ISBN 1-903815-06-1

Learning and Teaching Support Network

LTSN Physical Sciences Practice Guide

# Virtual Learning Environments

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Published by the LTSN Physical Sciences Centre

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# Introduction

The aim of this practice guide is to introduce the concept of an important computer technology that is currently having and will continue to have a big impact on teaching in Higher Education, with an emphasis on science based teaching.

Over the years computer tools have been developed to support teaching, such as assessment or communication tools. In more recent years technology developments have enabled these tools to be combined into single products, called Virtual Learning Environments, or VLEs. Therefore, a VLE can be defined as a self contained computer based (web) environment enabling interactions between lecturer and student.

Unfortunately, as with all computer-related technologies there is usually some confusion with terminology and VLEs are no different, with the term MLE (Managed Learning Environment) often being used interchangeably with VLE. A VLE handles information directly related to student teaching, which covers things like lecture notes, online discussions and perhaps student grades. As its name suggests, an MLE deals with other information which may not be directly connected with teaching 'in the classroom'. This information could include student personal details and information such as module or financial information. Therefore, a VLE is really a subset of the information contained within an MLE. So, whilst a VLE can cover a lot of what an MLE offers, an MLE can offer much more in the way of information management.

MLEs are closely associated with the concept of the student Intranet, a closed network available to registered users only, compared with the Internet, the global network accessible by everyone. An Intranet (in theory at least) will allow the student to log into services and information specific to their needs. This means that the technology coordinates the flow of information between different systems, such as student records and departmental information and presents it to the student. MLEs follow the same principle in which information from different sources can be linked together in a customisable manner that suits the end user.

Certain products available on the market are capable of acting as both a VLE (purely teaching support) and an MLE (integrated information management) so an MLE might be employed to operate like a VLE but has the additional functionality of an MLE if required, hence the interchangeable terminology. For the purpose of this guide the term VLE shall be used since the focus is on direct teaching support, rather than the more complex issue of total student information management within an MLE.

Having put all this jargon into context a large part of this guide will actually focus on the use of VLEs to teach science effectively rather than simply how to use the technology. This guide will therefore highlight the background to VLEs, discuss the various tools available within a VLE and provide ideas and information about how VLEs might be used effectively to support teaching and learning within a science context.

## What is a Virtual Learning Environment (VLE)?

A VLE is an online (computer) environment, where various tools are provided for the student to facilitate their learning experience. Some VLEs require specific software to be installed on the user's computer but most VLEs operate across the World Wide Web, so you often only need an Internet connection to access a VLE although access will be restricted to registered students by the lecturer. Figure 1 illustrates the core features of a VLE.

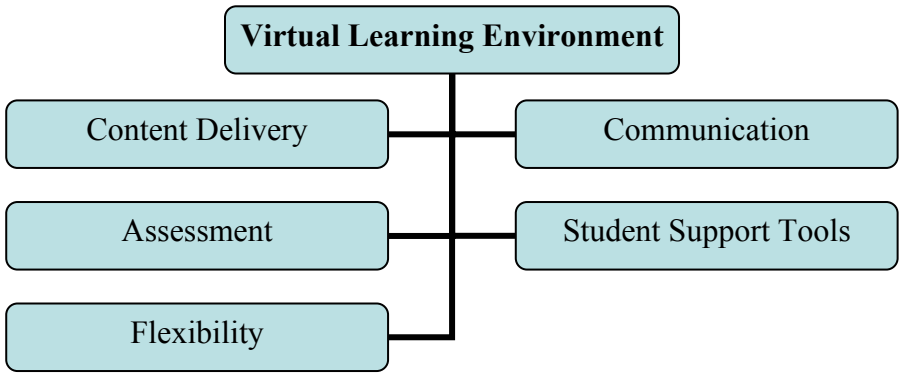


**Figure 1.** A VLE offers wide ranging functionality

## More on MLEs

Whilst this guide is going to focus on the features of a VLE in direct relation to learning and teaching, it is worth just briefly mentioning the reason for the evolution of MLEs and their future potential within Higher Education Institutions. If you consider a student within an institution, there is a lot of information which is connected with them, ranging from personal details (addresses, qualifications etc.) to exam results and module choices. Much of this information is held by different people and in different databases.

