Students' experience of component versus integrated virtual learning environments

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Abstract

The use of virtual learning environments (VLEs) has become increasingly common in most higher education (HE) institutions. Recent developments have proposed the interoperability of software systems and content, to create component VLEs in contrast with the integrated, monolithic ones that are currently prevalent. This paper examines the student experience of two VLEs, one integrated approach and the other component. In general, students preferred the component system, although this may have been influenced by other factors such as performance. Although the study is limited to one cohort of student it makes a number of suggestions relevant to anyone deploying a VLE. These are that the component approach is a viable one from a student perspective, the broader context in which the VLE operates is important in student perception and that poor system performance may have unpredictable consequences for the learning experience.

Introduction

Virtual learning environments (VLEs) have become a pervasive technology in much of higher and further education, with 86% of respondents from UK HE institutions reporting the presence of a VLE in their institution (Brown & Jenkins 2003) and 70% of UK further education (FE) colleges using a proprietary VLE (Becta 2004). As with many new technologies, there are many definitions for the term VLE, and it is often used synonymously with the term learning management system (LMS). The differences between many definitions are often subtle and serve the particular aims of the definer. Definitions can be in terms of functionality, for instance Whatis.com states 'The principal components of a VLE package include curriculum mapping (breaking curriculum into sections that can be assigned and assessed), student tracking,

online support for both teacher and student, electronic communication (e-mail, threaded discussions, chat, Web publishing), and Internet links to outside curriculum resources'. For the purpose of this paper the Joint Information Systems Committee (JISC) definition (JISC 2000) which states the term refers to 'the components in which learners and tutors participate in 'on-line' interactions of various kinds, including on-line learning' is sufficient (interactions here can refer to interactions with content as well as those with students and tutors). Although this paper focuses on the VLE, much of what is covered can be broadened to the wider technical environment, commonly termed the Managed Learning Environment, which, according to the JISC definition (JISC 2000), includes 'the whole range of information systems and processes of the College (including its VLE if it has one) that contribute directly or indirectly to learning and learning management'.

There are two approaches to the design of VLEs. The predominant one is what can be termed a monolithic or integrated approach. This provides all of the

common online learning tools within one software package. As well as providing an off-the-shelf solution to most of the e-learning needs of an institution there are also benefits to having all components within one common system. The key benefits are administrative in that they provide a single integration point with which other institutional systems can interface, and pedagogical, in that they allow student activity to be tracked across components, so a holistic view of their online behaviour can easily be viewed. For many institutions being able to purchase a single system that has most of the online tools they will require enables them to quickly establish an online presence.

Recently it has been suggested that an alternative approach is both feasible and desirable. This design can be termed a component, or hybrid architecture. As well as offering the benefits of a single interface to the various online components for the user, it also offers the possibility to adopt a 'best of breed' approach, by combining components from different providers (including free or open source software) into a single system.

The viability of such component VLEs has been raised by recent developments which seek to specify a generic, standards-based approach to VLEs, often focused around open-source systems. These include the SAKAI initiative in the US and the JISC service-oriented architecture in the UK. The SAKAI project aims to deliver the following (http://www.sakaiproject.org), all as open source:

> The products of this project will include an Enterprise Services-based Portal, a complete Course Management System with sophisticated assessment tools, a Research Support Collaboration System, a Workflow Engine, and a Technology Portability Profile as a clear standard for writing future tools that can extend this core set of educational applications.

The JISC framework (Wilson *et al.* 2004) outlines the benefits and approach for adopting a service-oriented architecture, which can be seen as a means of viewing the integration of systems:

> When we embark on this kind of analysis, identifying the parts of the MLE at a more granular level than monolithic systems, then we eventually end up with a *framework* of service descriptions. We are no longer interested so much in replicating data between large systems, but instead focus on what kinds of services are needed in the overall architecture to provide certain kinds of behaviour from applications.

