Blended problem-based learning for widening participation: a case study

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Abstract

This paper discusses some issues involved in a model of delivery adopted for widening participation at outreach centres for Liverpool Hope University and explores the rationale for using blended Problem-based learning (PBL) as a means of addressing the issues and improving learning.

A number of principles are proposed for the effective use of blended PBL and the paper analyses a case study, explaining the design and organisation of the module, together with the research methodology adopted. It provides some initial guidelines for other practitioners who wish to pursue similar activities.

Institutional Context

Part of the Widening Participation strategy of Liverpool Hope University is the Network of Hope (NOH). This is a partnership between Liverpool Hope University (LHU) and a number of sixth-form colleges across the North West of England. This partnership offers evening undergraduate programmes of study in locations where there is limited Higher Education provision and has been successfully delivering programmes for a number of years. The programmes are a subset of the full-time courses available at the Liverpool Hope Park campus and students may swap between the two modes of delivery.

However, there are a number of issues relating to the teaching of students in this way: Tuition is confined to evening sessions and consequently the short class contact time available (3 hours) often makes the sessions intense and

more didactic in nature than would be desired. Additionally, the part-time nature of study also often means that the peer support networks that are readily available on a university campus for full-time students are more difficult to develop. Finally there is a resource issue of transporting tutors to and from the Network centres each week, since tuition is provided by full-time LHU academics.

The aim of this project was to evaluate interventions designed to address these issues. Problem-based Learning has been incorporated into several Computing and Business modules at the Hope Park campus for a number of years, and it has been found to be particularly beneficial for promoting self-directed learning. Being team-based it also provides a built-in support network for students. Thus, it appeared to offer a possible means of improving learning and support in the NoH by providing a more student-centred model.

Furthermore, the growth in the availability of e-learning technologies, such as a VLE and the availability of videoconferencing facilities at all campuses suggested that a blended model of PBL may enable us to provide a mix of face-to face and electronic contact that was both efficient and provided appropriate levels of support for students.

This paper outlines the characteristics and claims for PBL and then discusses the principles adopted for the design of the blended model and explains how these were applied to redesign the module. The next section describes the research design and methodology, after which we present the results and discuss the implications of the innovation.

Problem-based Learning

Traditional university teaching typically takes a positivistic philosophical stance which perceives knowledge to be 'out there' and existing independently of the learner. Where knowledge is viewed in this way, learning is perceived as a transfer of knowledge from one person to another conducted in didactic teaching scenarios such as lectures and seminars.

Knowledgeable experts are believed to transmit their understanding to their students, who are habitually seen as empty vessels waiting to be filled with information by the teacher.

Much university teaching and learning can also be seen to be detached from 'real life'. Much of what is taught in universities can appear to be without context and the student may perceive its only use and application is in passing exams or completing prescribed assignment tasks (Entwistle and Entwistle, 1997). PBL provides a forum in which students can practice with 'real life' scenarios, similar to a traditional apprentice in learning a craft before being allowed to act alone.

Ramsden (2004) advocates a theory of teaching in universities which makes learning possible. He encourages a move towards student-centred approaches to learning to enable students to prepare for a complex and ever-changing world. He promotes a move away from traditional 'transmission' modes of education which encourage surface approaches:

> "Surface approaches …………belong to an artificial world of learning, where faithfully reproducing fragments of torpid knowledge to please teachers and pass examinations has replaced understanding" (p. 59)

PBL is in line with instructional principles originating from constructivism. Schmidt (1995) claims that 'learning …. (as) essentially an act of cognitive construction on the part of the learner is well implemented in problem-based learning.' (p.248) In constructivist learning theory, knowledge is understood as a social construction, created by each learner as they endeavor to make sense of their world. This conception of learning is therefore opposed to traditional models and requires a different approach if learning is to be affected. Belief in a socially constructed view of knowledge demands that students are active in their learning: they are not inert 'vessels' waiting to be filled with information but instead involved in creating and structuring their own learning. PBL therefore promotes sense-making over content-accumulation. This is the basis on which PBL is built – that students generate their own knowledge and ways in which they view the world, by dynamic involvement

with real life problems and dealing with the difficulties these problems and their solutions generate.

