The bigger the better?
A new look at Virtual Learning Environments

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***Abstract* – In this paper, a new approach to Virtual Learning Environments is presented. These systems are considered as tools to aid communication both *between* teaching staff and students and *within* the student body. Two alternatives to commercial systems are considered, both of which are free to the user and do not enforce any pedagogical model upon teaching practice. The authors conclude that for a technical environment it is often best to do away with the Virtual Learning Environment completely, and within non-technical environments a simple, resource sharing application such as the one presented here makes sound pedagogical, technical and financial sense.**

I. INTRODUCTION

From the moment they appeared in schools and colleges, computers have been used in teaching and learning. Within those disciplines where computers themselves are the subject matter, they are naturally used to teach Information Technology and Computing skills. As well as using computers to learn how to use computers, software has been produced to enable computers to assist in the teaching of other subjects. Initially, custom built subject specific teaching programs were created to aid in the learning of specific skills or concepts - an early example of such a system that all readers will be familiar with is Logo, the original turtle graphics program. This was one of the first pieces of educational software and has been used for decades to introduce students to mathematical and programming concepts (and has been the subject of much research - see, for example [11]).

More recently, a new type of computer program has emerged - the Virtual Learning Environment (hereafter VLE). These packages are designed not to illustrate specific concepts or to train students in specific skills, but to support student learning in a very general fashion. The emergence of these systems can be linked to two main developments – the first is the ubiquity of networked machines in the age of the Internet, and the second is the expansion of higher education and the increased reliance on learning distributed both in time and in space. The current authors see the primary aim of these system as being to facilitate communication between staff and students by providing an integrated "Virtual Environment" in which this communication can occur. The phrase "Virtual Environment" is perhaps a little grand for the reality: these systems are typically implemented as database driven websites.

This paper is about this new type of software. Section II features an outline the main functions these VLEs offer, and highlights the major similarities and differences between existing systems from technological and pedagogical perspectives. The analysis of VLE functionality presented in Section II feeds into a consideration of two alternatives to the market leaders. In Section III we consider abandoning the VLE approach completely and adopting instead a combination of existing technologies. In Section IV we present a new VLE that differs significantly from commercial offerings.

II. THE ROLE OF THE VIRTUAL LEARNING ENVIRONMENT IN HIGHER EDUCATION

There are a number of papers comparing one virtual learning environment with others, and surveys of the most popular options (see, for example, [3, 12, 7]). These comparisons consider the obvious similarities and differences in functionality, aspects such as ease of use for staff and students, and perhaps most significantly cost. Cost can be cast in terms of material costs such as that of server and software purchase, hidden costs such as the cost in people-hours of training or retraining teaching staff, and the need for technical expertise to install and maintain any server technology. Given the existence of such comprehensive surveys, there is no need to enter into a great deal of detail here.

A new approach to evaluating the usefulness of these VLEs is proposed in [2]. In this paper two grounded frameworks for the evaluation of these environments are discussed. The first is pedagogical, and based around the conversational model of Laurillard [9]. This model emphasises individual interactions between student and teacher, and has its roots in the Socratic tradition. The second has its academic grounding in organisational theory but also emphasises the role of individual student-teacher interactions: what is studied is not the pedagogical nature of these interactions as with the first framework, but the organisational ease with which it is possible for a tutor to set up a large number of interactions with individual students. A further framework worth considering when evaluating learning technologies is Mayes' taxonomy of courseware (see, for example, [10]). Here, Primary courseware is that which allows direct instruction (lecturer talks, students listen). Secondary involves discursive dialogue, and Tertiary permits discussions *between students* allowing the development of

courseware that directly addresses the learning needs of students – this necessarily involves dialogue of some form or another.

The key concept in these evaluative techniques is that of an "interaction", and this ties in with our earlier emphasis on the communicative aspect of VLEs. Students and tutors need to communicate with each other and amongst themselves, both in the real world and within these virtual environments. These communications repay in-depth analysis, and through such an analysis it is possible to divine what exactly a VLE attempts to enable. Do they simply replicate real world styles of interaction? Or can they facilitate something entirely new? We suggest 5 distinct forms of interaction based upon number of contributors, type of contributor and whether or not the interaction can be thought of as "discursive" (ideas communicated with an expectation of comments, comeback, correction or clarification) or "published" (where an idea is communicated with the expectation that it will be digested as-is).

- **One-to-one: Student and Tutor** The one-to-one tutorial is an increasingly rare beast in the real world, but in the virtual world email is the obvious analogue and is frequently used to communicate.
- **One-to-one: Student to Student** An often overlooked learning mechanism is that of students discussing work amongst themselves. Some VLEs can help facilitate this with links between "bulletin boards" or "discussion rooms" and individual email functions.
- **One-to-many, Published: Tutor to students** This mode of communication has its roots in traditional chalk and talk lectures, and in VLEs the analogue is the publishing of notes for students to digest.
- **One-to-many, Published: Student to students** This mode of communication has its roots in students sharing articles they find with each other. On the Internet, this can be as easy as one student recommending a URL to the others in a class. This fits in with Mayes' tertiary learning category - the students' actions can be interpreted as saying "I found this difficult, but that article helps".
- **One-to-many, Discursive: Tutor and students** This mode of communication has its roots in the traditional University tutorial. Within VLEs "discussion rooms", or "bulletin boards" serve this function. A tutor or a student can post messages, which can then be responded to by other students or other tutors. In a culture of lively bulletin board usage such as that outlined in [1] one frequently finds that students answer each other's queries. In such a culture, these discussion forums can often lead to robust student feedback on aspects of teaching style as well as academic content[1]. Again, this fits in with Mayes' tertiary learning category.