This can all be viewed in the broader context of a move towards interoperability. Over recent years a number of standards have been developed in educational technology, notably by the IMS Project and ADL in the US. The IMS web site (http://www.imsproject.org) describes key specifications in simple terms by placing them in categories describing their core function:

- Specifications used to describe, discover and exchange content.
- Specifications for Content interaction and tracking.
- Specifications for Application system interoperability.

The motivation behind all of these standards is the desire for interoperability. This can be in terms of content (being able to share e-learning material between institutions and thus reduce the cost of developing it), student data (being able to easily transfer student records to provide a more flexible learning path for students) or systems (being able to describe generic interfaces for systems).

This move towards looser integration of systems and less proprietary based solutions is not confined to the educational sector. In broader terms the development of web services seeks to achieve much the same goal. The idea behind web services is that a piece of code is available to remote machines over the Internet. The code in effect acts as a service, providing functionality or data to a remote machine without having to download the code. It is delivered over the web, hence web services.

XML underpins all of this and is at the heart of web services, being the method by which data is packaged and passed between systems. Web services are language-agnostic, thus one service might use Java to develop its service, and another use Visual Basic, but they could still communicate. This is significant because it means services can be integrated across different systems without the need for costly reengineering of both systems (although the implementation of web services will have an associated cost).

Web services are often promoted as a solution to enterprise architecture integration. Their advantage in this area is that they do not require expensive integration of databases or recoding of existing systems. They are simpler, based on open standards, more flexible and cheaper than other forms of integration. If

one views the VLE as essentially an integration problem, then web services offer a viable means of realising this across most applications, without the need for extensive alteration to existing systems.

There are inherent benefits in each of these two design approaches but both can be seen as striving for the advantages of the other approach also. For instance, many integrated commercial VLEs such as Blackboard and WebCT offer means of integrating new software components into their existing provision through the use of a standard application programme interface (API). Conversely the SAKAI and JISC proposals seek to provide a common interface both in terms of data and 'look and feel' to a disparate set of tools. Both approaches are keen to support the use of standards. This raises the issue of whether there is much difference between the systems from a user's perspective. While they may operate differently and necessitate different technical skill sets, from an end user perspective they may feel similar, which makes the institutional decision to adopt either approach largely a strategic one.

It is this perspective that this paper seeks to address by examining the students' experience of two different VLEs, which correspond to the two design approaches, while studying the same postgraduate course. The course in question is *Learning in the Connected Economy* (H806), which was one of three pilot courses for the UK eUniversities (UKeU) initiative which aimed to deliver online courses from UK-based Higher Educations Institutions to a global audience. The UKeU developed a new VLE (in collaboration with Sun Microsystems) through which all courses were delivered.

The course was developed by the UK Open University (OU), but presented through the UKeU. The UKeU was responsible for marketing and hosting the course, but students were supported by OU tutors and the award was through the OU. The course consists of four modules, each divided into approximately 1 week's worth of study material. Each week is then comprised of a number of learning objects. The course lasts for 8 months and provides approximately 450 student study hours.

In June 2004 it was announced that the UKeU would cease operation by mid-July (http://www.hefce.ac.uk/news/HEFCE/2004/euni/june.htm). As the course still had 3 months of presentation remaining, it was necessary to migrate students from the UKeU VLE to the OU's platform. This provided a rare opportunity to evaluate the student experience of VLEs based on different design principles.

The UKeU VLE was developed in collaboration with Sun Microsystems. It was based around a component architecture, but designed from a top-down perspective as an integrated system. It incorporated some third party technologies, including forums, multiple choice software and calendar system. As such it can be viewed as representative of the monolithic, integrated design approach.

In contrast the OU has developed a range of components to meet specific needs over a number of years, without necessarily integrating these into one system. Such in-house developments include an assignment handling system and an authentication system. In addition some commercial systems have been adapted and incorporated into widescale use in the OU. The most notable of these is OpenText's FirstClass, which now has 252 000 registered OU users. In order to integrate these the OU has adopted a web services approach, developing a student portal and VLE called the eDesktop. The VLE uses a template approach, to provide course teams with a means of creating an online presence. This is the standard web presence used for over 250 of the OU's current courses. Minor customisation is supported and varying course resources are provided, but the default eDesktop presents a student portal incorporating course-specific calendars and news, direct access to relevant assessment, conferencing and library resources – all of which existed as free-standing components before the development of the eDesktop. The OU VLE can therefore be seen as representative of the component, best of breed approach.

