VLE 2.0 and future directions in learning environments

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This paper looks at the current use of VLEs in institutions, and in particular the shift from commercial to open source systems. The process of technology adoption in institutions is analogous to that of succession in plant communities, whereby successive generations of colonizers alter the environment, making it favourable for other species. Using this notion the future direction of learning environments is examined, and the concept of a VLE 2.0 outlined.

Key words: VLE, virtual Learning Environments, LMS, Learning Management Systems, open source, LAMS, e-learning, technology adoption

Current use of VLEs

Virtual Learning Environments (VLEs) may not be the most innovative educational technology to be found in use today, but they are one of the most pervasive, with 86% of respondents from United Kingdom Higher Education (HE) institutions reporting the presence of a VLE in their institution (2003). This lack of innovation is perhaps why many researchers and educational technologists hold them in something resembling disdain. There are a number of charges often leveled at the more popular VLEs, and particularly commercial ones, which can be summarized as:

- They are content focused;
- They have no strong pedagogy;
- They are based around a teacher-classroom model;
- They combine a number of average tools, but not the best ones;
- They do not feature a particular tool;
- They operate on a lowest common denominator approach;
- They do not meet the needs of different subject areas;
- It is difficult to exchange content between them, despite claims to interoperability.

A 2004 survey conducted by the Organisation for Economic Cooperation and Development looked at e-learning in tertiary education in thirteen countries and a smaller survey by the Observatory of Borderless Higher Education reveal a good deal about the current situation regarding VLEs (OCDE 2005). The survey showed that only 37% of respondents had a single institution wide VLE, while the remainder had a mixture of systems, often with one institutional and then a number of local versions, although 90% expected to have an institution-wide system in the next 5 years. Just over half of the institutions used a proprietary system, often in conjunction with some open source systems.

The OECD survey seems to strengthen the position of commercial VLEs, but this may reflect the history of VLE uptake rather than its future direction. Three factors may see this position gradually undermined:

- Open standards – the development of open standards presents something of a dilemma for commercial VLEs. Customers expect the systems to comply with standards, and yet in doing so the commercial system begins to lose its unique selling point.
- Convergence of functionality – as system converge in terms of functionality, there is little to choose between commercial and open source options.
- Reliability of open source solutions – since 2004 a number of open source solutions have gained momentum to become serious rivals, most notably LAMS, SAKAI and Moodle.

Perhaps of greater interest is what the survey reveals about the other systems that form part of the wider managed learning environment. Only 6.6% of respondents reported an institution-wide content management system (CMS) while 31% reported an institution wide portal, with a further 24% expecting

to implement one within a year. Compare these figures with the almost total adoption of VLEs (only one respondent reported no VLE).

Technology succession

What this demonstrates is that VLEs have achieved a level of uptake and penetration that has been rapid, but has not necessarily caused major disruptive changes. Most VLEs seek to match current practice, certainly much more closely than a CMS for example. In order for a CMS to be used effectively the following contextual factors need to be in place:

- Most content is available digitally – this is not too controversial, as all institutions have a good deal of information available digitally, but this is often administrative in nature and may not be the case for the majority of educational material. It may follow then that there is a requirement for all information to be produced in this way.
- Content is in appropriately sized chunks – without absolutely requiring a learning object approach, for a CMS to be useful it needs to store chunks of learning content that can be aggregated together in different packages (usually courses). The granularity of the resources therefore needs to be suitably small to permit this, which has implications for how academics produce material.
- Reuse of material is encouraged – while a CMS can be used to create content, and is particularly useful when doing so collaboratively, there is an assumption that the resources within an CMS will be reused in different contexts. If reuse is not part of the culture then the value to the institution of the CMS will be diminished.
- E-learning plays a significant role in the overall educational strategy – a CMS is an expensive and sophisticated system, which requires a critical mass of resources for it to be worth the investment. This assumes that the CMS is used to support teaching, and is not an institutional CMS for storing and managing mainly internal, administrative documents.

This demonstrates that a CMS, and many other e-learning systems, including eportfolios, portals and learning design systems require much more extensive social and educational reform to be realizable, whereas standard VLEs have managed to match current practice relatively easily. From this perspective then we can ask to what extent can VLEs be seen as a Trojan horse for other e-learning applications and practices that begin to more seriously change the nature of Higher Education? Portals and CMSs are, arguably, more significant change factors (whether for good or ill), but the VLE can be seen as the *sine qua non* for the implementation of such systems.