It is essential that this information is accurate, not duplicated and accessible by relevant people (including the student) in a quick and reliable manner. Therefore, the management of this information is very important. Figure 2 visualises the way different resources and information sources can link together in an MLE.

It makes sense that one system should be capable of coordinating and linking all this information together in a seamless fashion, hence the development of Managed Learning Environments. Therefore, MLEs are evolving which can link all the various databases of information relating to students into one coherent form. One small example of this is tying student records in with module choice so that a student can access their marks for the modules which they have taken.

In a learning support context, a student can be provided with resources specific to their own course or module, or have access to customised external resources such as journal archives or scientific data sets. Technological developments already allow (to a great degree) a student to log in to an MLE and have customised access to their own

records, teaching material and even more extraneous information such as news feeds, weather reports and even pay fees online.

Due to the complexity and work involved in coordinating all this information and various services, the adoption of an integrated MLE will almost certainly fall within the remit of the Institution rather than any individual. This should follow extensive consultation and adoption of a formal strategy for implementation.

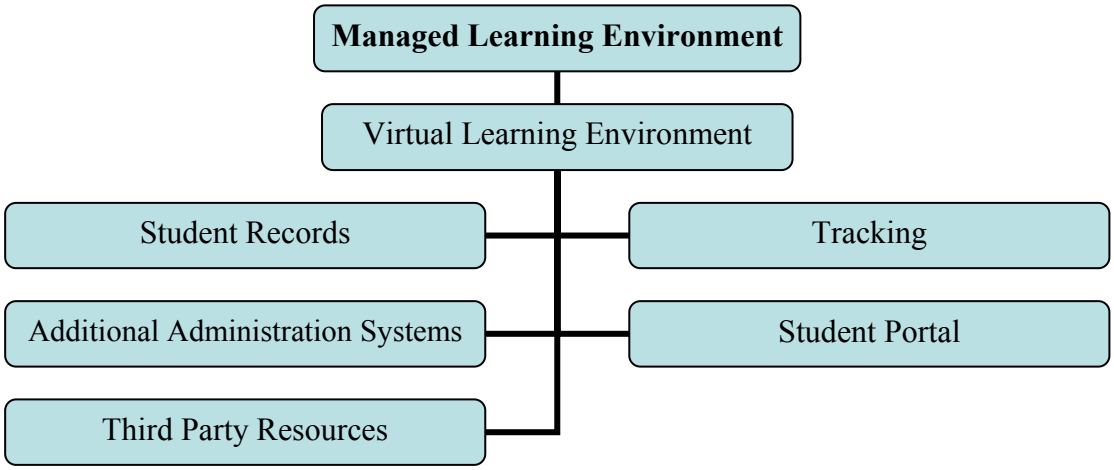


**Figure 2.** An MLE encompasses the tools of a VLE

# Why use a VLE?

If we now consider the case for using VLEs to support learning and teaching it is useful to consider what face to face teaching can offer in order to foster learning:

- Information delivery
- Peer support
- Group work
- Self assessment
- Formative/summative assessment
- Lecturer-student communication
- Tutorials

A VLE provides a range of tools to apply the same teaching and learning principles, but delivered online in a 'virtual' environment. Thus, using computer technology does not involve a whole new approach to teaching; it is just the same methods but applied in a different manner. However, this means that the same thought and consideration must also be applied to online teaching as you would do face to face.

To take a fundamental example, many lecturers now transfer their lecture notes to the web. There is nothing inherently wrong with this but the lecturer must consider how the students are going to use these notes. Is the student expected to read and comment on the notes, will they be assessed on them? If the lecturer has no real purpose for offering the notes then what is the point of giving them out in the first place?

It is important to realise here that exactly the same sort of questions apply equally whether the information is paper or computer based, hence the teaching method is more important than the technology. Hence, technology should not be used for the sake of using technology but with a specific teaching purpose in mind. Having said that, in what way can VLEs help support learning and teaching?