While there has been much interest around the potential to build a component VLE, there are relatively few examples of this in practice. Both the JISC and SAKAI work is aimed at fostering the development of such systems. The main implementation of such an approach has been the LeAP project in Tasmania, which has successfully employed a service-oriented architecture, based around a set of loosely coupled components. Given that it is unusual to have a set of students who experience two different platforms, and that the number of component-based implementations is limited, the following research is necessarily limited in scope.

Data collection

Method

On completion of H806 students were asked to complete a web-based questionnaire, which focused on issues associated with their use and experience of the two VLEs and the migration process. Twenty two of the 24 students who completed the course responded to the web questionnaire and twenty of these were subsequently interviewed by telephone (one declined to be interviewed and one responded to the questionnaire after the interviews had already been completed) The 20 interviewees were allocated randomly to the three course team members to conduct structured interviews according to an agreed set of questions, each interview also drew on the interviewee's responses to the web questionnaire.

The interviews lasted between fifteen and forty minutes each, and were transcribed by the interviewer. They were conducted over a 5-week period after the completion of the course.

Issues in data collection

The issue of subjectivity and potential bias is raised by members of the course team conducting the interviews. However, given the requirement for familiarity with the migration situation and knowledge of both of the learning environments involved (one of which was no longer available for reference), it was felt that the advantages outweighed potential disadvantages. The possibility of bias was compensated somewhat by randomly allocating students to three separate interviewers.

It should also be borne in mind that this is a small number of students, at Masters level, and many of them were already experienced in e-learning at the start of the course (52% (11) had studied online previously). Similarly, the evaluation was limited to only the two VLEs mentioned, and a much broader survey would be necessary to validate any findings. The course represented an unusual opportunity to perform an evaluation whereby the VLE was the only variable – the course and cohort remained constant, which would not be the case with any wider research.

A further issue with the data collection is possible bias in the response students gave to representatives of the OU when drawing comparisons between their platform and that of another institution. However, these are mature students and are accustomed to giving honest feedback, and as the researchers were not responsible for implementing either platform, it was felt that this potential bias was negligible.

Survey results

The results of the web survey are shown below:

Have you had experience of using a VLE (virtual learning environment)?

Yes	11	No	10	

Have you used the web interface or the client when using FirstClass?

Web interface only	9
Client interface only	5
Both	5
Not sure/Don't know what the client interface is	2

Have you used the web interface or the client when using FirstClass?

Web interface only	9
Client interface only	5
Both	5
Not sure/Don't know what the client interface is	2

How would your ate the speed of access and performance of the UKEU platform overall?

Very Good	Good	Okay	Poor	Very poor
1	5	6	4	4

How would you rate the speed of access and performance of the OU platform overall?

Very Good	Good	Okay	Poor	Very poor
7	12	2	0	0

How do you rate navigation within the UKeU platform (the ease with which you could find things and get to them)?

Very Good	Good	Okay	Poor	Very poor
2	4	9	5	1

How do you rate navigation within the OU platform (the ease with which you could find things and get to them)?

Very Good	Good	Okay	Poor	Very poor
6	12	3	0	0

How important is the technical environment to your learning experience?

Very important	Quite important	Not very important	Not important at all
13	7	0	1

Did you prefer either of the platforms?

The UKEU platform overall	5
The OU platform overall	15
Did not prefer one over the other	1

How successful was the migration from the UKEU platform to the OU platform?

