highlighted in grey. The discourse in the PBL tutorial is supported with activities such as guided reflection, guest seminars, demonstrations of the technologies and peer evaluation. The online components of the blend include some course management standard features such as student homepages, online timetables and a set of personal individual progress statistics. These are augmented by virtual PBL tutorials which encompass online activities such as discussions, presentations, formative assessments and delivered using a set of tools such as video conferencing, podcasting, discussion forums, chat rooms and interactive tutorials.

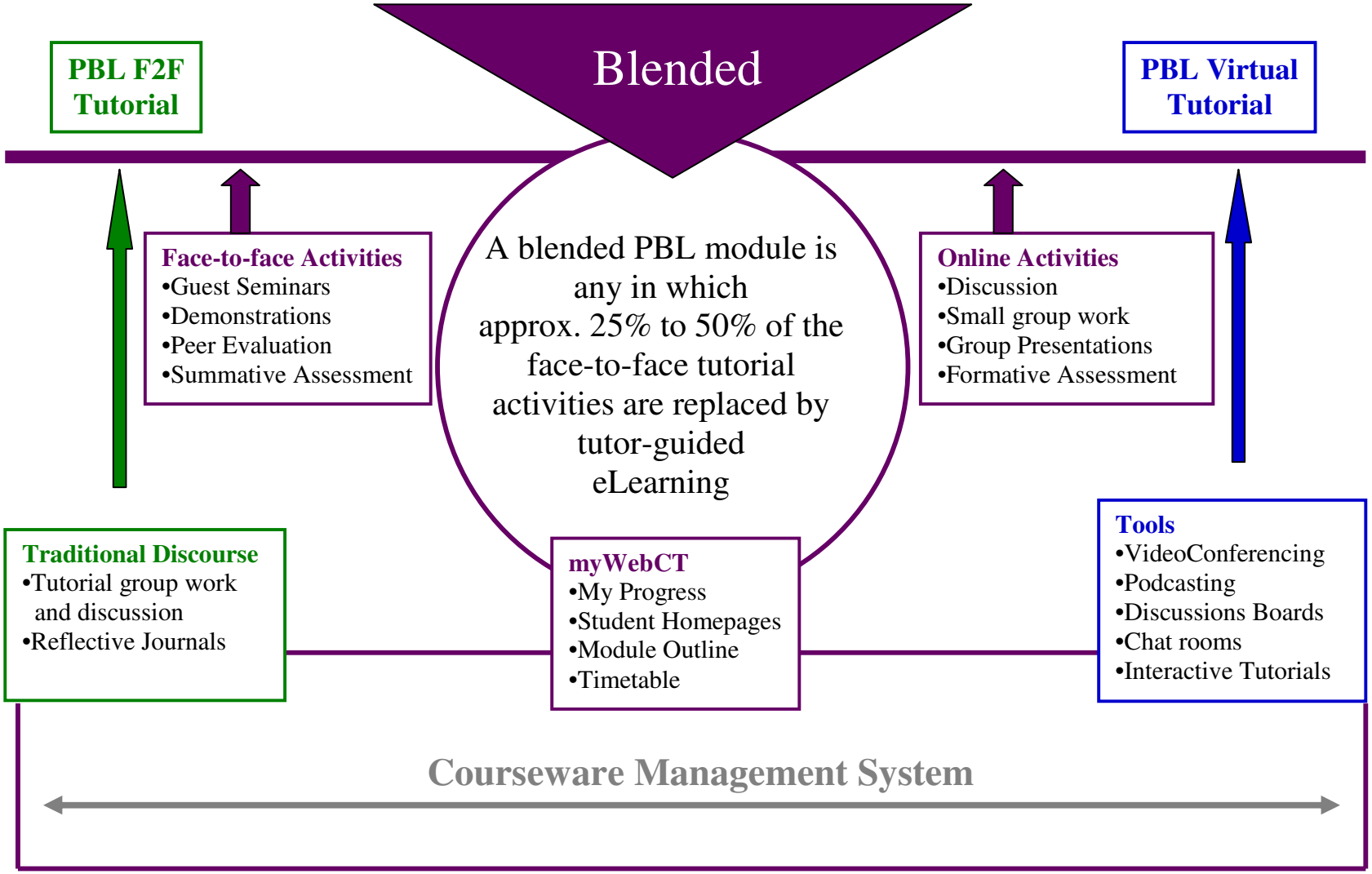

Figure 1. The Blended PBL Module

Whilst there is no specific recipe for mixing up the ingredients of the blend of problem-based learning adopted, with the amount of face-to-face, synchronous and self-directed work being prescribed by the learning outcomes of the module itself, Table 2 provides a breakdown of the activities in the blended PBL module and estimated time for completion of each activity.