PBL has been the focus of many developments in teaching and learning in higher education in recent years and a body of knowledge has been established on which various claims have been made for its effectiveness. (Boud & Feletti, 1997; Savin-Baden,. 2000; Newman, 2003; Owens & Luck, 2003; Uden & Beaumont, 2006). PBL aims to produce independent learners who are motivated, engaged in deep learning, work as part of a team, and develop effective strategies, skills and knowledge for life-long learning and professional work. Biggs (1999) also cites PBL as a good example of aligned teaching.

The construction of new knowledge requires collaboration with others and PBL relies heavily upon group work. Johnson and Johnson (1993) illustrated that cooperative learning experiences encourage higher achievement than their competitive or individualistic counterparts. This work also indicates that cooperation on mutual projects may promote the development of higher order levels of thinking, essential communication skills, improved motivation, positive self- esteem, social awareness and tolerance for individual differences. These characteristics are also associated with 'employability'- a term that has received considerable attention recently. PBL provides a rich and complex learning environment, which provides considerable opportunity for students to develop employability characteristics. (Beaumont and Frank, 2003).

In addition to improving learning, the authors believe that the process skills and teamwork developed by PBL can promote the development of peer support groups and develop self-efficacy and independent learning skills which can make them much less dependent on class contact. This is particularly important where class contact time is relatively short. Manchester

University's Engineering department also reported improved retention rates when introducing PBL.1

The second part of the intervention is to incorporate blended learning into the programme. We envisage reduced face to face tutor-student contact, replacing the support by a variety of synchronous and asynchronous ICT tools: principally Virtual Learning Environment (VLE) and ISDN videoconferencing. It has recently been shown that a rich ICT environment involving both synchronous and asynchronous tools can effectively support distributed PBL students (Beaumont & Chew, 2006).

However, the online environment needs careful consideration if it is to work effectively. Generic e-learning principles need to be considered, such as the 5-stage framework that Salmon (2006) advocates in order to provide suitable scaffolding to enable participants to develop appropriate e-learning skills.

Problem-based learning provides additional challenges and online environments have been developed specifically for PBL. For example POLARIS (Ronteltap, 2006) which aims to provide support for PBL based on principles of situated and self-directed learning and eSTEP (Hmelo-Silver et al, 2006). In the latter chapter, the authors describe and evaluate the use of eSTEP, an online PBL environment which incorporates resources (a Hypertext book), a library of videocases and a set of tools. The tools included personal notebook, threaded discussion and a whiteboard. Facilitation and communication were asynchronous. Initial evaluation showed 80% of students disliked the online environment more than any other class activity and students cited the communication tools as barriers rather than enablers. Indeed, students created their own online synchronous chat outside of the system. Hmelo-Silver raises pertinent points regarding asynchronous facilitation of PBL: The process occurs at a much slower rate, (which affords more time for reflection if used in that way) but some students regard the tutor role as policing 'what they were doing' rather than facilitating, and students were also able to ignore facilitator comments easily. The adoption of the

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[1] Personal Communication

blended approach, together with synchronous tools was seen as a way of mitigating these potential difficulties.

Development of specific tools can indeed align the technology closely to the pedagogy, but this is fraught with difficulties in two areas. Firstly, as Hmelo-Silver illustrates, students do not necessarily use the technology in the way that the designers envisaged and consequently tools may be inappropriate. Secondly, technology is developing at such a rapid rate that it is difficult to provide an environment that incorporates leading-edge tools: for example, if the interface of a synchronous chat facility in a VLE is perceived as less usable than a commercial alternative (such as Windows Messenger) or one with which they are already familiar, then students will not use the VLE. Consequently, a range of tools was provided and students were allowed to select the most appropriate.

Thus, the aim is to design and evaluate a resource-efficient blended learning distributed PBL model that can be applied to improve the quality of learning, and provide effective peer support systems. This would enable higher education provision to be taken to students who would otherwise not be engaged.

The Blended PBL Model

Principles:

The blended model was devised for the presentation of a final-year 15-credit module throughout a single semester (Jan-May 2005). The design was based on principles based on the authors' experience and research. The detailed schedule of activities is included in Appendix 1.