In addition to supplementing traditional face to face teaching methods there are a number of challenges in Higher Education which VLEs can help with and these include:

- Increased student numbers
- Automated assessment
- Widening participation
- Improved access to limited resources

The reason VLEs have become so popular and embedded in many institutions is because there are real benefits to be gained from the use of the technology. Ever increasing student numbers is one obvious aspect of Higher Education where VLEs can help. They can maintain good communications links and there are opportunities for automated assessment. In terms of widening participation VLEs can provide support and resources to say, part time students who can't always travel to the campus.

## What products are available?

There are a plethora of commercially produced and home grown products available, probably too numerous to mention in one go. The following list of products is therefore just a sample of commonly used products or current market leaders in either FE and/or HE, in no particular order.

### COSE

Developed at Staffordshire University around sound pedagogical theory, this product is free.
http://www.staffs.ac.uk/COSE/

### Learnwise

This was originally developed at the University of Wolverhampton and is now marketed as a commercial product by the Granada Learning Group
http://www.learnwise.com/

### Blackboard

Blackboard is an American company that started around 1998 and is now one of the larger vendors of commercially developed MLEs. It offers different levels of functionality depending on the type of licence purchased.
http://www.blackboard.com

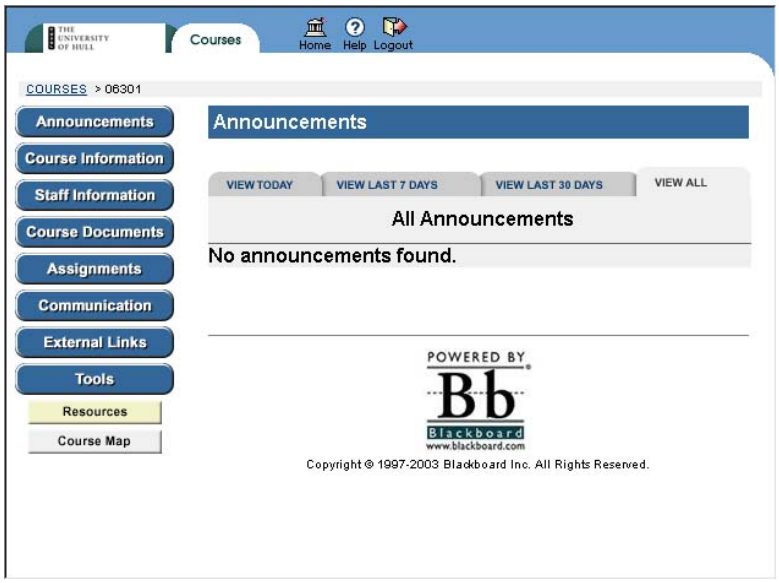


**Figure 3.** A screenshot of a Blackboard course

### WebCT

WebCT is another market leader of MLEs and, together with Blackboard and Lotus LearningSpace, is arguably one of the main commercial vendors to UK educational institutions.
http://www.webct.com

**Lotus LearningSpace**

This product is another of the major commercial products available.
http://www.lotus.com/products/learnspace.nsf/wdocs/homepage


**Figure 4.** A screenshot from Lotus LearningSpace[1]

[1] Screenshot taken from a Lotus LearningSpace guest user course

## Selecting a VLE

If there was one VLE that matched the requirements of all institutions and individual lecturers for all of their needs, there would currently only be one product on the market. As one might expect, different people have different priorities and thus need to select a VLE according to their own needs. Therefore, each institution/lecturer must first decide which criteria are important to their teaching needs and then select a VLE on this basis.

Adoption of a VLE is a big undertaking and ideally should really be taken on by Institutions rather than individuals simply because of the investment of time, resources and cross campus(es) potential of such a tool. This should be accompanied by a formal strategy that clearly lays out a policy for adoption and use within the Institution. It is possible however, for individuals to use VLEs on a small scale for their own teaching purposes even on a trial basis. Strategies aside, there are two main practical issues to think about when choosing a VLE that best suits your needs.