Commercial VLEs have a design which is driven by their customers. This can lead to what is known in Computing as *Feature Creep* - the tendency for extra functionality to be added on an ad-hoc basis, without consideration for the design or pedagogical function of the system as a whole. Thus, you have VLEs offering file upload pigeon holes, proof reading facilities, timetabling options, scheduling software, multiple choice questionnaire authoring tools and other form-based types of interaction (for both summative and formative assessment), live chat, ... These functions are all useful in some situations, but the current authors doubt that anyone anywhere uses all of them. With so many functions available to the user a problem of interface design presents itself - creating a simple and easy to use interface to a highly complex system is a difficult task, and the result is often confusing to both students and teachers. Thus, these functions can distract from the core function of the VLE, which is to facilitate communication.

One "hidden" benefit which those evaluating VLEs often fail to consider is the acquisition of transferable IT skills by both staff and students. The extent of this benefit is very dependant on the VLE in question: some of these learning environments go a long way towards hiding the technology and wrapping the interface in layers of metaphor (for example, navigation aids become stairs in a virtual building, interaction happens in a virtual classroom). It is clear to us that the more tailored and unique a VLEs interface is the less useful and transferable any operating skills become. Computing as a discipline is saturated with metaphor (bus, memory, web, web*page* …) and the usefulness of adding to these is worth questioning. In [4] Clark and Boyle go even further and argue that in the context of the internet there is no need to provide an extra metaphor for those raised on the web.

The costs of commercial offerings are high. The software itself invariably costs heavily, and the hardware required to mount these packages can also be punitively expensive. As [3] shows clearly, it is difficult to determine exactly how much a particular VLE will cost, as licensing depends often upon type of institution and number of users but most packages seem to cost at least £2,000 per annum for the most basic form of license, and can cost as much as £25,000 per annum. This cost is for the software alone.

[1] Such feedback can be a little too robust at times, as students new to electronic communication can find it easy to criticise from behind the pseudo-anonymity of a keyboard. Nevertheless the current authors concur with those of [1] in that rude feedback is valuable feedback nonetheless.

III. A HANDFUL OF PACKAGES

An approach which is used in many institutions is that of multiple packages. Websites distribute material from tutor to student, and can be as elaborate as the tutor's skills allow. Electronic mail allows for the various forms of one-to-one communication, and has the great advantage of being low cost (in terms of software, training and bandwidth). In many institutions a local Usenet server is run - at the University of Leeds there is an institutional server carrying world Usenet and a few course-specific groups, and within the School of Computing there is another, purely local server with at least two bulletin boards for each module (one for announcements, and one for discussions). These bulletin boards can facilitate the discursive one-to-many forms of communication with ease: as well as module or course specific groups there are software specific groups (e.g., local.talk.c-plus-plus). Staff and postgraduate students use these groups to communicate and ask for help in exactly the same way as undergraduate students. This has led to a lively electronic discussion culture exists. For a more detailed investigation of this system see [1].

This approach can be adopted by default: early adopters of electronic communications technology may well have installed such systems and developed course websites long before VLEs arrived on the scene. And for the technologically adept, the advantages of using this approach rather than an integrated VLE are manifold. The transferable skills gained by staff and students are truly transferable. The software required is minimal and comes for free in many cases - for the students, it is possible to pay money for web browsers, email clients and news clients, but these tend to be exceptions rather than rules. For the server side of the equation again these pieces of software are available for free, and most institutions run a web server and an email server already. Anecdotal evidence suggests that local Usenet servers are also very common in academic institutions.

The disadvantages are as obvious as the advantages: you have to maintain different systems and your students have to be familiar with different systems (news, email, web). The technical skills required to maintain multiple systems are clearly more varied than those required to run one. Different accounts and security systems have to be available for each medium (one account for email, one for Usenet, one for any coursework submission system etc…).

Thus the current authors recommend the multiple packages approach to those who require the communicative facilities presented by a VLE, but are working in a technical environment. In a Unix environment, for example, people are used to working with a philosophy in which a number of small tools each do one job very well. A person working within this sort of environment will appreciate the multiple systems approach. Within the familiar and superficially user-friendly environment of beginners or applied computing, an approach which presents a simple and unified means of communicating with teaching staff and other students will enable much more rapid use of the technology.

