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Investigating the Effectiveness of Teaching 'Online Learning' in a Problem-based Learning Online Environment.

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Introduction

This chapter reports on the evaluation and subsequent re-design of an e-learning module that utilised a problem-based pedagogy. The module was a component of a Postgraduate Diploma in Third Level Learning and Teaching for lecturers from a range of higher education institutions in the Republic of Ireland. The online delivery took the form of using a range of electronic resources and online asynchronous and synchronous discussion to solve a problem-based learning scenario. In designing the original module I had envisaged that the key to the module participants' success would be to collaborate online and share valuable information with colleagues from a variety of other disciplines. However, on undertaking an evaluation after three years I realised that a conflict existed between the individual's right to learn online, using the online learning environment (WebCT) in their own time and at their own pace and the obvious benefits of interacting online with peers in a problem-based learning group. The actual learning situation entailed interpersonal complexities and subjective depths of meaning that challenged my assumptions about how problem-based learning would happen online. From an analysis and interpretation of the evaluations of this module I gained a better understanding of the problem-based learning group process in an online environment. The module was then

re-designed using a blended learning approach in which weekly face-to-face problem-based learning sessions were complemented by the use of the WebCT online learning environment.

In this chapter I report on participants' experiences, the analysis of collected data and present a structure for the development and design of a blended approach to problem-based learning, where the problem-based face-to-face learning in a classroom is integrated with an equivalent e-learning component.

Research Methodology

The research context

The Postgraduate Diploma is voluntary and attracts lecturers who are keen to implement novel pedagogical approaches in their own subject disciplines. The aim of the module in the study is to enable the participants to become aware of the practicalities of designing, delivering, supporting and evaluating an online module in their own subject discipline. Generally, there are between six to eight participants in the problem-based learning group. Over the three years of the module's existence, a wide variety of subject disciplines has been represented.

Research Question

This research study was instigated to uncover which aspects of the online learning module on the Postgraduate Diploma in Third Level Learning and teaching were problematic for the participants and what changes could be made to the module to improve the learning experience for the participants?

Research Design

I chose to adopt an interpretivist, participative approach to the study. I felt that a Participatory Action Research approach would assist in enhancing the understanding of the module context both for myself, as module tutor, and the participants. The phenomenological meaningfulness of lived experience, people's interpretations and sense making of their experiences in a given context constitutes an appropriate and legitimate focus for social inquiry (Greene, 1994). Understanding meaning as the goal of interpretivist inquiry is not a matter of manipulation and control, particularly with respect to method; it is rather a question of openness and dialogue. Central to this study was the concept of learning and working with other people, therefore it was important to concentrate on eliciting the reality of the participant experience on this module. When change is a desired outcome of the research, as it was in this study, some participative form of action research is often indicated. In this study, 'participative' is interpreted as a partnership between the teacher as researcher and the academic staff as participants.

Participatory action research was chosen ultimately as the methodology for this work, because the issues that had emerged from past evaluations of the module were very important to me, as the researcher and tutor on the module, and equally important for the academic staff who participated in the module. This form of action research is research *with* rather than *on* other people. I explained to the participants how I hoped to improve the educational situation for them in the module *here and now*. The intention was to create a structure for partnership between myself and the group currently undertaking the module. This would help to increase the honesty with which the group members reported

information as it was to their benefit to have accurate information on which to make changes. The acquisition of specialised and detailed information from participants would provide a basis for analysis and elucidatory comment on the topic of enquiry. A process of concurrent analysis involved data transformation from the raw state to a form that allowed them to be used constructively to make changes as the module progressed and, ultimately, to re-design the module.

Data collection

Data were collected through questionnaires and focus groups. A qualitative questionnaire was presented to the participants in the final week of the module. The questionnaire consisted of a series of open questions under three main headings: the module structure, the role of the tutor and the content, including the problem-based scenarios. The questionnaire also addressed the participants' perceptions about the online delivery method as well as the educational implications of their patterns of usage of the online problem-based learning resources.