### Technical considerations

Many VLEs now only require the software to be installed on a single computer server, which can then be accessed by all end users via the Web. Most of these products will run on a variety of operating systems (Windows, Unix etc.) so it is down to individual choice, though compatibility with other systems within the institutions should also be taken into account.

When considering a VLE you need to decide what technical expertise is available to enable implementation of a particular system so that support is available quickly. How the product integrates with other systems within the institution is also a big factor in making it work. Over and above installing the system there are also technical issues relating to what the product can do in order to meet the needs of the user. For example if you want to do online assessment the VLE must be technically capable of offering an assessment tool.

Once you are clear about which technical criteria are most important in relation to the implementation and use of a VLE it can be difficult to compare different products based on the features each system offers. Whilst it is not always possible to compare like with like (e.g. apples and bananas) handy references are always useful. Fortunately there are a variety of tools and publications which can help you compare functionality and these are listed at the end of this guide.

### Pedagogical considerations

Whilst the technical specifications of a VLE are important, how such a tool will actually be used to support teaching and learning is, arguably, paramount. In the same way that you must decide which criteria are important when choosing a VLE you must also be clear about how you intend to use the VLE to support staff and students alike. Therefore you should have specific learning and teaching goals in mind with which the VLE can help.

One common starting point is the facility to provide lecture support resources and the ability to communicate interactively with students. Any product you choose should

therefore have the capability to easily deliver resources such as supplemental lecture notes, or images. It should also provide extensive and easy to use communications tools such as discussion boards or email facilities.

Another very important consideration when choosing a VLE is that it should be capable of offering additional tools which you can also use as and when you become more confident in using the technology. So, once you are used say, to using communication and content delivery tools, you may want to explore the use of group work. Therefore your VLE should also be able to facilitate this without you having to consider using a totally different VLE in the future.

## Ease of use

The one consideration which must be tied in with all other aspects of choosing a VLE is that of ease of use. There is no point is choosing a VLE with multi functionality if there is a steep learning curve for using it, or if the students find it impossible to use. One of the problems with this issue is that 'ease of use' is often subjective, being based on individual preferences.

As part of this selection process student opinion should be considered carefully if the adoption of a VLE is to be a success. Regardless of how much the lecturer might like a VLE or how easy they find it to use, if the students don't like it then they will not use it. Issues arise such as how do people like the presentation (look and feel) of the VLE, how easy is it to navigate through the system? Is the interface (presentation of the VLE) and functionality customisable to suit local needs? All these factors must be evaluated carefully when choosing a VLE.

## Encouraging institutional collaboration

More often than not, the implementation of VLEs start out as pilot or local projects embedded in a small part of an institution. However, this means that there is sometimes little (or no) collaboration and coordination of efforts on a wide scale for the effective implementation of technological support of teaching and learning. Therefore, in order to address these issues there has to be an institutional wide strategy for implementation.

It is advisable that if you wish to consider using a VLE you should seek out colleagues in a similar position who can help and or share ideas and resources. The HEFCE funded body JISC (Joint Information Systems Committee) focuses on the use of technology to support teaching and learning and provides extensive help about the considerations of promoting the use of VLEs across institutions.

# What tools can a VLE offer?

## Communications tools

### Email

Probably the most fundamental tool of any VLE is the communications tool and there are a range of ways to enable communication. There are two forms of communication, synchronous (i.e. at the same time) and asynchronous. An example of synchronous communication is the use of the telephone, where each person talks to each other at the same time. The most basic form of asynchronous communication with computer technology is the use of email, where a message is sent and the reply is sent later i.e. asynchronously. So, all VLEs should provide at least basic email facilities.

### Discussion boards

Another fundamental tool is that of a discussion board. This is analogous to a physical notice board on the wall in a department, where anyone can post a message for everyone else to read and anyone can respond to this message on the same board. An electronic notice board works in much the same way by allowing people to post messages for other people to read and to post replies. One benefit of this is that group discussion can be encouraged. This will be discussed in further detail later.