Table 2. Activities in the Blended PBL Module

Features of a Blended PBL Environment	Duration of Activity
Face-to-face PBL tutorials	10 x 3 hours
Between tutorials: researching, reading, planning, designing ideas	Over 10 weeks
Online reflective journal entries	1 per week x 10 weeks
Video conferencing session	3 x 1 hours
Asynchronous discussions	5 per week x 10 weeks
Synchronous chat sessions	10 x 30-60 mins
International guest tutor collaboration	3 x 1 week

3. METHODS

A naturalistic, interpretative, qualitative approach was used in this study. The open-ended, exploratory approach taken 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.

Table 3 shows the sample for this study was the total population (17 participants) of blended PBL groups undertaking the PBL module in the two years the data was collected in order to explore the lived experience of a heterogeneous population of academic staff in Irish higher education; there were three PBL groups in this study. The sampling method chosen selected participants based on their particular knowledge of the phenomenon being studied and as Streubert and Carpenter (1999) recommend, for the purpose of sharing that knowledge. Acknowledging the existence of potential bias by virtue of this selection process, it is suggested that this bias can be used positively as a tool to facilitate the research. According to Morse (1991) …"an unbiased sample that has been chosen randomly, violates the qualitative principle of obtaining information from experts" (p139). Within a qualitative research sample, size is not a concern as this approach seeks an "informal rich" sample.

Table 3. Sample for the Study

Number	Attribute
17	part-time postgraduate learners in total
9	had competed 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).

Data collection methods employed to collect face-to-face and online observational data from three PBL groups in this two year study 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 an opportunity to explore interactions which were central to this study. 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.

The study was carried out in the PBL tutorial classroom with each group and online in WebCT. Deciding on the location and the setting required consideration of time, space and place, along with thought about gaining access to the setting because data was to be generated from the live discussions amongst the PBL groups. Surprisingly little research focuses on what is happening as group members interact with one another in a small group to complete the PBL learning problem in a live face-to-face setting. Rather than the qualitative data of interviews, reflective questionnaires, or even focus groups, analysis of the discourse itself provides a view of the meaning-making process as it is taking place. This focus on 'real-time' interaction is a notable departure from other forms of qualitative research that rely on a retrospective accounting of experience by participants. This form of inquiry captures the experience of engaging online and face-to-face while it is happening. Ziegler *et al*. (2006) found that confounding this lack of research to guide groups in traditional classrooms is the burgeoning potential for expanding learning groups through the use of technology.

The interview questions were open in nature to invite the participants to be receptive and expansive and were looking for a range of different responses to given situations in blended PBL tutorials; they were designed to invite the participants to make associations between different experiences on face-to-face and online interaction over the ten weeks of the PBL module.

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 WebCT system 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, there was a need to identify key interactional indicators. Therefore, the first analytical framework was formed from a conceptual framework based upon Wagner's (2006) work on interactions in blended learning. Specifically this suggested a range of three interactional learning indicators, which are illustrated in Table 4.

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 virtual learning environments (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. Whilst initially the *environment* was included as an indicator of technical interactions in blended PBL, it was subsequently omitted from the analysis as institutional environment factors were not playing a role within the confines of the module.

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 found 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 very useful for then examining examples from the participant observation sessions. Two examples 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.

Two examples of interactional sequences between participants from the observation of the face-to-face PBL tutorial with the PBL group, 'Cyber Club Seven', are included in this coding scheme to illustrate the application of codes.

Table 4. Coding Scheme for Identification of Three Interaction Types in Blended PBL

	TYPE OF INTERACTIONS									
Category			**TECHNICAL**				**ACADEMIC**		**PEER**	
Indicator	Enumeration	Environment	Effectiveness	Ease of Use	Engagement	Indirect Tutor Influence	Direct Tutor Influence	Responsive	Initiative	Unrequited
Definition	Counting occurrences	Institutional environment factors	Perceived educational effectiveness	Personal ease of use	Sense of Personal Engagement with the Technology	Subliminal tutor role	Conscious tutor role	Responsive talk	Initiative talk	Individual analysis
Criteria	The frequency of contributions of each participant	vision about technology in dept; actual level of technology in dept; readiness to change within dept; incentives available	the technology can: solve personally relevant educational problems; provide new forms of learning experiences; provide support for the existing curriculum	Hardware software	self-confidence with technology; technology fit with current experience	the tutor accepts and builds upon the tone of the participant in a non-threatening manner	tutor's moderating function	participant response to tutor or fellow participant; tutor or participant initiates the contact or solicits participant statement	peers initiate dialogue with each other and the tutor	Explore f2f PBL tutorials and online discussions
Keywords	Postings Threads Repeats Attachments	Vision Reality Change Incentives	Personally Relevant; New Experiences; Supporting curriculum	User-friendliness Accessibility Availability	Confidence Self-efficacy Connected	Affirming Positive Negative	Weave Advice Examples Summaries Questioning Clarification Facts Opinions Directions	Replying Answering	Involves the creation of ideas, critiques, collaboration and communication	In f2f tutorials: silence or confusion; pauses Online: Postings not acknowledged or responded to by peers

