Expected and Actual Student Use of an Online Learning Environment: A Critical Analysis

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Abstract: While Online Learning Environments (OLEs) can potentially support learning that is more autonomous and authentic in nature than traditional instructional environments often allow, students do not always use OLEs in the ways expected or desired by their tutors. This paper examines the findings of a recent evaluation of an OLE designed for Masters-level engineering students and, drawing on relevant research, offers possible explanations for the particular ways in which the students used the environment. The paper concludes with a short set of general recommendations for practitioners.

Keywords: Online learning environments, constructivism, student usage, learning facilitation

1. Introduction

Online learning environments (OLEs) can be an extremely effective way of delivering course content to students and supporting them in their studies. By enabling access to a range of materials, learning tools and communication facilities, OLEs can be ideal constructivist learning environments that allow students to become more actively involved in developing their knowledge and understandings. However, this is still a relatively new field of study, and research increasingly shows that students do not always use online environments in the ways designers and tutors expect or desire.

This paper examines the findings of the Computer-Based Learning in Petroleum Engineering (CBLPET) project, which developed online modules for Masters-level, workplace-based students of Petroleum Engineering and evaluated their usage and effectiveness. The students who participated in the research did not use the environment entirely as anticipated, especially in how they progressed through the course materials and in their use of communication facilities. While some of these findings were not particularly surprising, they are certainly worthy of reflection and discussion.

The evaluation of the CBLPET environment described the ways in which students worked online, and is discussed in Beasley et al. (in press). This paper takes the findings of this research a stage further and reflects on the possible reasons why students used the environment in the ways they did by drawing on the formal evaluation, other recent research, and informal discussion with the student participants. A number of limitations in the design and implementation of the course are identified, and the ways in which the online environment could be improved to encourage or enable students to make fuller use of the various online resources are considered.

2. Overview of online learning environments

This section examines the reported benefits of online learning environments, and considers examples of actual student usage from the literature.

2.1 Expected benefits of online learning environments

Taking a constructivist perspective, a learning environment can be defined as 'a place where people can draw upon resources to make sense out of things and construct meaningful solutions to problems' (Wilson 1996). Constructivist learning environments emphasise fostering long-term understanding through meaningful contexts and interactions that reflect how knowledge is developed and used in the real world. They are characterised by increased student responsibility, opportunities for reflection, a focus on realistic tasks, purposeful collaboration with peers and tutors, exposure to multiple perspectives, and course materials that go beyond purely abstract descriptions of a subject domain (Grabinger & Dunlap 1995; Jonassen 1999).

OLEs typically combine hypertext-based course materials with asynchronous communication facilities, supportive multimedia, and other interactive features to aid understanding. This provides a single point of access on the web, facilitating 'one stop shop' learning, with the obvious advantage over traditional environments that learners can study when and for as long as they want,

utilising whatever resources they require at any particular moment (Hill 2000).

The claims made for the educational value of hypertext generally rest on the increased level of learner control that studying with it involves. Within the navigational parameters of hypertext course material, it is the learner and not the instructor who determines the order and depth of exploration of the content. It has been proposed that this allows for more active and reflective knowledge appropriation, as learners can study according to their own ability levels and requirements. It is because hypertext allows the learner to interpret information and choose paths of enquiry in this way that it is claimed that 'hypertext is necessarily a constructivist environment' (Jonassen 1992).

More specifically, the opportunity to present course material non-linearly means that hypertext may be an ideal medium for enabling learners to develop a critical understanding of a domain. This is the central premise of Cognitive Flexibility Theory (CFT) (Jacobson & Spiro 1995), which advocates designing hypertext course material around case studies and problem scenarios. Through the provision of alternative navigational paths, the subject matter can be explored from different conceptual and thematic perspectives, and always with a focus on completing the task in hand. CFT contends that knowledge developed this way is richer in breadth and depth, and so more readily transferable than that developed 'linearly'.

While asynchronous discussion facilities also offer, through dialogue with peers and tutors, the opportunity for students to appreciate multiple perspectives, their main benefit is in the manner in which dialogue is enabled. The increased opportunity for students to reflect on their own opinions and those of others before contributing to an online discussion has the potential to lead to a deeper, more reasoned exchange of views than is often possible in real-time situations (e.g. Mason 1994; McConnell 2000). Allied with this is the idea that students who are less forthcoming in face-to-face discussions are more likely to participate online where they are relatively anonymous, and have ample time to compose messages and be sure of their communications. There are also obvious advantages for students enrolled in distance courses, as online discussion may provide the only means for social interaction and collaboration.