Semi-structured focus groups were held half way through the ten week module and one week after the module ended. Focus groups are a form of evaluation in which groups of people are assembled to discuss potential changes or shared impressions (Rubin and Rubin, 1995). As a general rule, focus groups are an appropriate research vehicle when the goal of the investigation is to gain an understanding of the why behind an attitude or behaviour (Greenbaum, 2000). The focus group discussion was structured on three areas: the improvement of practice (through the design of the module), the improvement of

understanding (individual and collaborative learning on the module), and the improvement of the situation in which the action takes place (the delivery of the module).

To complement the end-of-module questionnaire and the two focus groups, I kept an electronic reflective journal of my interpretation as tutor of how the module was progressing. I found that writing down thoughts about this module was a way of introducing me to the discipline of critical reflective thinking. I used the journal to store personal accounts of my 'observations, feelings, reactions, interpretations, reflections and explanations' (Elliott, 1991) to help me reconstruct the research position at any given time.

The selection, design and implementation of these research methods were based on practical need and situational responsiveness (Patton, 1987) rather than on the consonance of a set of methods with any particular philosophical paradigm. However, in interpretivist study, it is important to authenticate the interpretations as empirically based representations of programme experiences and meanings, rather than as biased inquirer opinion. As the issue of validity of evidence can be difficult and complex (Macintyre, 2000), I considered it important to have a form of triangulation in place. Coupled with this was a belief, (see Savin-Baden and Fisher, 2002), that it was important to situate myself in relation to the participants in this study. I felt it was important to tell my own story as designer and tutor of this module and to ask myself questions which emanate from a desire to understand the participants' lived experiences of this module.

Questionnaire Analysis and Interpretation

In the analysis of the questionnaires, I adapted Kirkpatrick's (1975) model of evaluation, with each of the three successive evaluation levels being built on information provided by the lower level. In the context of this study, each successive level represented a more precise measure of the effectiveness of the module.

Level One was concerned with *reactions*. It is purely a measure of participant satisfaction and not a measure of the quality of the participant's experience. There was a wholly positive reaction here; the blended learning approach to the module was seen as challenging, yet entirely worthwhile. Level Two was concerned with *what was learned?* Assessing at this level moves the evaluation beyond learner satisfaction and attempts to assess to what extent participants have acquired advances in knowledge, skills or attitude about online learning. All participants indicated that they were armed with considerably more knowledge about online learning and that they had learnt from the experience of being an individual student in the online environment and working in their problem-based learning group face-to-face. Level Three was a check to see if the learning which took place in module is actually used or has impacted on the participant's subsequent behaviour and, for this study, how they will facilitate online learning in their own subject disciplines in the future. All participants indicated that design and development of online learning materials would be taking place in their own subject disciplines in the next academic year.

It was confirming for me to see that the participants had a wholly positive reaction to the module. The blended learning approach had been designed to be supportive of their learning in every respect. A large range of resources about online learning was available

to them both in the classroom and electronically. Another factor to take into consideration in explaining their positive reaction was to ascertain the impact of the opportunity to work in a small team with like-minded people. This issue was followed up in more depth in the second focus group.

Focus Group Analysis and Interpretation

There were three steps in the process of analysing the focus group transcripts.

1. Data Reduction

   This involved careful reading of the recorded material to identify the main themes of the studied process and behaviour and categorization of the material.

2. Data Organisation

   This involved assembling information around specific themes, categorizing information in more specific terms and presenting the results in the form of text, and in one of the themes, in the form of a matrix. I followed this by multiple readings of the data therein for regular episodes of events, situational factors, circumstances, strategies, interactions and phases relating to the problem-based learning group process in Online Learning. The recurring regularities became the themes into which subsequent items were sorted.