Although the students were in their final year, and were therefore familiar with the existing system, this new approach still constituted a very significant change to the learning model: none of the students had previously experienced PBL and they had relatively little experience of e-learning. Thus,

we regarded it as essential to prepare students for the change and the blended approach provided a suitable scaffolding process.

There are numerous, well-documented issues for participants working in virtual teams, such as trust, communications, co-ordination, task-technology structure fit (Powell et al, 2004) and the importance of making accommodation for the differences (Lipnack, & Stamps,2000). There are additional issues involved for online PBL facilitators where the absence of non-verbal cues makes it more difficult to effectively determine appropriate dialogue moves. The blended approach was judged to reduce these issues (reducing risk of failure); while maintaining quality of learning and attaining some efficiencies and cost reduction. Video conferencing also provided benefits by enabling participants to detect non-verbal reactions.

Principle 1: Preparation and Induction

Students were familiar with the use of the VLE (LearnWise) but had no prior experience of videoconferencing or PBL. However, the students were in their final year of study and already had several years experience of study in higher education. We therefore planned an initial induction session which provided activities to orientate the students to PBL and videoconferencing.

Principle 2: Provide a rich set of communication tools.

Effective communication is critical. Beaumont & Chew (2006) showed that it is important to provide a range of tools which enable effective communication in a way that students prefer. By adopting this logic of affordances, rather than a logic of control (Boud, 2004), barriers to collaboration are reduced.

These comprised of: LearnWise VLE which incorporated asynchronous forums, synchronous instant messaging (IM) and email, together with regular videoconferences. Webcams were not used because of quality problems associated with bandwidth and technical issues associated with university and college firewalls. These facilities enabled students to select the most appropriate methods to share documents and meet online.

Principle 3: Provide a high proportion of Face to Face (F2F) facilitation early in the course

This principle is important in this model, to continue the induction to PBL and support students in 'modelling' the PBL process. It was also seen as a means of developing effective student-tutor relationships and avoiding the perception of the tutor's role as policing student activity.

Principle 4: The final reporting and reflection sessions of a PBL case should be F2F

F2F sessions were scheduled at the conclusion of all PBL cases where students report and present their solutions.   In this module, students produced, demonstrated and presented database applications as part of the assessment. A F2F session enabled exploration of the demonstrated application, and questioning of students more easily than through videoconferencing.

Principle 5: Gradually increase facilitation via videoconference throughout the semester

This principle is aligned with transferring responsibility gradually to students, as they became more independent and interdependent.   In our planning phase we had assumed that the videoconference facilitation would be similar to F2F, though the interaction model was one to many rather than a facilitator being part of the group.   In practice the sessions were perceived very differently by students. Withdrawing F2F face sessions and replacement with videoconferencing was seen as one of the risk factors in the project; the initial design was based on prior experience and identification of (what was regarded) as appropriate points in the PBL cases. The effectiveness of these decisions was monitored closely throughout the project through tutor perception and student feedback.

The next section explains how the module was redesigned in order to incorporate PBL, and apply the principles outlined above.

Module Redesign

The module selected for the project was chosen on the basis that it had been delivered for a number of years in the NoH and was therefore stable in content and presentation. This enabled a comparison of performance at the trial (PBL) centre with that of students taught traditionally at other centres. The module was part of a joint honours degree programme in Information Technology and was delivered in a traditional manner, using laboratory practical sessions, lectures, coursework assignments, class test and formal examination. It also fitted the timescale for the project. However, as might be expected, there were a number of aspects of the module that needed redesign to make it suitable for PBL. The cognitive learning outcomes and subject-skills were required to remain unchanged, to ensure compatibility with the traditional variant. Since PBL modules place emphasis on the process skills, there is often less emphasis on subject knowledge ('content'). However, in this case the intervention was running in parallel with the traditional variant and there was no option to reduce the subject knowledge content. This would clearly place additional demands on the PBL students.