There is an analogy with plant succession here. When there is a new environment, for example barren rock, a few pioneer species, such as lichens begin to grow. The acid from these decomposes some rock particles, and their own death creates a coarse soil. This is suitable for mosses, which require little soil, and in turn these decompose to enrich and deepen the soil, until it is suitable for some grasses to grow. The process ends with the establishment of a stable, climax community.

In e-learning terms, VLEs, and in particular commercial VLEs, have acted as the pioneer species, moving in to the new environment and creating slight changes which make the habitat suitable for secondary colonizers. Commercial VLEs have done this *precisely* because they match the current model of practice, and match the standard purchasing and support model, ie not in spite of the drawbacks outlined above, but because of these.

However, in a succession model the role of colonizers is to adapt the environment for secondary colonizers. This is where current open source VLEs now come in to play, particularly systems that begin to specifically address some of the pedagogical needs of e-learners, such as LAMS and Moodle, as well as closely integrated systems such as portals and eportfolios. The kind of environmental changes wrought by commercial VLEs include general acceptance of the e-learning approach, integration with administrative systems, staff development, recruitment of enthusiasts, changes in assessment practice, acknowledgement of tools already used by students, and so on.

Once secondary systems have been established, then the environment would be more receptive to systems that require more radical changes in practice, such as CMSs and Personalized Learning Environments (PLEs).

Some case studies

The UK Open University

The UK Open University (UKOU) is a distance education university, and often operates with large student numbers, for instance there are around 300,000 registered users on its discussion systems and some courses have cohorts in excess of 10,000. As such, the requirements it has of educational technologies are not the same as those of more traditional, campus-based institutions. This has led to the UKOU developing a history of innovation and implementation of ICT in its teaching materials, but often this has occurred at the course, rather than institutional level. The UKOU thus faced the sort of tension detailed above, most academics had been accustomed to developing their own specific tools, and were acting in revolutionary mode, while as an institution the University recognized the need to make e-learning provision part of the mainstream and to offer a uniform quality of experience for students with regards to the technology they encountered on different courses.

In 2004 the UKOU launched a VLE project. It was in the unusual situation of having developed or bought in a number of tools and systems that commonly constitute a VLE, without having these integrated in to a recognizable VLE architecture. The tools it already possessed were:

- Discussion and conferencing - through OpenText's FirstClass system;
- Authentication - handled through an LDAP compliant in-house system that allowed single sign on across all OU systems;
- Template driven content delivery - via an in-house system, Promises;
- Blogging - available on some courses through MovableType and an in-house ColdFusion driven system;
- Audio conferencing - Lyceum, an in-house product had been successfully deployed on a number of courses, particularly in languages (eg Hampel & Hauck, 2004);
- Assignment handling - a large scale system had been developed in-house to match the UKOU's award process;
- Assessment – a combination of QuestionMark Perception and an in-house product, Open Mark, were used, although there was no enterprise solution, and practice varied.

After an extensive review and consultation process it was concluded that a service oriented architecture (SOA) approach that integrated existing applications and the development (or procurement) of tools to fill existing gaps represented the best option. However, while SOAs have gained a good deal of attention, there are relatively few examples in operation. One is the Tasmanian LeAP project (2004) which uses a service oriented approach to create a flexible VLE. Perhaps the best known of such approaches is the SAKAI initiative (http://www.sakaiproject.org), which aims to deliver the following components as open source.

So, while a SOA represented a good architectural vision and was a worthy goal, there were also more pragmatic needs regarding the timely roll-out of the VLE and also the need to provide clarity to a number of related projects which would be interfacing with the VLE. For example, an eportfolio review was under way and this needed cognizance of the implementation of any VLE and detailed technical integration methodology.

A further review concluded that the adoption of the open source VLE Moodle represented a practical middle-ground between a fully developed SOA approach, and a proprietary VLE. The advantage of the Moodle option were as follows:

- Its existing tool provision allowed the UKOU to shortcut the development of some tools;
- The system could be integrated with existing systems;

- Access to the source code meant the system could be adapted to our specific needs and to our development plan, rather than waiting for releases;
- It mapped on to the UKOU's strategic directives, particularly that of being a leader in modern pedagogy and technology;
- The UKOU could contribute to and benefit from an existing Moodle community.

It is estimated that the adoption of Moodle will reduce the implementation time of a service oriented VLE by 25% in the UKOU. Currently Moodle has been integrated with the existing authentication system, assignment handling and FirstClass. The existing assessment tools within Moodle will be utilized, although in some instances integration with OpenMark will also be deployed. The content delivery, management and navigation functions of Moodle will be adopted wholesale, although with customization to a UKOU look and feel.