3. Interpretation

   This involved making decisions and drawing conclusions related to the research question. There were a number of findings to this research, which are discussed below. They can be categorised as problem complexity, language and communication, group; learning versus individual learning and the role of the tutor.

Findings

Problem complexity

In past evaluations, participants had expressed a wish for the module objectives to be clearer to them through the topics they were exploring; outlining that it was unclear what they were supposed to achieve.

> They were challenging but the work potential was not reached. Problems too complicated.

> The group could not understand what was required from the problems even up to the last week.

> I think that PBL requires us to teach each other, but that process never really happened from these problems.

The two problems which were presented for completion by the problem-based learning group online over the ten week period of the module, had been judged too complicated by the participants and the associated workload too heavy for the timeframe. This was changed to a single, two-part problem. In the second focus group, the participants in the study indicated that they found that one problem, in two parts (part one being theoretical, part two being practical), was more in line with a reasonable workload for a ten week duration, allowing them to move beyond surface learning of the relevant issues.

Language and communication

The participants highlighted that problem-based learning requires complex social interaction and attempting to do this fully online was difficult for participants lacking experience in online learning. Part of the group process problems was the fact that messages online were being read differently from what was intended by the person posting the message to the asynchronous discussion board, as highlighted by some comments from the module participants in the first focus group:

> PBL requires complex social interaction and online this is difficult to achieve.

> Language has to be used carefully as it can be read very differently from what was intended.

Group versus individual learning

The analysis indicated that, despite being aware of the problem-based nature of the module from the outset and willing to overcome initial reservations about working in a problem-based learning group online as opposed to individually, by the end of the module, participants were still requesting individual learning technology support to enabling them to learn in their own time and at their own pace. In addition, they wanted more organisation and tutor input than was present in 'traditional' problem-based facilitation.

Overall, it was felt that the online medium and activities required were acceptable, but the associated challenges of working with a problem-based group experiencing process problems needed to be addressed explicitly and early so they could be overcome

Some comments from the most recent module participants reflect the pull and tug of the group process:

> I genuinely feel we are putting our shoulder to the wheel yet recognising individual constraints.

> I learn from the others contributions, the multidisciplinary nature of the group has huge benefits for me as an individual.

> At times, I feel I contribute very little. This feeling stems from the fact that my colleagues are at (as I see it) a more advanced stage of development than me. Last week I did not feel on the periphery but this week I feel as if I am back on the margins of the group. Some group members seem to be brilliant - steam-rolling ahead in terms of their comprehension and contribution.

> I actually feel we have gone beyond the group and are a real team.

The persistent pull between group goals and the tug of individuals' motives within small problem-based learning groups is represented in by the matrix in Table 4.1 The group pulls between tasks to accomplish and work to produce but they also tug to maintain cohesiveness and an optimal level of morale.

Insert Table 4.1 near here

The four categories that emerged from the analysis of the data under this theme were task-group, task-individual, social-emotional-group, and social-emotional-individual (Table 4.1). The group can become more effective if they are able to pursue more than one of these activity categories simultaneously.

The Role of the Tutor

A hugely important area in problem-based learning is the role of the tutor. The tutor's role of encouraging participation from the students, showing interest in their progression, responding positively to their enquiries, providing helpful feedback on module work, and making the students feel that their contribution to module activities was valued was defined early in the module. Previous evaluations indicated problems with the tutor's role namely that the online component needed a more authoritarian tutor. They acknowledged is against the grain of 'traditional' problem-based learning.

> I feel the tutor's level of online participation was hindered due to the PBL approach. What was needed was a more authoritarian tutor which would have been against the 'PBL rules'.

> For me, the key to online learning is the level of interaction and the factors that determine a student's level of interaction must be conspired e.g. motivation through tutor interaction.

In the re-designed module I solicited feedback from the individual participants and listened throughout the entire process and was concerned about the participants' success. Every individual needed to be given the opportunity to improve until the learning

experiences came to an end and reasonable accommodations for the participants' needs and desires were made. This appears to have been successful.