### Live chat

As the name suggests this tool allows synchronous communication and sometimes is referred to in different ways, often called ‘chat rooms’ by commercial providers with which many people are familiar. Since communication is synchronous this means that two or more people must actually be using the VLE at the same time. One benefit of this tool is that it can enable students to communicate even if they are in different locations.

## Interactive whiteboards

As stated earlier in this guide, the use of VLEs is mainly the application of traditional teaching methods to computer technology, but delivered in a slightly different manner. If you consider the use of a whiteboard in a physical class setting, the lecturer can write things on the board and ask students to contribute, with the other students able to view the work. This learning and teaching method is interactive, hence the term.

Applying the same principle to a VLE tool, staff and students are able to compose materials interactively in a synchronous way where everyone sees the work and is able to contribute. Again, an advantage of this is that students can work together with the lecturer without having to physically be located in the same place.

## Content delivery

A core tool of any VLE is the ability to deliver content in a variety of file formats. This can consist of delivering lecture support notes; presentation files; images; or even audio or video, as well as interactive animations. There are usually two main technical issues that arise with the use of content. The first is the ease of use by which the lecturer can submit (upload) work into a VLE. A lecturer should not have to be a technical expert to make content available to students and this goes back to the 'ease of use' argument. The second is the ability to access this content. An obvious example is the use of an audio file if the student computer isn't capable of playing audio.

## Assessment

Although not all VLEs are capable of offering assessment tools there are a wide range of independent assessment products available which can sometimes be linked to a VLE to enhance its functionality. One big advantage of having an integrated assessment tool is that it usually enables results to be stored and used with other content within the system. Probably the current market leader as a stand-alone assessment product is a company called QuestionMark, which produce a product called QuestionMark Perception. An example of a question type from QuestionMark is shown in figure 5.

The range of assessment options available usually includes multiple choice questions; true/false answers; fill in the blank; ordering or matching questions (e.g. list or image labelling); typed response questions (open content). Due to the range of products available each has its own strengths and weaknesses but some of the main advantages of electronic assessment are almost instant marking, quick data analysis and quick feedback for students.

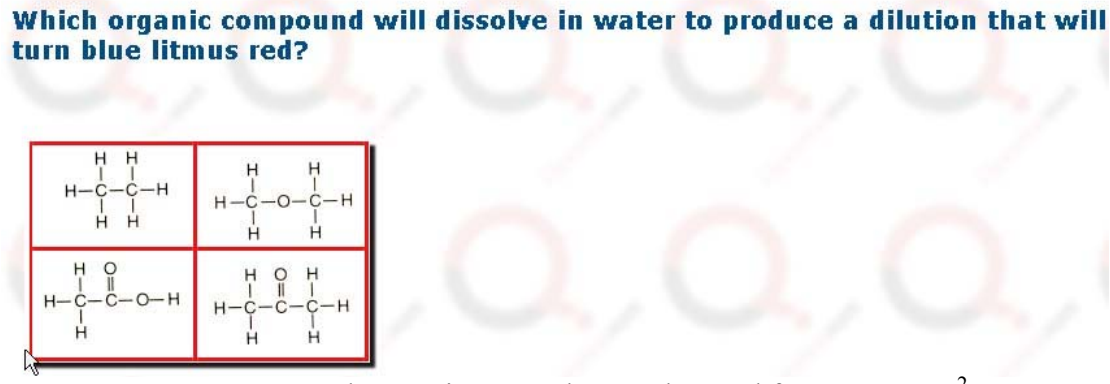


**Figure 5.** Sample question type that can be used for assessment[2]

[2] Actual question and screenshot is example taken from QuestionMark web site. QuestionMark is a commercial assessment tool that can link to VLEs, adding functionality. (www.questionmark.com)

## Content exchange and group work

Over and above the ability for staff to provide students with files, students are also able to share files with one another. This means that students are able to share work in an online environment rather than have to meet face to face all the time. A student could potentially share resources with fellow students or put work up for comment. Taking this into account with the other tools available within a VLE, students can therefore communicate with each other, share ideas online and even share files and collaborate on work as part of a group.