Assessment Redesign

One of the most significant aspects requiring redesign was the assessment strategy. The traditional design specified in-class tests and individual project, presentation and examination as shown in Table 1:

Component	Start	Finish	Weighting
In Class Test	Week4	Week4	15%
Presentation	Week 6	Week 10	10%
Individual Project	Week 7	Week 13	35%
Examination		May Assessment period	40%

Table 1: Traditional Assessment

This structure of assessment does not align with PBL, and some redesign and 'minor modification' revalidation of the module was required. It was necessary to redesign the module specification to permit either mode of delivery, thus the

coursework assessment specification was generalised and identified possible optional elements. The assessment for the PBL variant was formulated as shown in table 2:

Component	Start	Finish	*Deliverables (graded on)*
Coursework PBL1	Week 1	Week 5	*Presentation of findings and demonstration of application* *Individual Research Handout*
Coursework PBL2	Week 5	Week 7	*Presentation of findings and demonstration of application Individual Research Handout*
Coursework PBL3	Week 8	Week 12	*Team Report* *Demonstration* *Presentation* *Individual Research Handout*
Peer Assessment	Week 12	Week 12	*Weighting 10% of coursework*
Examination	Assessment Period		*Weighting 40% of module*

Table 2: PBL assessment

The coursework in the traditional module addresses the same learning outcomes, and the final examination was maintained for comparability purposes, within the limits of the module revalidation exercise. The form of the final examination was unchanged from the traditional (two short answers and a seen question) format of the module, and not particularly suitable for PBL. Examinations are often considered to divert student attention towards 'learning knowledge for the exam' rather than focus on the deeper approach to solving the PBL scenarios. However, examinations are efficient at identifying individual work, and one approach that has been successfully used in order to satisfy both requirements is to set 'seen' examinations comprising of a short PBL scenario.

PBL Scenarios

The PBL scenarios were of increasing complexity. The first scenario presented students with a partially functioning database application and poor user interface; students had to evaluate this against functional and HCI requirements, understand how it worked, design, develop, document and present improvements. They also had to evaluate other team's solution. This approach of providing an incomplete or buggy application has been used successfully to introduce students to programming in other modules, and stimulates students to investigate the code operation. Exemplars in the form of other applications were also provided. The second PBL scenario extended the first application, adding functionality, requiring macros/ VBA/ SQL coding. The final scenario required students to perform data analysis to produce a 3NF model and implement the application from scratch, based on a specification which incorporated more complex DB design, security and interface requirements.

Learning Schedule Redesign

The learning schedules of the traditional and blended PBL variants are shown in Appendices 1 & 2. The schedule shows the activities and occasions when videoconferences (five occasions for facilitation) were incorporated.

Learning Resources Redesign

PBL requires students to research and solve problems without formal taught input from tutors. There were no lectures. Students were provided with a detailed set of notes covering much of the technical content. These were also available to students in the traditional variant, in conjunction with lectures. PBL students also had access to sample database applications, lists of web sites and other resources on the VLE.

Research Design and Evaluation Methods

The research aims were:

- To improve the quality of students' learning of Computing through blended PBL.

- To evaluate the effectiveness of this model of blended PBL as a methodology for (1)
- To evaluate the effectiveness of the use of blended PBL to support NoH students.

A Participatory Action-research approach (Kemmis & McTaggart, 1988) is appropriate in this setting. The underlying epistemology is Constructivist-Interpretive, since it was the perceptions of all participants that was examined and their various possible interpretations and meanings. Action Research requires a collaborative team approach, and an experienced validation group was recruited to critically review the design, planning, observation and reflection.

An educational intervention is not a simple experiment in which variables can be selected and outcomes monitored in a straightforward way. The context is complex, and consequently data was gathered in a variety of ways to obtain multiple perspectives in some depth and to try and tease out the subtleties of the situation. This approach also provided some element of triangulation.

Data was gathered from:
- Regular tutor meetings to reflect on action and reflective tutor journal. It was envisaged that data collected in this way would provide a record of activity and observations made by researcher-participants.
- VLE postings / chat logs. Data collected from chat and forum logs provided task and process related data from the student-participants. These represented two sources of data for analyzing student use of the technology in completing the tasks. They also provided sources of data to analyse the quality of interaction (e.g. depth of discussion of concepts) and collaboration.
- Individually completed student questionnaires, complemented by video recorded focus groups. The questionnaires were administered after the focus groups in sessions that took place at the start, middle and end of the module, in order to explore any changes in attitude and usage of tools

throughout the module. Additionally on-line, in-depth, interviews (using instant messaging) were conducted at the end of the course. These interviews provided a degree of participant validation, as the researchers explored questionnaire responses in more detail to negotiate meaning. A key objective of the research was to test the effectiveness of ICT to support collaborative work. Hence questionnaires and interviews/ Focus groups (conducted by the validation group) were appropriate methods for gauging learners' attitudes to the technology. The research was primarily qualitative, consequently the richness of the data was important, and the authors have found in the past that a limited number of interviews (around 5) provide a very useful vehicle for achieving insight. Interviews were recorded and partially transcribed.