> The role of tutor was significant. I cannot imagine what it would be like with a larger group. In our case the tutor was so supportive with encouragement but also guidance and feedback when needed. This was also done in a quiet gentle way which was refreshing.

Some further issues to be considered by the tutor included providing an effective induction, encouraging participation online, knowing when and how to make the resources available, how to make the problem-based online group process visible both to the tutor and to the external examiner, and juggling the e-tutoring role with that of a face-to-face problem-based learning facilitator. For this latter point problem-based learning typically requires intensive contact between tutor and students and this proved to be more difficult to implement online, particularly when problems of group dynamics arose. A major challenge for me as tutor was to help ensure that each individual participant learned while also gaining the experience of working collaboratively. With regard to to the problem-based learning group, I kept participants aware of where they stood with respect to the module assessment process on a regular basis. The tutor gave the participant timely and quality feedback on their contributions to discussion, as part of the group process, along with their contribution towards the end product.

Discussion on the Design of a Blended Module using Problem-based Learning

The research surrounding this module was based on the belief that interaction between participants in the problem-based group was the key element to a successful online learning experience for all involved. As a result of the findings of this research, a number of changes were implemented to both the design and delivery of the module. Changes fell into two broad areas: module design and collaborative learning.

Module Design

From the design perspective, it was decided to strip the module down to reflect the reality of the context in which it was being delivered. The participants were not in the position of having to present courses entirely online. A blended approach with appropriate face-to-face encounters was deemed much more relevant both for their needs and the needs of their students. As established, previously the online delivery took the form of using a range of electronic resources and online asynchronous and synchronous discussion to solve a problem-based learning scenario. Now, there are a small number of face-to-face sessions strategically placed at the start and middle of the module to facilitate cohesiveness, good dialogue, quality tutorial input and individualised support.

Figure 4.1 is a site map of the re-designed structure of the module. There are three elements to the module: Supports, Resources and Tasks. In terms of Support, the main features are the collaborative discussion features of discussion board, chat room and email. The Resources facility provided links to a wide range of learning material in the area. The Tasks area is an information centre holding details on the weekly online tasks, the reflective journal and the problem.

Insert Figure 4.1 near here

Prior to starting the module participants are now asked to complete a Learning Style Inventory, based on the theories of David Kolb, and an access and technology comfort survey.

Learning styles

The redesign of the module followed Felder's (1996) view that teaching designed to address all dimensions of any learning styles model is likely to be effective. The participants on the OL/PBL module were familiar with Kolb's Experiential Learning Model (Kolb, 1984) therefore the dimensions of concrete experience, reflective observation, abstract conceptualisation and active experimentation were now utilised both online and face-to-face. The changes made to the module design attempt to cover the range of Kolb's learning styles. Effective visuals have been added to appeal to the learner who tends more toward reflective observation, preferring to generate a wide range of ideas and to gather information from many sources. The use of reflective journaling and online chats that involve thought showering have also been included to aid the reflective observer. Incorporation of fieldwork and development work through the provision of authentic problems may assist the learner who is more likely to learn through concrete experience. A video-conferenced lecture session coupled with reflective writing is geared towards the abstract conceptualizor. Incorporation of a gradual move towards asynchronous conferencing, where the active experimenter is encouraged to view issues from different perspectives and interpret the meaning of events, will support interaction and facilitate a sense of community among participants.