The range of tools just listed may range between VLE products, with some offering some tools but not others, or some tools being more versatile between VLEs. As you might expect, the teaching and learning possibilities are almost endless given the range of tools available. The next part of this guide will now consider some examples of the ways in which VLEs can be used to support teaching and learning in the sciences.

# Using VLEs for learning and teaching

## Starting out

### Managing your work

Before embarking on using a VLE for learning and teaching it is important to plan your work so that you can keep track of progress. We are all guilty of last minute preparation at some time or other but in the case of adopting a new approach to teaching with the use of technology all eventualities must be covered to avoid running into problems.

One of the obvious ways to plan your work is to view it as a project in order to pilot your teaching on a VLE platform. This way you will be able to plan and prepare your work better and build in tasks such as how you will spend time getting used to using a VLE, how you will teach students how to use the VLE and how you will even deliver the teaching during the course of the pilot study. It is also very important to focus on what it is you hope to achieve with the pilot study and plan your evaluation beforehand so that you are able to record suitable data and student feedback to review the success (or otherwise) of how well your project went.

### Getting support

One thing you can guarantee with the use of technology is that at some stage things will go wrong. The use of a VLE should therefore have some sort of support or backup plan to cover such eventualities. As part of the planning process sources of help should be identified who may be able to help at short notice, say in the event of a network problem. A short term alternative should also be prepared for example, an independent activity, as cover for when things do go wrong.

There are usually a variety of staff within Institutions capable of providing such support, ranging from technical staff in computer services to specialized units that can offer help and advice on the use of VLEs. These units often have a range of names but they may sometimes come under the general remit of elearning units, staff development services or general support units.

## Content delivery

Delivering teaching and learning content, say lecture support notes, is very straight forward but something which can quickly turn students off if not thought out properly. Sometimes staff complain that if they put their lecture notes on the web the students won't attend the lectures. Or complain that students don't read the notes even if they do put them on the VLE. These are valid points but which equally apply if the content was paper based.

If a lecturer wants to give students supplementary notes there should be a reason for this which should be clearly explained to the student. It may be supplementary reading essential to helping understand a concept, or it might be work which the students will later be assessed on. If so, this should be made clear to the student so that they can engage with the content.

One possible way of using a VLE to encourage student learning is to give a skeleton of the lecture notes online and use the lectures to 'fill in the gaps'. This way, more time during the lecture can be spent discussing the content with the student rather than simply expecting them to dictate your notes. This also avoids the risk of non student attendance as the absentees will not get a full set of your lecture notes.

## Images

In science teaching images can greatly help visualise concepts or descriptions of objects/compounds etc. How often do we offer slide shows during lectures? This helps bring a lecture to life and to stimulate interest but the students don't have access to your only set of slides afterwards, particularly if they were ill and missed this lecture.

It is now very easy to digitize (scan) images and make them available on a VLE, allowing for copyright of course. Through the simple act of making such images available it is possible to make content more interesting and students have access to images which they can also refer to as aide memoirs. One such example is the visualization of liquid crystals, as shown in figure 6. Due to the abstract nature of the crystal images, students can benefit greatly from being able to reference the images at any time.

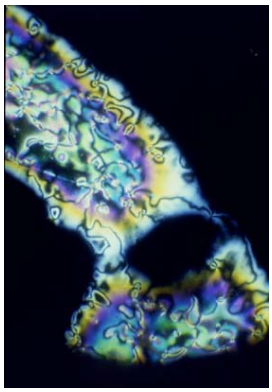

**Figure 6.** Image of liquid crystal[3]

## Communication

It is obvious that communication is a valuable source of interaction for students as well as a way to discuss new ideas and share information. It is very difficult to single out a specific method of using communication in science teaching because there are so many ways of using a communication tool. At a very base level it can be used as supplementary support to keep students informed about day to day activities in the teaching, such as work deadlines or timetable changes. Using a VLE as a communications tool in this way quickly adds to the teaching support role which students might otherwise miss. After all, how often do students check the notice board in the department compared to checking email or accessing the Web?