- Student performance in assessed tasks and retention data was available through the university administration systems. Although this may initially seem not to be aligned with the interpretive approach, it provides another dimension of data for interpretation, rather than being considered in a positivistic way.

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The validation group had an essential role to ensure that claims made for the project outcomes are supported by evidence. It included critical friends who were independent of the project yet had considerable expertise in the area of e-learning and PBL.

Results

This section provides analysis of the data obtained from the questionnaires, focus groups and tutor reflections, together with quantitative data from the assessment results.

There were only six students who registered for this module (divided into two PBL teams), and one of the students was unable to attend classes on many occasions, because of a serious illness. The students were predominantly mature and ages ranged from 21 to 49 years, with a mean of 33 years.

Tutor perceptions

The tutor had previously taught the module in the traditional manner for a number of years and was able to reflect on the engagement and quality of learning displayed by students in comparison with the traditional method of delivery. The tutor perceptions during the module can be summarised as follows:

- There was a high degree of student engagement throughout the module. Attendance and commitment were of a very high level. The tutor perceived this to be higher than comparable classes he had taught.

- The students had worked together in groups over a number of years and had developed good trust relationships, which were confirmed in focus group discussions. Problems that are commonly associated with groups, such as poor participation, did not occur, and the teams performed well throughout the course.

- While induction and preparation of students to the videoconferencing technology and PBL was planned, a number of unforeseen technical difficulties with VLE access and operation of the videoconference system were experienced. Thus, preparation of staff, students & full testing of technology is essential, with contingency plans for technical problems.

- Facilitation of a PBL team through a videoconference is a completely different experience to that in a F2F team. The interactions are focussed on the tutor, who acts more as a mediator and controller rather than as a group facilitator.

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Student Perceptions

The initial questionnaire and focus group was designed to identify prior experience and attitudes to teamwork and technology. The results are summarised below:

Team working and PBL

These particular students displayed a very positive existing attitude to team working: 5/6 agreed or strongly agreed that they enjoyed team working (the other was neutral). The entire class agreed or strongly agreed that team

working improved their learning. Only one student had prior experience of PBL.

In the middle of the course, only two students out of six stated that they enjoyed PBL! Typical comments from the focus group were:
"I don't like it, I'd sooner be taught, I feel less confident than with other methods …. I hate research, it takes so long". (21-year old student)
 "We wasted so much time at the beginning"
"I am unsure of the depth of knowledge needed… in the past we knew exactly what we needed to do.."
"I wish we'd had some prep material ... a basis to build on"

This is not uncommon in students who are new to PBL. Woods identifies a period of 'grieving' and adjustment where performance actually falls for a time. (Woods, 1994).

However, at the end of the semester, all students agreed/ strongly agreed that they enjoyed PBL, comments were much more positive.   An interesting contradiction also arose at this point: most students felt that learning through PBL took longer than the traditional lecture method, yet at the same time they criticised lectures as events when "knowledge went over their heads and they learned nothing".

All students agreed that team working improved their learning.

Use of ICT communication tools
Students initially stated that they had a high degree of confidence in using email and VLE forums. However, there was wide variation in confidence and experience of using Instant Messaging (IM), and videoconferencing. Only two students expressed any experience of videoconferencing, and that was very occasional. The focus group revealed that technical problems had reduced effectiveness of previous videoconference attempts.

Students were asked to identify which tools would be useful, and what purpose they saw them serving. Universally email was regarded as useful, for 'communication'. Students ranked *forums, video conference, instant messaging* and finally *Webcam* in descending order of usefulness. Interestingly, forums were identified as useful *for problem solving, knowledge, interaction* and *notices/ information*.