I had no problems	19
It took me some time to get used to the new system	1
I had some technical problems but otherwise it was fine	1
I did not manage to migrate successfully	0

Issues arising in interviews

The immediate view from the questionnaire is that the OU platform was preferred by most students. However, the interviews revealed a more complex picture. The UKeU platform, being a new development, suffered from performance issues, in that some pages would take a long time to load, and there were occasional downtimes of up to forty-eight hours. The last UKeU upgrade was on the 1 June, introducing additional functionality which students would have had only a small time to adjust to before the platform was withdrawn. The OU platform was more stable and thus its performance was more reliable. In a pure e-learning course such as *Learning in the Connected Economy*, VLE performance is an important issue as it represents the environment in which nearly all study takes place. Therefore the preference of the OU platform was likely to be influenced by this performance factor, which was unique to the UKeU platform, and not typical of commercial VLEs. In interviews, 12 students reported performance problems including slow access, screens 'freezing', access to particular resources or tools and downtimes. These students responded that the performance issue did influence their view of the platform overall.

Additionally, although most students preferred the OU platform overall, they often differentiated between different functions of the platforms, particularly with regard to computer conferences (or discussion groups). In this area nine students stated that they preferred the discussion facility in the UKeU platform, and of the five who stated a clear preference for the OU's discussion system (which uses FirstClass), three of these used the client software to access the discussion . FirstClass can be accessed via both the web and specialised client software. The speed and functionality of the client is usually superior, but some of the integration within a single web browser interface is lost. In this respect it was not possible to make a direct comparison between systems. The remaining students did not express a preference in this area of functionality.

Another important issue that arose from the interviews was the significance of the broader context within which learning takes place. The OU has a student portal, termed StudentHome, which offers personalised information regarding the student's re-cord, general advice from a range of university sources (e.g., advice on course choice), university and regional news, etc. As the UKeU operated as a portal to many different university providers, this level of information was absent. Although the course team did not stress the use of StudentHome (as students had migrated mid-course the focus was on the course area rather than university level information), ten students reported that they used this area and found it useful. Many students stated that they found its presence 'reassuring', since it made them feel part of a wider university, with the associated support. As one student put it 'although I didn't use it much, it was nice to know it was there, I felt part of a university. It was comforting'.

On the issue of integration eleven students (52%) responded that they felt the OU platform was more integrated, five (24%) preferred the UKeU platform and the remainder stated that there was little difference between the two in this respect. Integration is, however, a difficult concept to define, and it was clear that its meaning varied between students. For some it was a matter of design, or aesthetic uniformity, for others it was more related to functionality, and for others navigation was the key issue. Integration within a complex system is a combination of all of these and the interviewers deliberately avoided a tight definition so as to elicit an impressionistic, rather than academic, response. The issue of integration is likely to be influenced by the previous two issues – performance will influence a person's perspective and the presence of the OU student portal can be seen as providing a more integrated experience.

On the issue of integration, one area of discussion that arose from some interviews was the extent to which integration is *desirable* anyway. Four students offered the comment that they felt integration was not important. One student suggested that 'if you've got good tools then that is enough'. Another student claimed that integration may in some respects be detrimental, since it does not expose students to the sort of software they may encounter outside of the educational context, the tools which would be available to them beyond the course, and there was value in 'going out and bringing things back from the web. Doing this makes you more confident because there is no sense of the safety of a hermetically sealed product'.

Discussion

While it is necessary to be cautious about generalising from such a small study, there are some lessons and conclusions that can be drawn from this work. The first is probably the most obvious, but is worth stating, namely that in an e-learning context platform performance and reliability are paramount. The consequences of poor, or unreliable performance can be difficult to predict. They may not always be manifest in standard course feedback parameters, for example, student satisfaction for this course, as a whole and with regard to content, was very high. Students in this course were required to differentiate between the course and the method of its delivery. Some students commented that they engaged in dialogue less frequently than they may have done otherwise because of performance issues associated with the discussion tool in the UKeU platform (pages frequently froze).

A related issue, that should act as a caveat to any conclusions drawn here, is that the OU has gained considerable experience over a number of years with a number of the components of its VLE, particularly FirstClass and the assignment handling system. Thus, the degree to which the component approach represents a good starting model for any institution is debatable.