State University of New York

The State University of New York (SUNY) has 64 campuses distributed over New York state. It also offers an extensive online programme through SUNY Learning Network, which has over 100,000 students, 3,000 staff and 40 of the campuses participate. Any VLE system therefore needs to support purely online, blended and campus based education, over a widely distributed system.

In 2005 they embarked on an extensive review programme to find the solution for their next generation VLE (having used the IBM Lotus Notes/ Domino system for a number of years). Their final recommendation was for a component approach, which combined uPortal, LAMS and a range of other open source tools, which they believe 'Provides a much richer feature set than any currently available single-platform LMS' (SUNY 2005).

The SUNY solution is summarized as 'a component strategy, as no single-platform LMS solution exists today to meet our needs. This powerful component strategy would integrate several carefully chosen Open Source projects, each with strong technical compatibility, resulting in a whole far greater than the sum of its parts'. This is unusual in a number of respects. Firstly, it places the portal at the centre of the system, rather than a VLE. Secondly, their process places a strong emphasis on the Learning Design specification, with it being one of the five key criteria that was used to determine the final system. This leads us on to the next noteworthy point about the SUNY solution, namely the selection of LAMS as their main VLE tool. While LAMS has gained a lot of attention and been successfully deployed in local contexts, it is rarely employed as the central system. The SUNY implementation will be an interesting test of how well LAMS manages this promotion to centre stage. The last point of note from the SUNY study is the conclusion of a component strategy, as with the UKOU a service oriented architecture was recognised as the optimal solution in terms of pedagogic requirements and flexibility, but existing open source solutions provided a convenient means to achieve this in a short timescale.

New Zealand open source VLE

Moodle was selected by The New Zealand Open Source VLE project to form the basis of their collaborative development. The project is a coalition of twenty tertiary education establishments in New Zealand who have committed themselves to using and developing an open source VLE. This is driven by a desire to share the costs of e-learning development. This made an open source option the most logical choice, so it was not a choice between open source and proprietary but rather a choice between open source alternatives.

Their objectives of the project are to (Wyles, 2004):

- Significantly reduce the total cost of ownership at a system wide-level;
- Select and contribute to open source communities;
- Encourage collaboration and user networks;
- Reduce to barriers to entry: technology, support and professional development;
- Accommodate flexible pedagogical approaches;
- Support localisation - including Maori and Pacific Island languages;
- Advocate for interoperability;

- Act as a catalyst for innovation.

They evaluated three open source options in detail: Moodle, ATutor and Ilias. They used two frameworks for their evaluation: Chickering and Ehrmann's (1996) seven principles of pedagogy and technology selection and Britain and Liber's (2004) Framework for the pedagogical evaluation of e-learning environments.

They chose Moodle in 2004 because they felt that it offered:

- An open and active community with a critical mass of developers;
- A modular system architecture;
- Relatively easy integration with other systems;
- A course/student focus rather than tool-centric;
- Adaptability.

Using Moodle as the basis, each of the participating institutions creates a distinctive and localized version. The second stage of the project is focusing on the development of additional tools such as a personalized portal, personal development planning (PDP) tools, e-portfolio, simulations and instructor support tools.

VLE 2.0

What the three case studies demonstrate is that open source solutions in particular now represent a viable enterprise solution for many organizations. This highlights the process of technology succession in action. Having established a base level of practice with existing applications, usually commercial or in-house, the institutions in question have then reviewed their position, and opted for open source solutions, which provide both the flexibility and robustness they require.

This brings us on to considering the future direction of learning environments. One useful way of thinking about how learning environments might develop is to look at current trends in internet technologies. Given the somewhat conservative nature of Higher Education establishments this is often a good indication as to where institutional solutions will be heading. A useful term for summarizing the current trends in internet technologies is that of 'Web 2.0'. As a number of different applications and uses of the web began to become popular, there was a feeling that these represented a new phase of internet usage, one that was the result of the growing competence of users, the ubiquity of connection and the low cost of data storage. Web 2.0 can be seen as an umbrella term to describe some collective trends in the use of the internet. As such it may be a term that fades as quickly as it has risen, but for our purposes, particularly given the lag between general internet usage and institutional adoption through learning environments, it is a useful means of thinking about the challenges that VLEs will need to face over the coming years.

Web 2.0 is often specified in one of two ways – either as a way of thinking about the internet, or as a set of technologies that embody these principles. Although there is some debate as to who was responsible for the term, the publisher Tim O'Reilly is often associated with the term, and he clarifies what it means in an article 'What is Web 2.0?' (2005), and sets out a number of principles.