Often integrated within the hypertext of OLEs are visual representations in the form of static, animated and interactive graphics, which are generally referred to as 'supportive multimedia' as their content is intended to complement or extend the textual information (Najjar 1998). Of the many cognitive benefits associated with supportive multimedia, the two most important from a constructivist perspective are the authenticity of the learning environment and the concept of 'distributed cognition'.

Supportive multimedia can contribute to the authenticity of a learning environment by presenting objects and phenomena in forms closer to those encountered in the real world, rather than describing them solely through text or highly abstract images. This enables a qualitatively better comprehension of whatever is being depicted, for example a physical item or process, therefore increasing the likelihood of it being recognised and understood on future occasions (CTGV 1993; Honebein et al. 1993).

The idea of distributed cognition is, in short, that certain tools and artefacts within our environment can enhance our cognitive abilities and 'make individuals smarter…while using them' (Bell & Winn 2000). In relation to supportive multimedia, the concern is whether still or moving images help learners to understand what is being depicted more effectively than would be possible in their absence (Scaife & Rogers 1996). In relation to other types of tools and media, for example interactive glossaries and self-tests, then the concern is similarly with the unique ways in which these respective features might aid recall or help consolidate understanding.

2.2 Actual student use of online learning environments

Despite the claims that can be made regarding the educational potential of OLEs, it is becoming apparent that some students, often including those who value what the learning environment has to offer, do not interact with them in a manner conducive to fully experiencing the benefits.

Many students have a tendency to procrastinate rather than exploiting the opportunity for self-paced learning that exists online, which typically leads to them 'falling behind' (Hiltz 1997). It is also common to find that much studying actually occurs offline, and is largely based around working with printed copies of material (Crook 1997; Ward & Newlands 1998). Furthermore, research into

the influence of learner differences in online contexts tends to indicate that only a minority of more focused or active students will fully utilise the materials and tools at their disposal, while the majority limit themselves to working with core materials and only satisfy the basic requirements for interacting with other features of their environments (Light et. al. 1997; Gibbs 1999; Karuppan 2001). Finally, in relation to online communication, it is widely accepted that students will rarely participate in asynchronous discussion or collaboration simply because a facility for this has been provided (Tolmie & Boyle 2000; Salmon 2002).

2.3 Background to the CBLPET Project

The CBLPET project was a one-year EU-funded research project, completed in March 2003. Using the ASTEP framework (MacKinnon et al. 1998) for designing learning environments according to constructivist principles as a starting point, the aim was to develop an online environment for mature, workplace-based students of Petroleum Engineering, and to evaluate the effectiveness of that environment for the target student group and the ways in which they used it.

The CBLPET environment was designed so that students had access to the complete materials for the modules online, interspersed with activities – particularly real-world worked examples and case studies, and instant-feedback assessment questions. This combination of reading material and activities could be utilised in two ways: each chapter of material could be read and the activities used for testing and consolidating knowledge; or the students could start with the activities and use them in a more problem-based manner, accessing material when required to complete an activity.

As students were remote from academic staff, discussion fora were made available as a means for them to communicate with staff and peers. A search facility, comprehensive hyperlinked glossary, and individual progress reports were also implemented and the environment was rich in colour graphics, although the use of simulation and animation was limited owing to the short development time.

Two distinct student groups took part in the research: a group of 12 distance learning students who were already studying the modules using paper-based materials; and an additional group of four students who agreed to study the modules online and participate in a more in-depth evaluation. The opinions of the former group were evaluated with two questionnaires: a short questionnaire to gather first impressions and a more in-depth questionnaire later on. The latter group were evaluated using a series of interviews and a task walkthrough.

All of the students who participated in the trial had opted to take part in the study and use the online environment, and had a fairly high degree of computer literacy and experience of independent learning. The market analysis showed that the distance version of the programme is usually undertaken by graduate engineering professionals working in aspects of the industry, and who want to move into petroleum engineering specifically. The qualification would be necessary for advancement in this area, which would usually be accompanied by a significant salary rise. It is therefore likely that the learners who participated in the study may be more open to the idea of online learning, but also more strategic in their approaches to studying by having extrinsic motivations focused beyond the course itself (Entwistle 1997).

Interviews were also carried out with the company mentors, academic, managerial, and technical staff, which examined their expectations of the environment and whether or not they had been met.

3. Discussion of the student experience

This section examines the key findings of the evaluation and, drawing upon relevant research, reflects upon the possible reasons behind them and highlights recommendations for future practice in the delivery of the programme.

3.1 Preference for linear learning

As noted previously, the learning environment could be used either with a materials focus or with an activity focus, and despite the opportunity to explore the material in a more active, non-linear fashion, students exclusively studied the material linearly. From the evaluation there was evidence that all students knew that the non-linear option was available but chose not to make use of it.