For those with an interest in the potential of component VLEs, based around the combination of a number of separate components, the results from this research are encouraging. These were sophisticated students, many of whom had prior experience of VLEs and who were acquainted with relevant theoretical developments, such as personalisation, standards and learning theories. From the student perspective the OU platform felt, and behaved, like a VLE. A'Herran (2000) has suggested that there are four perspectives on VLEs, and that different criteria are important within these:

- *For administrators*: scalability, value for money, integration with existing systems.
- *For technicians*: robustness, user base, technical support, ease of maintenance.
- *For course developers or teachers*: customisability, flexibility, integration of legacy materials.
- *For learners*: consistency, accessibility, quality of design.

This research has only focused on the learner perspective, and it is possible that either platform would have provided a different response from one of the remaining perspectives. However, Timmis *et al* (2004) claim that 'to date, the evaluation, subsequent support and use of VLEs has focused on staff rather than learners'. While all perspectives are valid, this is the one, which should probably have the highest priority. The OU VLE is not a fully realised component VLE, in the manner of the Tasmanian LeAP project (LeAP 2004) which uses a service oriented approach to create a flexible VLE:

> The project has guiding principles of interoperability and the use of standards for data and infrastructure. The preferred application architecture model uses a 'service based infrastructure' approach. The reality is that the diversity of products within the educational computing environment makes it impossible to adopt a single approach to application architecture. LeAP considers it good practice to use existing services and create new services as application development progresses.

The LeAP project represents the adoption of the component approach in developing a VLE, whereas the OU experience is that a similar approach is a useful means of combining pre-existing components into a cohesive architecture. Work is currently under way at the OU to further integrate back-end systems and to describe interfaces in a generic manner that facilitates easy decoupling and exchange of components.

The results of this research may indicate a convergence in learning environments between technological developments and a growing maturity in the use of online technologies by learners and educators. The move towards interoperable, service-based solutions makes the notion of a more fluid VLE, which offers different components within the same overall technical framework, viable. In parallel, as learners and educators become more sophisticated with their use of online technologies, the need for systems that are easily reconfigurable to suit the demands of a particular learner or cohort becomes more apparent. Kraan (2003) of the UK advisory body CETIS has suggested that 'the only way in which all subject communities will be catered for properly, may be to forget about monolithic VLEs, and move to collections of specialised tools that do one or two things really well'. This idea can be extended beyond subject

communities to different types of learners also, in essence, is a VLE that is suitable for a first time undergraduate learner the same as one for an experienced e-learner?

The last issue raised by this work, which has implications beyond this course, is that of the role of the broader context in the learning process. While it may seem obvious to state that a VLE does not exist in isolation, and operates as part of a broader institution and educational experience, the role of this wider context is little understood and appreciated. Even before the demise of the UKeU it was being reported that students preferred to study online with well-known providers rather than with new purely online ventures (Berry-Helmlinger 2004). The significance of this wider educational context is sometimes overlooked in the move towards exchangeable content and data. This view typically overestimates the importance of content and underestimates the role of support. For example, McCrea *et al* (2000) suggest that 'more and more content will migrate out of the classroom' with the view that content is like any other consumable. As one student put it on this course, 'the OU looks and feels like a serious organisation – which for a learner nervous about 'unproven' e-learning approaches must have great psychological value'. How this broader context is realised online is only just being appreciated, with the development of personalised portals, and is likely to be an area of growth in the coming years as tools which facilitate informal dialogue are adopted.

In conclusion then, the OU platform was preferred overall. This may have been a result of performance or familiarity however, and should not be interpreted as a complete vindication of the component approach. This evaluation does demonstrate however that the student perspective of architecturally different systems is that they were largely comparable with areas of preference in both, in our case performance and the portal in the OU system and discussion boards in the UKeU one. The implications of this for institutions adopting a VLE or renewing their VLE provision are that the decision should either be determined by strategic, financial considerations or they should decide which specific area of functionality is of prime importance to them, and choose the solution that best serves that need.

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