The first of these principles is the notion of the web as platform. This was an idea that first surfaced with much of the initial dot com hype. It challenged Microsoft, amongst others, because it suggested that the web browser essentially replaced the desktop operating system. In this view Netscape became the new Windows. That didn't come to pass, but O'Reilly suggests a crucial difference this time around, which is personified by Google. Whereas Netscape was based around a software product, Google is based around a service.

Another principle, and one that has relevance for education, is that of 'harnessing collective intelligence'. Wikipedia is an obvious example here. This ability to harness what James Suriowecki (2005) calls the wisdom of crowds is partly what sets aside successful e-commerce sites such as e-bay and Amazon. This seems to be one of the key principles, that users add value and the technology or site needs to be set up so

that it encourages participation. This shift to co-ownership of information and technology challenges the conventional hierarchical model found in traditional broadcast media.

In terms of software development, Web 2.0 applications operate a much more evolutionary model, continually adding new features and monitoring the use of these. Because the applications are all delivered online this can be achieved without the need for a major update and release of software. O'Reilly suggests that:

> *Users must be treated as co-developers*, … The open source dictum, 'release early and release often' in fact has morphed into an even more radical position, 'the perpetual beta', in which the product is developed in the open, with new features slipstreamed in on a monthly, weekly, or even daily basis….
>
> Real time monitoring of user behavior to see just which new features are used, and how they are used, thus becomes another required core competency. A web developer at a major online service remarked: 'We put up two or three new features on some part of the site every day, and if users don't adopt them, we take them down. If they like them, we roll them out to the entire site'.

A further principle is that of lightweight programming models. The key to these models are that systems are loosely coupled, rather than tightly integrated. This facilitates the 'perpetual beta' model and also means that tools and services from other providers can be easily assimilated to make the overall system more powerful. The RSS method for syndicating information is also part of this approach, and this allows different information sources to be assembled to make a personalized and customizable interface for a user. The approach is summarized as 'innovation in assembly', whereby value is added by assembling a number of different components together in a useful manner. This may have been achieved through hardware previously; for example, Dell computers assemble components to produce PCs that suit a user's needs. With the sort of lightweight programming models now in practice, the same approach can be applied to tools and services.

Having looked at the Web 2.0 concept in general, we might now consider what the implications are for VLEs and e-learning, in short, envisage a VLE 2.0. Just as Web 2.0 can be framed both in terms of technology and mindset, so a VLE 2.0 can be considered from two perspectives. Firstly, how would a VLE 2.0 be constructed, and, secondly, what would VLE 2.0 education feel like? The two are not the same, and Downes (2006) has coined the term 'e-learning 2.0' particularly to refer to the latter.

Taking the technology aspect first, it seems fairly obvious to state that a VLE 2.0 would be based around a service oriented architecture, but there are a number of implications from this that are worth exploring. The concept of innovation in assembly is derived from the web services approach. This requires not only a technical adjustment, but also a cultural one, in how we develop and think of tools for use by students. The tendency up until now has been to develop tools that meet the specific needs of a course or set of students. The emphasis now is on developing tools that can be reused in different contexts and assembled in different ways.

The notion of 'perpetual beta' does not sit very well with some of the support and quality requirements of Higher Education, but it does suggest a method of VLE development. In this model, a new tool can be integrated in to the VLE, but only released to specific students. Following the evaluation of this, the tool is then made available to all students and academics. In this way the VLE becomes the conduit for new technologies, and accompanying good practice, that can be disseminated university wide. The lightweight programming models and perpetual beta go beyond software development methodologies however. As we saw with the processes for selecting a VLE, these can be seen as embodying deeper values of the institution. Most Higher Education institutions will favour rigorous, consultative approaches when developing or adopting software with the specification process taking months and maybe years to complete, with the intention that the system will be in place for a suitably lengthy period. Such an approach does not match well with the faster, loose knit, rapid turnover mentality of the Web 2.0 approach. Whether this conflict can, or should, be overcome will play a large influence in the direction of educational technology over the next few years.