Technology comfort

Jonassen *et al.* (1999) believe that what computers can do best is liberate the student to explore, discover and create personal meaning from diverse sets of material in a proactive manner. They argue that technology should be used as an engager of thinking and knowledge construction rather than merely a transmitter of information. Other research (Mioduser and Nachmias, 2001) has shown that individual online learners use the Web for e-informing rather than e-learning. Many individuals undertaking a module with an online component find that these modules support processes such as rote learning or information retrieval, rather than promoting engagement in collaborative group learning. In the research literature, there are developments investigating whether an online tutorial can be used as a tool for learning, in addition to being a tool for delivery of information. Curtin (2002) examined whether online tutorials can be used to encourage participants to undertake prescribed readings, distinguish the evidence and arguments of these and relate the ideas to everyday experience through peer discussion online. One suggestion is that participants who use online materials individually may then search for more opportunities to interact with their peers.

Collaborative Learning

The key to collaboration was found to be to give the participants the opportunity to experience online learning as a student; firstly as an individual, then in pairs, with one in a mentor role and finally, in a series of online group and reflective activities. Therefore, the engagement now begins with content-centred academic interaction between individual participants and online resources. It then moves towards collaborative

participant interaction, complemented by social interaction between the participants and the tutor, the latter taking the form of interpersonal encouragement and assistance (Jung *et al.,* 2002). After individuals have gained experience with the flow of activities face-to-face in problem-based learning and are thinking deeply about the problem, their online collaborative work can begin. The group can meet online with the asynchronous feature of an Online Learning Environment, which is designed to scaffold students as they organise their task and then synthesise, post and critique the results of their deliberations. Collaboration now takes the form of a member of a group working toward three common goals: learning collaboratively, problem-solving collaboratively and achieving individual curricular outcomes collaboratively.

From a constructivist viewpoint, studies on web-based learning environments have shown that there are three critical components to interaction. First, an academic (learner-to-content) component occurs when learners access online materials and receive task-oriented feedback from the facilitator or from a technology-driven feedback system. Second, a collaborative (learner-to-learner) component occurs when learners are engaged in discourse, authentic problem-solving, and product-building using web-mediated communication and collaboration tools. This integration component helps learners validate their learning experiences, and requires a level of reflective articulation that promotes collective knowledge-building and a deeper personal understanding of what is being studied. Finally, an interpersonal/social component occurs when learners receive feedback from the facilitator and / or peers in the form of personal encouragement and motivational assistance. Social interaction can contribute to learner satisfaction and frequency of interaction in an online learning environment. Without the opportunity to

interact and exchange ideas with each other and the facilitator, learners' social as well as cognitive involvement in the learning environment is diminished (Grabinger and Dunlap, 2000).

The problem

The problem scenario for this module now includes the steps of analysing the need for online learning in the context of any of the group's subject disciplines, finding and investigating useful information for producing a design of an online learning module in this subject discipline, finding and understanding appropriate theories and synthesising a plan of action for the development of such a module. Each year a new problem will be presented to the group. The context and landscape of e-learning is constantly changing therefore the nature of the problem should reflect this.

Mentoring

The essence of the redesign concentrates on the collaborative learning aspect of the module having been somewhat in conflict with individual differences in the preferred learning styles of the various participants. Based on individual differences, adult learning emphasizes learner-centred instruction. Additionally, social constructivism contends that knowledge is constructed by social interaction and collaborative learning (McDonald and Gibson, 1998). In an attempt to bridge these two perspectives within the module, a mentorship role was encouraged in the module redesign where experienced individuals can help inexperienced learners by co-operating together in their learning.

Currently, there is a lack of research describing the role of the online leader, particularly for academic programmes that also utilise mentors. (Boyer, 2003). Boyer's research identified three levels of leaders involved in a programme of international collaboration, networking and mentoring relationships namely, student (participant) leaders, process leaders and instructor leaders who struggled to define identity roles within the virtual group. A clear need for purpose, identification and role clarity to scaffold the virtual experience and fortify the mentoring process surfaced from their research.