A notable change took place in patterns of use throughout the semester. Email usage remained high throughout, all students indicating daily use. However, usage of the forums dropped markedly; initially students were using the forums at least weekly, at the end only one student used the team forum weekly – which rendered it virtually useless. A corresponding rise in the use of Instant Messaging occurred, and most students registered daily use. This was not expected from previous experience, and researchers explored this trend during the interviews and focus groups.

Students stated that they constructed group email lists and used their personal emails for sharing research and asking questions. Personal emails were stated as more convenient than university email (GroupWise). The main reason cited for this preference was the relative convenience of personal email which was familiar and didn't require frequent re-authentication (GroupWise timed out relatively quickly). It emerged that students had used email in this manner on a number of occasions, and were consequently used to working in this way.

The VLE was regarded as inconvenient, again requiring extra log-in and not perceived as adding value to email or IM. Students perceived the VLE as primarily useful for notices and communication from tutors (rather than as a means of sharing and co-constructing knowledge). One student stated she used it "*because she thought she had to… and it was duplication of what she had already done*" (via email).

IM usage increased as students gained experience, "*it was excellent, fast for questions and answers*"

The overall balance of videoconferencing and F2F was stated to be appropriate, and students stated that initially the higher level of F2F contact was needed.

Student performance at assessment.

The following graphs provide some comparative assessment score information. The data should be interpreted with caution, due to the small numbers involved in the class.
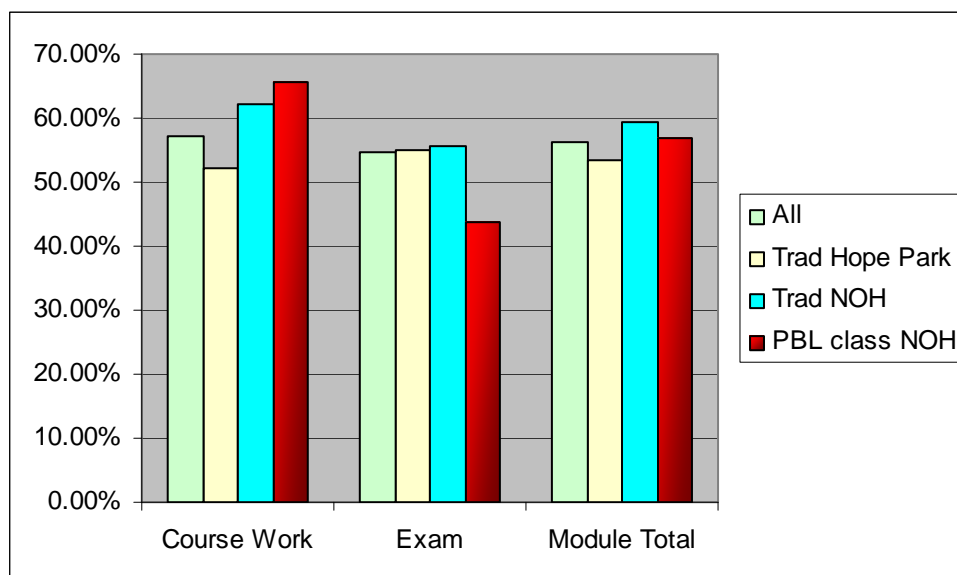

Figure 1: Assessment scores.

This graph compares assessment scores for four samples of the student cohort. The sample labelled *Trad Hope Park* consisted of 17 students at Hope Park, mainly full time 18-21 year olds, taught in a traditional way, with coursework as specified above. The sample labelled *Trad NoH* comprised a class who were most directly comparable to the PBL class in terms of educational experience, (part-time mature students) but were taught and assessed in the traditional manner. The series labelled All incorporate traditional and PBL classes.

If it is accepted that the coursework is comparable, assessing the same learning outcomes, it appears that the PBL class perform marginally better than the corresponding *Trad NoH* class., achieving a high mean score (66%). In the examination, the converse is evident: the PBL class had a mean score of 44% compared to 55%.   However, this masks a considerable difference in preparation for the examination: the traditional classes received specific preparation, including an in-class test which provided practice at similar questions. The PBL class received no examination preparation.