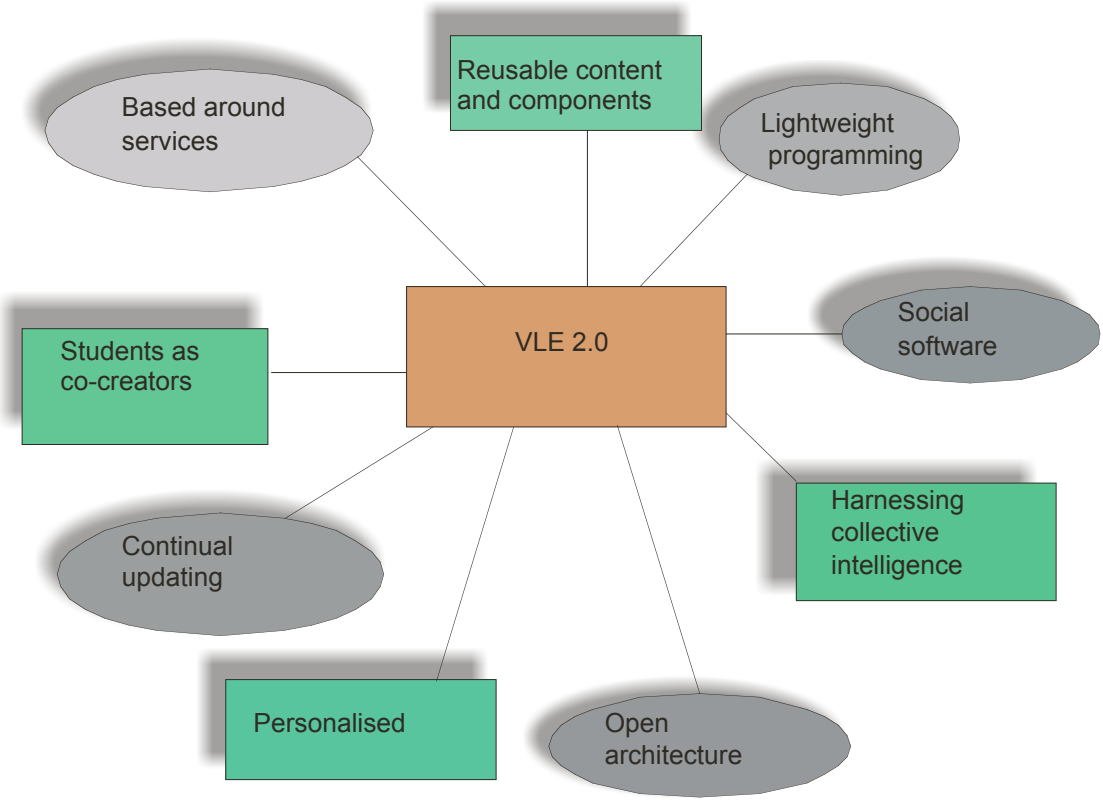

Figure 1: The VLE 2.0 concept

The VLE 2.0 concept is summarized in Figure 1. A VLE 2.0 need not necessarily be open source, although many of the principles are in line with the open source philosophy, and as we saw with some of the case studies, an open source system can meet the needs of both the conventional and lead users. What is more important is that it is an open architecture, based around standards, so that the sort of easy coupling and decoupling of tools mentioned above can be accomplished. It is likely, however, that a VLE 2.0 is much less of an 'out of the box' entity than current VLEs, as it will be constituted from a range of tools and services and configured differently for different users. It is unlikely that all of these components will come from one provider, some may be commercial products, others open source and still others in-house solutions. Given their open approach a number of these services will be from outside the educational sector, for example by incorporating Google or Flickr tools into a VLE. Users will become increasingly unable to determine that they are using a different application, as these can be adapted to meet the needs of the institution.

Although the VLE is likely to be an institution-wide one, localization and adaptation can be realized through a service oriented approach, and is in keeping with the Web 2.0 principle of lightweight assembly. Thus the medical school in a university may have a different configuration of tools than the business school, but both are using the same underlying VLE.

The portal approach to assembling information and tools seems more in keeping with the Web 2.0 principles, with increased emphasis on the sort of MyUniversity space. In terms of VLEs then this may see portals occupying a more central role in the overall MLE, or VLEs becoming more portal-like in their operation.

In terms of the impact upon educational practices, the principle of collective intelligence is probably the most significant. This could be realized in a number of ways, but at its core is the idea of students as co-creators of content. This could be in terms of creating chunks of content that populate a resource pool, or

in making course content available in a wiki so students can modify it, allowing students to mark up content and create shared bookmarks, and so on. The content thus evolves over subsequent presentations as each cohort modifies it.

Another principle that has wider implications is that of reuse, which is inherent in the Web 2.0 way of working. In terms of applications this means reusing tools and components, but once reuse is common practice, the same may apply to content and pedagogy also. Thus tools which facilitate reuse, such as LAMS, will be central to a VLE 2.0 approach.

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