	TYPE OF INTERACTIONS								
Category			**TECHNICAL**				**ACADEMIC**		**PEER**	
Myra			I suppose we could go online to talk about this, but I just like this, doing it face-to-face.					Declan I think the other aspect that we were going to try to look at is e-learning pedagogy and where it is useful. What part of the key skills learning would be more effective online? We need to use those ideas, and ascertain that everyone here is 100% sure that this can be applied with their own students.	We have everyone here in the tutorial now. I feel we nearly have it, I know it can be flushed out here rather than waiting til later to go online.	
Declan			That is a very good point; we can save ourselves a lot of time if we have some conversations online after the f2f tutorial.		Well Myra, I think its important that the students know how to put up a web page, as well as design a learning object. We need to consider that IT skills are inherent in this.			Yes, for the models we should explore, if we are going with this idea, then social constructivism working in groups/pairs is key and then constructivist tasks that the students are assigned and interact with and be engaged.		

The subjective, partial and open-ended nature of the interpretation of the blended PBL participants' discussions is acknowledged and that it was the author, not the participants who interpreted the data of the discussions (even though they participated in participant verification sessions). The findings were interpreted in the light of blended PBL and interaction literature. It is also acknowledged that other interpretations of the data are possible. Morse et al. (2002) have made a valid point in relation to this study in that as a qualitative researcher, it is important to reclaim responsibility for reliability and validity by implementing verification strategies integral and self-correcting during the conduct of inquiry itself. Cutcliffe & McKenna (1999) also put forth a compelling argument for this position and encourage researchers to return to the participants to attempt to gain verification. Any findings that were not recognised by the participants were identified and if disagreements existed, these were reported.

A two hour participant verification session was held with two of the three groups in this study on 5th and 8th February 2007 respectively; the majority of participants attended, and both were audiotaped. The participant verification sessions were held to check, confirm and be certain about the findings from the study.

4. RESULTS

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. 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)

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

4.1. 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: peer-focused, tutor-focused, and 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."

4.1.1. 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)

4.1.2. Tutor Focused

A number of facets were evidenced with interactions between participants and the tutors: (provision of technical assistance, ideas, questions, dealing with disappointment, provision of encouragement, making comparisons/similarities/threads and the stimulating role of the interaction with the international guest tutors):

It would be very difficult to quantify the tutor's input over the entire module because it is not just about the time online responding to messages, it is all the preparation prior to that. In actual fact, the role never leaves you, You are all the time aware of the need to be thinking about it. From my perspective, the first 5 weeks for the tutor seemed very intensive, but since 18th January, you seem to have been happier to stand back somewhat. (Sorcha, FG2)

Another major aspect in a blended situation is the role of the tutor f2f and the eModerator and the main thing is knowing when you feel the group have attained enough confidence and have bonded sufficiently within themselves to step back. (Darragh, FG2)

4.1.3. 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 some of the literature on e-learning (Ikpa (2004); Smart & Cappel, 2006) 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 5 show findings where participants expressed their favourite three media experienced on the module.

Table 5. Preference for Technologies in Blended PBL

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

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.

4.2.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 though 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 though 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 et al. (1996) have characterised this as the 'untechnologised' lecturer in 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.

Studies have been conducted such as that by King (2003) which has shown that asynchronous CMC can provide instructional benefit to programmes that are interested in transformational learning. However, other research by Lepage & Robinson (2005) like this current study, wish to go beyond how learning technology itself can be transformative in order to give a new perspective on goals, what we do in our practice, and how we think about our work.

5. CONCLUSION

In general terms, Dewey (1938, 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 has suggested a communicative approach and co-operative 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.

Factors governing the success of the blended PBL tutorial involved the cognitive depth achieved in online and face-to-face discussions and reaching a balance of depth that could be transferred from the traditional face-to-face tutorial to an online environment and vice versa. 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, exchanges with the tutor (whereby the online presence of the tutor was evident in many ways, particularly the 'model-coach-fade' role), interactions within the group and engagement with the technology.

The nature of the blend involved distinguishing what worked best in the face-to-face and online environments. It was important to utilize time spent online for organising work for the f2f tutorial and as a source of positive peer feedback. Conversely, the face-to-face tutorial was useful for clarifying any misunderstandings which took place online.

The main findings of the analysis of the data indicated that there was a preference for live tools in the blending of PBL and eLearning, specifically the face-to-face PBL tutorial. Of the online tools utilized in the module, the online reflective journals were the most favoured. For all three groups, at the close of the ten week module, the cognitive postings were significantly higher than the community postings. However, the technology also acted as an opportunity to enhance community building in the PBL groups and extend the collaborative dialogue from the face-to-face PBL tutorials. 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, evidenced by the fact that the most prolonged online interactions over all three groups were with the international guest tutor discussions.

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