The overall performance of students in the PBL class (mean 57%) compared to a mean of 60% for the *Trad NoH* is marginal.   Performance in the three other modules that the students had completed was also compared. On average the class scored 1% lower in these modules than the *Trad NoH* class.

Discussion

In this project radical changes have been made to the teaching and learning model. The students were new to PBL, but had some experience of using ICT for communication and collaboration. They were also experienced in group work and a high degree of trust existed prior to the start of the project. This latter factor, together with small team size removed many of the issues of group working that commonly arise. It should be emphasised that problems experienced with group work are frequently reported and the importance of preparing students for the negotiations involved cannot be underestimated. Owens (2007) reports positive and negative student experiences from the development of leadership and negotiating skills to the frustrations of freeloading and trials of conflict handling.

Returning to our initial motivators for the research, it was discovered that peer support networks were already in operation prior to the new model, however, the PBL approach had reinforced these and the flexibility afforded by the blended model enabled a student with serious illness to participate actively at a level that would not have been possible using the traditional approach.

The aim to improve the quality of learning is difficult to measure. The overall academic performance (judged by assessment scores) of students using this model appears to be equivalent (with the caveat about small sample size), though the PBL students performed worse in this style of examination. However, comparing PBL purely on the basis of academic performance in assessments does not capture the dimensions of problem-solving, team working and self-directed learning skills that PBL encourages. While we did not devise any measures for the improvement of these skills, it is argued that students were participating in a learning experience where they were able to exercise control: at the end they regarded it as enjoyable and fulfilling. It is felt that this will promote a deep approach to learning as suggested by Ramsden (2004, p.56) 'deep approaches are related to higher quality outcomes and better grades. They are also more enjoyable'.

The issues that students raised about PBL (slow start, unknown depth, lack of initial confidence) are common among students new to PBL, and are part of the adjustment phase. At times some were confusing learning with knowledge transfer. This was exhibited by their desire for more knowledge before they started. It showed that they had not adjusted to PBL as a learning system and regarded it as a problem solving process. There were also issues about framing learning issues / questions: students tended to construct vague research questions and required considerable guidance from the tutor to improve their specificity.

The PBL model used was not 'pure' in the sense that the tutor acted both as facilitator and sometimes as subject expert. Students adapted to this and at times, it appeared that they exerted some influence on the tutorial model in the way that they interacted with the tutors. This raises interesting questions about models of facilitation using videoconference technology. It is more difficult to create a student centred tutorial group using such technology, a view supported by Rosenberg's (2002, p.207) work in which she describes the negative impact of the lack of the tutor's physical 'presence'. More

pragmatically unreliable technology is a significant demotivator in the learning process. McCartan (2000) warns "the stress induced by malfunctioning equipment cannot be overstated for both lecturers and participants".

Students and tutors judged the balance of videoconferencing/ F2F sessions to be appropriate and students were able to receive the support that they needed. However, it was not easy for students or tutors to demonstrate software applications remotely using the technology employed. This was a source of frustration at times. Introduction of additional facilities for demonstration of software, and tools such as Macromedia Breeze could further improve flexibility of the remote sessions. Comparing F2F learning with video or web conferencing is probably ultimately unhelpful however. Different media require different approaches and have distinct advantages and disadvantages. As Robinson (1997, p.56) points out "Learning by videoconferencing is not a second best; it is different". The key here must be to carefully consider each element of the blend and use it its maximum potential and in the most appropriate way.

Students readily adopted ICT for sharing information and discussing issues. Group email (asynchronous) and IM (synchronous) were heavily used. The VLE was almost regarded as incidental. It was clear that students preferred to use tools that they were familiar with, and that were easiest to access. Group email was effective in such small teams, but forums may be judged more efficient with larger teams. Given the rapid development of web technology, particularly Web 2.0 tools, the authors believe that it is particularly important that the selection of tools is considered carefully, for both pedagogical effectiveness and usability. Students are often 'digital natives' with more experience of online communication and social networking tools than tutors and this needs consideration in design. For example, a Wiki affords an excellent platform for developing and displaying socially constructed knowledge, and it is also able to track contributions. Such a tool appears to be closely aligned with the PBL model and provides an easy way to enable a team to collaboratively construct an article as a deliverable outcome from a

PBL trigger; a Wiki provides a much more natural vehicle than a VLE forum for such a deliverable. However, the issue of familiarity is always important: such an approach has recently been incorporated into a module, and students have initially shown some reluctance to develop drafts in this way, preferring to circulate email!