[3] Reproduced by kind permission of Prof. John Goodby, University of Hull

Discussion boards have long since become popular tools for discussion and their use in science teaching can be particularly useful. A key aspect of science learning is problem solving. Part of this process involves the student voicing their thoughts, sharing ideas and getting feedback on problems in order for them to develop an understanding of the problem so as come up with an answer. By providing a communications forum with which to facilitate this process it is possible to get a better understanding of how students work through these problems and provide useful feedback as and when required.

One advantage communications tools have for lecturers is that many VLEs enable you to archive (store) discussions which can be used as resources for future students. For example, a useful discussion might develop around a particular topic which may be historically difficult for students to conceptualise. Through discussions with both lecturer and students a successful summary of the issues surrounding the topic might arise. This may then be helpful to future students in helping them understand the topic too.

## Peer support

Due to ever growing constraints in science teaching, laboratories often have to hold more students than previously. This means that students often end up working in groups, but this is not necessarily a bad thing, as it offers the opportunity for peer support and group work exercises.

When students collaborate on practical experiments or any other similar group work they often have timetable clashes or other constraints that sometimes mean it is difficult to collaborate effectively outside the allotted time for the actual group or practical work. By adopting the use of a VLE it is possible to foster online collaboration using a range of tools.

To take a realistic scenario, a group may consist of students who have timetable clashes due to differing module choices. Some students may not live near the campus and so cannot easily come into the Institution outside of formal teaching hours. The result is that the group have difficulty meeting up to discuss their work and to coordinate activities.

By employing a VLE it would be possible to communicate with each other electronically. It would also be possible to share work and exchange notes. Any group questions could then be coordinated through a spokesperson to elicit support from the tutor, who could address the whole group and not repeat his response to individual students. There is also the possibility to submit draft documents and even the final completed work electronically.

In adopting such approaches to supporting learning and teaching students can physically work in isolation but safe in the knowledge that there is a formal system of support, communication and access to resources which may previously be denied them because of logistical constraints.

## Simulation work

Students undertaking practical work often only get one chance to do a particular experiment during a module. This may because laboratory space is at a premium or the experiment costs too much to repeat. The result is that a student gets one chance to practice the skill or record results and if the experiment fails for some reason, then this learning opportunity is lost.

Part of the learning process in these situations is to do something, observe the results, and draw conclusions based upon the outcomes and prior knowledge. This often takes time for reflection before the student may fully grasp the concept being taught. If they can repeat the procedure more than once or even (ideally) repeatedly then this would be of great benefit.

Over the years computer simulations have developed to help students simulate experiments which would otherwise be costly in terms of time, space or even on safety grounds. Although there is often no substitution for the real experiment, simulations can help the student address and answer many of the same problems posed in the real experiment.

Whilst simulated experiments are not really directly linked to VLEs in any way, the support mechanisms can be, such as a forum for discussion and to share group work online. In addition, it is also possible to devise theoretical simulations within a VLE that can promote student learning and problem solving in a similar way real experiments do.

One way of promoting simulation work within a VLE might be to devise an experiment where the students are given certain information to start with. They then have to undertake work based on prior knowledge about the subject to postulate outcomes. As they continue working, they could then be given bits of data or clues to help them until they reach a sound conclusion.

Another slant on simulation and even real practical work could be online preparation for a ‘wet lab’ experiment. Due to the constraints of running experiments, procedures can sometimes end up a bit like recipes where the student simply follows step by step instructions without really thinking about the work they are doing. A potential problem with this is that only after the student has completed the experiment and is attempting to produce a report that they wish they could re-visit the experiment to make some further observations or take further data samples.

It is possible to avoid such problems by preparing the students beforehand. If the experiment outline is made available on a VLE the students could be asked to work together to review the experiment and attempt to answer some questions based on the experimental procedure. There are a number of options possible here, such as tried and tested card sort exercises where students prioritise various aspects of the procedure. The aim is that students develop a much better understanding of the experiment when they physically come to do it and are more aware of what observations they should make and what results and data to collect.