A straightforward explanation for this could be that the students were used to working in a linear fashion, and that it was lack of

experience at working in a non-linear fashion that led to a lack of use. The idea that some students do not possess the necessary skills or mindset to learn online effectively, and when presented with online materials will rely on the tried-and-tested methods of studying they developed in conventional courses, is an established proposition (Bostock 1998; Ward & Newlands 1998).

Another possible explanation is that although students were aware of the functionality that enabled them to access the materials in an activity-based manner, they were not given any specific information on how to study in this way. Previous research has found that learners who are provided with clear navigational guidance embedded within the content of educational hypertexts are much more likely to explore in a more active manner (Veenman et. al. 1994; Relan & Smith 1996). The likelihood is that this form of support would be required to ensure the students are not just aware of the non-linear functionality, but actually know how to use it effectively. Therefore a key future recommendation would be to provide explicit instructional guidance on the purpose of these aspects of the OLE, how to operate them, and the expected benefits of using them.

The individual progress reports were not used at all, as essentially the students saw no need for a system that told them what they had yet to study. When studying linearly they could simply start from where they last left off to ensure that all material was covered – something that was not so easily guaranteed if the students were working via the non-linear hyperlinks. It would be interesting to discover whether the reporting functionality would be of greater perceived value had a non-linear approach been used, and how the students have would used the site if they had access to the online materials only.

The students placed a high value on the self-tests provided at the end of each unit and it is possible that the students worked linearly in order to take full advantage of these tests, because if students worked through the material non-linearly it would be more difficult to ensure that they had covered all the relevant material for the tests.

One factor students mentioned that could have increased the non-linear use of the materials would be if they were structured into timed lessons, because workplace-based students often had distinct blocks of free time to spend studying. If the materials were structured into timed units then more effective workplace study could be facilitated, and adequate time ensured to follow the alternative paths through the materials. Although the idea of tightly timed units of online instruction is counter to the idea of self-paced, needs-based learning via hypertext (Jonassen 1992), on a practical level it may have been beneficial to the students on this particular course.

Two features of the environment that were used in a non-linear manner were the hyperlinked glossary, which in particular was cited as extremely useful, and also the search facility. A possible explanation for this is that these features provided functionality not available or easily accessible in the book version, as there is some evidence to suggest that simple-to-use, immediately responsive hypertext navigational tools of this kind can encourage more direct interrogation of content (Najjar 1996).

3.2 Requirement for paper-based materials

The students who were only given access to the online materials quickly requested an additional paper version and for all students there was a preference for the paper-based material, used in conjunction with elements of the online environment. Students appreciated the flexibility of working in any place that the paper materials allowed, with most learners studying predominantly on paper at home and using the online materials at work.

Although both mediums were used, the two formats were not used in conjunction. This is perhaps a failure of the design of the online site, which largely mirrors the content of the paper-based version and was not significantly re-written to go online. The heavy use of the paper materials, which are linear by their very nature, may have even encouraged linear usage of the online site, as this would have enabled the students to transfer easily between paper-based and online modes of studying.

An improvement to the online environment would be to add visual, interactive elements that would also not be possible in print form, such as animation and simulation, which could have two potential benefits. The students reported going online to study the supportive graphics, which they found easier to understand than the print versions because they were in colour and allowed better differentiation between aspects of the images. Some form of ‘distributed cognition’ (Bell &

Winn 2000) was therefore being experienced as the graphics supported their learning in this respect. If an increased number of supportive and interactive elements were added, the main benefit would be in the enhanced opportunities for learning through such features. Furthermore, if their presence meant that students would go online to study them, then a secondary benefit could be in encouraging more interaction with other aspects of the environment. This is highly speculative, but what is accepted as certain is that the benefits of interactive online features can only be realised when students are actually online to use them (Crook 1997; Taraban et. al. 1999).

Feedback from students was that the site was fast, usable and largely without technical problems, so technical issues can be discounted as factors that may have adversely influenced the use of the online materials. All those who participated in the study were mature students and would not have grown used to reading online in childhood, so it may well be the case that in future years, as student cohorts have more experience of reading and working online, this preference shifts the other way.

A preference for working with paper has been found in similar studies (Crook 1997; Ward & Newlands 1998) and, consistent with these findings, this investigation showed that most learners found studying at work difficult owing to noise, interruptions, and large amounts of time spent away from the desk, and favoured working at home or in the office out of hours. The inability to annotate the web-based material was also cited as a reason for preferring to work on paper, and O'Hara & Sellen (1997) provide evidence that students may be reluctant to make separate, paper-based notes while reading online.

This use of paper-based materials may well indicate a reliance on 'traditional' studying strategies, but equally it could be seen as learners being active in working around some of the disadvantages of studying online – the unsuitability of the access environment, and the reduced scope for making sense of materials through personal annotations.