Finally the new model reduced the travelling for Hope academic staff by 40% (approximately 10 hours) in the semester.

In conclusion, our analysis suggests that there is positive evidence for further developing and refining this model. However, the university moved to 30 credit modules the following year, and the Deanery took the opportunity to revalidate the programme, and due to a number of financial constraints further iterations of this module were not possible.

In this article alternative methods have been outlined, together with supporting research publications. A set of principles have also been identified which can assist HE educators when considering adoption of this, or a similar approach. The principles employed for implementing the blended model appeared to be successful in creating an effective and efficient model of distance learning. However, developing an effective learning environment is rarely completed, and the following identified areas for particular attention have been highlighted for future development:

- Preparation of students and tutors for PBL and the training in the use of ICT tools.
- Careful considerations of the selection of ICT tools to support the pedagogy, taking particular account of students' prior experience.
- Further reflection and exploration of ways to use the video or web conferencing sessions and F2F sessions most effectively.
- Careful redesign of assessment to align with PBL.

Although the tools available to support blended learning are developing rapidly, the principles outlined here are equally applicable to the most recent

technologies; indeed the authors strongly advise that all tools, and support for them, be evaluated thoroughly for reliability and most importantly pedagogy should always take precedence over technology.

Appendix1: Traditional delivery course schedule and assessment

Course Schedule

Week Commencing	Class Topics 1	Class Topics 2	Private Study
24 January 2005	SQL - Create Table Enforcing Referential Integrity and Relationships	Simple SQL statements - Insert Into Simple Select Statements	SQL Activities
31 January 2005	More SQL – Join types Union Distinct	More SQL – Action Queries Date Manipulation Functions	SQL Activities
07 February 2005	Interface Design SQL for GUI's	Consistency Revision for In-class test	SQL Activities
14 February 2005	In-Class test on Weeks 1-3 1½ hours.	Access Screen and Properties. QBE Grid	Access Activities
21 February 2005	Queries in Access	Queries in Access	Access Activities
28 February 2005	Form Creation, Forms for Navigation	Master and Sub Form Issue Research Topic for Group Presentation	Work on Presentation
07 March 2005	Reports and Menus	Issue Project	Work on Project and Presentation
14 March 2005	Data Validation	Integrating with other applications	Work on Project and Presentation
EASTER			
04 April 2005	Work on Project and Presentation		

11 April 2005	Presentation	Work on Project	Work on Project
18 April 2005	Work on Project		
25 April 2005	Examination Revision	Work on Project	Hand In Project 02 May 2005 Before 3.00pm to School Office

Appendix 2: Blended PBL delivery course schedule and assessment

Date	Week	Group activities	Video conference*	Tutor Location
25 Jan	1	Introduction to the module Introduction to problem based learning; Form teams Case 1 issued; Brainstorm problem; Identify learning issues	7.30	NoH college
1 Feb	2	Share learning; Apply to problem		NoH college
8 Feb	3	Share learning; Apply to problem	7.00	Hope Park
15 Feb	4	Half term. Online meeting (VLE chat) 6pm.		Hope Park
22 Feb	5	Complete case 1 Present findings Case 2 issued; Brainstorm problem; Identify learning issues		NoH college
1 Mar	6	Share learning; Apply to problem	7.30	Hope Park
8 Mar	7	Complete case 2 Present findings		NoH college
15 Mar	8	Case 3 issued; Brainstorm problem; Identify learning issues;	6.15	Hope Park
22 Mar		Easter		
29 Mar		Easter Online meeting (VLE chat) 6pm.		Hope Park

5 Apr	9	Share learning; Apply to problem	7.00	Hope Park
12 Apr	10	Share learning; Apply to problem		NoH college
19 Apr	11	Complete case 3	7.00	Hope Park
26 Apr	12	Present findings Reflection and peer assessment Examination preparation		NoH college

* Times (pm) are for scheduled video conference sessions. Tutor will remain logged on to the LearnWise VLE throughout the evening and is therefore available for email or chat.

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