IV. THE LIZARD: AN ALTERNATIVE VLE

The Lizard Learning Network (hereafter LLN) is a simple web driven application that differs from both the handful of packages approach and existing commercial VLEs. The system was designed with two main priorities. Firstly, it was to facilitate the communication types outlined in Section II. Secondly, it was to do so as simply as possible. Simplicity has served as the driving force behind all design decisions made during the construction of the LLN. In this way, the authors hope that the system is as transparent and accessible as possible for all users of the system. All users naturally includes teachers, students, and administration staff, but also any programmers that wish to extend the system and any other computer systems that wish to make use of the content stored within the LLN.

This last point hides some detail: the LLN is "Open Source" software under the Gnu Public License. This means that as well as being free to download and install, institutions or individuals can, if they wish, modify any aspect of the program as long as changes are sent back to the original authors. Further details of this can be found at the LLN's open source home:

https://sourceforge.net/projects/thelizard/

The principal benefits of the system for the users (teaching staff, students and administrators) are:-

- The system mirrors the needs of the user.
- The system does not enforce a pedagogical methodology.
- The interface is simple, consistent and multilingual.
- The system is easily accessible to those with disabilities. (In the UK, this is shown by SENDA compliance).

This paper is not a technical outline of the LLN. However, it is worth mentioning that there are several advantages to working with the LLN for developers:-

- Very simple relational database design.
- Interface presented in XHTML 1.0 and CSS 1.
- Easy to understand, well documented PHP source code.
- Simple open source licensing.
- Active, contactable development team.

The LLN is based on the sharing of resources both as published documents, and as dialogues. If the author

chooses, the information stored within the system can be accessible to anyone with an Internet connection and a web browser. For published modes of communication, the LLN also acts as a web server of sorts. In contrast with many content management systems, every document stored in the system has a permanent and valid URL e.g.: http://www.lizard.dept.edu/frank/reports/plato.html rather than a dynamically generated program instruction. This means that when a resource is created within the LLN, it is available to anyone the creator chooses using a simple web browser, from anywhere on the Internet.

With the spread of network computing within education, and the resultant heterogeneous computing environments, systems developers and project managers are searching for standards to implement in their systems to aid interoperability. Wisely chosen standards can be useful when working on joint projects with other institutions, or when developing new systems where others in an institution would like to have access to your content. Development driven purely by technology or gadgetry can lead to a tendency to re-invent the wheel from time to time: standards work to prevent this extra workload and ensure your systems are accessible to others by defining in advance what types of information or metadata are appropriate.

The trouble with standards is that there are so *many* of them: trying to choose the "standard standard" can be a research headache for developers who just want to get on with supporting their users. The solution employed in the LLN is to make the content, presentation and metadata logically separate in the system. This means new presentation, content or metadata standards can be added where appropriate, without affecting the working of the system.

An example of the utility of this approach to standards is in the area of *metadata*. Educational metadata allows the description of resources for easy indexing and searching. However, there is not yet an overall winner in the race to find a standard metadata format. Thus, the LLN supports the two most common educational metadata standards, Dublin Core [8] and IMS metadata [5]. These can be stored in multiple languages for simple internationalisation, simply plug into the system as database tables, and can be unplugged or replaced by simply adding or deleting a table without affecting the rest of the system.

In line with the styles of interaction laid out in Section 2, the LLN also supports student publishing. Any user may publish work, create new resources, or recommend resources to other users. This allows students to share their knowledge and resources with their peers, an example of Tertiary learning as outlined in [10].

One final advantage of the LLN over commercial VLEs is in cost of hardware and supporting software. As well as being free software itself, the LLN has very basic hardware requirements and will run on hardware many consider obsolete. The operating system of choice for the LLN is OpenBSD, a fast, secure and stable version of UNIX available free over the web. This operating system is best for getting the most out of old hardware, and is well documented. However the LLN will also run on Windows, Linux, Solaris, NetBSD, FreeBSD and Mac OS X (or indeed any other operating system which supports PHP, MySQL and Apache).

Finally, and perhaps most importantly, as the LLN is a simple resource sharing application there is no enforcement of pedagogical methods upon users. Whilst the idea of the virtual classroom that many systems present is intriguing, most academic staff use real classrooms, and simply want to get their resources distributed to students, and interact with their students as teachers have been doing in one way or another for thousands of years. Through its emphasis on communication, the LLN supports education independently of any specific teaching methodology or technological metaphor.

Source code, documentation and the install CD are available on our website (http://lizard.chrispyfur.net) or our project space on the open-source developers network (https://sourceforge.net/projects/thelizard/).

V. CONCLUSIONS

Whilst some commercial packages have some appealing features such as online tests and scheduling, they limit the user with these same features. Locking users into using the proprietary, often complicated applications results in higher training costs for deployment and later to difficulty when requirements change. A simple web based resource sharing application allows users to publish online tests just like any other document. Thus, common VLE features such as timetables can be generated by existing institutional software, and simply published just like any other resource.

The commercial Virtual Learning Environment marketplace has a wealth of superficially attractive products. When considered from a pedagogical perspective, however, they can be over complicated and restrictive in the methodology they force teachers to adopt. Concentrating upon the modes of communication common to all teaching and learning allows us to strip down the "virtual environment" to an absolute minimum, and still allows us to work effectively - more effectively, we argue, as the environment in which we work is less complicated.

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