In essence, the blended approach used for this module redesign can be likened to the 'Wrap Around Model' of online learning (Mason, 1998). This model consists of tailor made materials (module handbook, activities and discussion) wrapped around existing materials (textbooks, web resources and face-to-face problem-based sessions). The tutor's role is also extensive because less of the course is pre-determined and more is created through the discussions and activities each time the course is delivered. Real time online events feature in this model. The Synchronous Chatroom feature of WebCT is used for problem-solving areas of the curriculum so that the tutor can help students on a one-to-one or one-to-small group basis. Participants interact with each other through posting email and Discussion Board questions.

Recommendations

Having discussed of how the findings of the research have influenced the re-design of the module in context for the future, the following recommendations are offered to anyone designing and implementing a blended online problem-based learning course in a third level context.

- Following the principles of constructivism and engagement is vital to create collaborative and authentic learning for participants on blended learning courses.
- Participants benefit greatly from being given an opportunity to interact face-to-face first before collaborating online.
- The design of such courses benefits from scaffolded collaboration. Working online individually, then with a mentor, and then in small problem-based groups, will prepare individuals more adequately for collaborative work online. This preparation should be followed with collaborative activities conducive to reflective guidance of group interaction.
- Completing an individual reflective journal provides participants with an all-important space in which to record, revise and synthesise their thinking. The journals can be evaluated by the tutor, who can give formative, individualised feedback.
- The tutor has a very specific role:
    - Their responsibility should be aimed at creating a learning environment that utilises life, work, and educational experiences as key elements in the learning process in order to make it meaningful.
    - The tutor should present the curriculum in a manner that allows the participant easily to translate theories into applications and provides participants with the proper tools to transcribe theory into practice.
    - It is the tutor's responsibility to help the group to probe more deeply. A number of ways can be utilized to do this, for example by raising questions that need to be explored, pointing out conflicting evidence or asking questions that would extend the inquiry into key directions.

Conclusion

This study aimed to investigate the existing problems of an Online Learning module in a Postgraduate Diploma in Third Level Learning and Teaching, with a view to re-designing the module as a solution to these. While it is acknowledged that a certain amount of caution should be employed in drawing conclusions from this study, as it involved only a small sample, the findings nevertheless provide encouraging results. The findings indicate that working collaboratively on an authentic problem is enhanced by face-to-face working in addition to being supported online. This can help eradicate communication problems amongst group members. Using problem-based scenarios with a theoretical foundation, illuminated by the opportunity to apply this theory to an authentic, interdisciplinary learning situation works well in this approach.

Individual learners can benefit from scaffolded support, both face-to-face and online, before being required to collaborate in a problem-based group in an online learning environment. The self-directed learning focus of problem-based learning, combined with a blended approach to delivery, can produce learners who are motivated, know what they want to learn, set their own objectives, find resources and evaluate their learning progress to meet their goals. Although the participants have felt that there was an increased workload for them as individuals within problem-based learning, they did appreciate that the pursuit of the learning goals was their own domain, with the group performance being evaluated by peers. They also acknowledged that the self-directed learning trails that they found themselves on within the problem-based learning group, both online and face-to-face, did lead to a greater awareness of individual interdisciplinary thinking.

The problem-based learning facilitator has a very distinctive role to play in a blended learning delivery. Many technologies can meet varied individual needs and each technology has its own particular instructional strengths. The redesign of this module needed appropriate selection and choice of a blend of delivery methods to meet the learners' needs. Thus the role of technology in this instance is the same as the facilitator's: to be a facilitator in online learning.

In line with the participative action research approach used for this study, another cycle of research will take place on the module with a new group of participants when it is offered again. The aim will be to continue to shed further light on the challenges of using a problem-based learning approach to deliver online learning.

Table 4.1 Matrix of Individual and Group Activities

	Task	**Social-Emotional**
Group	Setting Learning Goals PBL Tutorial Discussions Group Project	Discussion about Group Process Setting & Reviewing Ground Rules Peer Discussion and Review
Individual	Fixed Resource Inputs Independent Learning Individual Paper	Supportiveness Reflection Mentoring

Figure 4.1 Site map of the re-designed module