Overall, it is apparent that online materials provision should not be seen as a replacement for the printed materials currently used on the MSc programme, as the students valued and made use of the flexibility that having both resources allowed them in fitting their studying around their work.

3.3 Limited use of communication facilities

During the requirements analysis, the students expressed a clear desire for online discussion facilities to communicate with peers and academic staff, which was seen as particularly important because they were often physically remote. An asynchronous discussion forum was provided for students to ask subject-specific questions of academic staff, and the purpose of the discussion boards was communicated to the students via a guide to studying online that was available on the web site. However, the students indicated that – despite being aware the guide was available – most had never actually looked at it. In practice, no use was made of the discussion facility for either peer or tutor interaction, although it was used sparingly for technical information and support.

The main reason given was that the students genuinely saw no need for such a feature as they could gain all the support required from the company mentor, and preferred to get that support face-to-face. However some did report being discouraged by the lack of activity in the forum, and so were presumably open to the possibility of using it. Another key reason for the low usage levels is possibly that the academic staff were not trained in how to use the forum effectively to encourage worthwhile discussion, and were of the opinion that students would use the facility if they needed it.

Although the students did not feel disadvantaged in relation to the non-use of the discussion forum, it is arguable that the opportunities this offered for interaction could have enriched the learning experience, and in this respect the non-use of the facility can be attributed to shortcomings in course design. The main failing was that no tasks or activities were associated with using the discussion board. Tasks for facilitating online discussion can take many forms, from online seminars to more sophisticated collaborative projects, but it is generally accepted that without there being a reason or purpose to participate in online discussion, very few students will (Tolmie & Boyle 2000; Salmon 2002). To make online discussion purposeful, it is essential that students are provided with a clear understanding about the task or activity to be undertaken, and also what is expected of them as participants. Although usage scenarios were provided in the training materials, students were not overtly encouraged to make use of these materials and, in addition, student

use of the discussion boards was not mandatory, which would have at least ensured some level of participation.

The course could be improved by developing specific learning activities based around the discussion forum to encourage peer and tutor interaction and foster a sense of community, and by providing explicit instructions and indication of purpose.

3.4 Use of self-assessment activities and worked examples

As regards the more active ways in which the students interacted with the environment, the vast majority studied all of the core reading material, using a combination of paper-based and online learning, and also used extensively the self-assessment exercises and worked examples that were embedded throughout the materials. The activities were used predominantly to test and consolidate understanding of what had just been studied.

The reflective activities, worked-examples and quick quizzes were all perceived as useful aids to enhancing and, where applicable, testing understanding. Peat (2000) observes how in online and other independent learning contexts, students often find self-assessment opportunities invaluable as they provide for the kind of responsive support for evaluating understanding that is often readily available in conventional courses but which would otherwise be missing in online equivalents.

This seems to be the likely reason why the self-assessment tools and activities in the course where so heavily used, and why the students were forthcoming in their requests for more interactive online elements to support various aspects of their learning.

For future developments it is important that the online environment be used strategically to integrate added-value interactive elements that complement and enhance the paper-based materials. The evaluation brought forward several ideas for interactivities that would aid understanding and learning. These included glossary word-matching quick quizzes to test knowledge of the complex terminology within the subject area; animated graphics of geological and time-dependent processes where appropriate; the ability to isolate separate data segments on complex graphs to simplify the data representation; and the provision of hints, such as bringing up a solution to a problem a line at a time so that keen learners can pick up the problem from where they understand it to increase learner control over how much relevant support they wish to receive.

4. Conclusions

Although the students in this study did not use the online learning environment in all the ways intended they did perceive the environment to be a valuable resource. Yet from an instructional perspective they were arguably not using the it in the most effective ways, and in part this can be explained by the lack of explicit guidance provided to the students, many of whom were new to learning online. However, while it is likely this would have helped to improve the ways in which the environment was used, ultimately it should be recognised that the expectations of tutors are often different from the requirements of the students.

It is felt that the lessons learned from reflecting on the evaluation of this programme may have some practical worth for those involved in the delivery of online courses, and who wish to increase the likelihood of all students in a course utilising an online environment as effectively as possible.

When developing an online learning environment, it is important to:

- consider the likely educational experiences of students, particularly in relation to online learning, to identify the kinds of online learning support required;
- give explicit instructional guidance, within the environment itself, on the purpose of aspects of the environment and how to operate them, including specific guidance on how to study course material via non-linear hypertexts;
- include appropriate supportive visual and interactive multimedia to increase potential opportunities for enhanced learning and transferable knowledge;
- provide self-assessment tools and materials to allow students to test their understanding and reflect on the effectiveness of their learning;
- ensure there is a purpose, in the form of clearly communicated tasks or activities, for students to participate in online discussion.

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