## Project work

Project work ties in closely with peer support options and simulated experiment work. As with face to face project work, where students collaborate together and periodically liaise with the tutor, VLE supported project work can act in much the same way. One of the advantages of supporting project work in this way is that student progress can be monitored more closely, as well as offering more timely support. Many VLEs offer miscellaneous tools such as online calendars, task lists and reminders that enable both the lecturer and students to coordinate deadlines.

## Assessment

There are well established methods of assessment and much research has been undertaken about the validity of different types of assessment, such as the ability of multiple choice quizzes to assess deep (comprehension) or surface level (factual recall) learning. These questions apply equally to paper based assessment and computer based assessment. Therefore, computer based assessment is not more invalid than paper based assessment and has an important role to play in supporting learning and teaching.

As stated earlier, there is a wide range of assessment tools that can be linked to some VLEs, whilst other VLEs have a range of assessment tools already built in. These tools can be used for formative or summative assessment that is, they can be used as revision aids or for formal assessment. Although its name might suggest otherwise, assessment is an important part of the learning process since it provides students with valuable feedback on how well their learning is going. It can serve to confirm a student's level of subject knowledge and comprehension or can be used to highlight areas where the student requires further help and support.

On a more pragmatic level, computer based assessment can speed up marking and feedback procedures which might otherwise take days or even weeks, by which time the positive effect any feedback may offer has been lost. If students take online assessments it is possible to deliver almost instantaneous feedback, providing a mark and extra feedback on particular questions. From the lecturer's point of view, apart from saving valuable marking time it is possible to check for confidence limits of questions. This means that they are able to assess the validity of particular questions to see whether they are statistically relevant or not. For example, depending on the results a question may come out as being too easy or too difficult, enabling the lecturer to modify the assessment accordingly.

## Evaluation

In addition to computer based assessment, similar tools can often be used to deliver anonymous surveys. An obvious advantage here is that electronic surveys can be administered to students and the results analysed quickly. Perhaps an obvious primary use is to use this tool to obtain evaluation data from students.

One of the major problems however with VLEs, is that evaluation is often an after thought when it should actually be one of your first considerations. When deciding to use a VLE to support learning and teaching you should have a clear idea of what it is

you hope to achieve. You may want to consider the role of communication tools and their effect of promoting student collaboration and peer support. The evaluation should then be prepared so that it will elicit the relevant data to support your aims, based on a set of relevant and valid questions that will provide explicit responses.

## Accessibility

When mentioning accessibility many people think about support for disabled students and how technology might help. Whilst this may be a pertinent point, there is also the issue of allowing everyone access to VLEs by assuming they have access to a networked computer off campus. The real issue therefore, is not one of accessibility but of fair access for everyone.

Technology can improve access to resources for disabled students and it is important to be aware of the fact that new legislation came into force in September 2002 making Higher Education more accountable for supporting disabled students. So, a blind student say, can use screen reader software to 'read' content. But what if the content has been developed without consideration for a blind student? If a chemical reaction turns a solution a particular colour and the student is asked to describe it, how would a blind student describe a colour if they do not understand the concept of colour in the same way as sighted people? In this way, thought would therefore need to be given to developing content in such as way so as not to unfairly disadvantage a student.

In terms of fair access, it is easy to make the assumption that all students have use of a networked computer at home and can therefore access a VLE at most times during the week. If a students is expected to use a VLE as part of the module support/work then this student would then be at a disadvantage in relation to other students. One solution is to gauge how many hours you expect students to use the VLE during the week and make computer facilities available on campus for comparable hours.

## Epilogue

Whilst the various features of a VLE have been discussed and the potential use of each tool in the support of learning and teaching has been alluded to, this guide has deliberately refrained from attempting to offer a teaching model that will fit all occasions. The reason for this is that teaching and the learning process that goes with it is an individual design based around the lecturers own teaching aims and personality.

It would be wrong to try to dictate exactly how to use a VLE as it is possible to use any or all of the features in a different way, with similar successful outcomes. However, when using the various tools contained within a VLE there are clear approaches that should be adopted in order to make the learning process a positive experience. It is this which has been discussed so as to make the overall use of VLEs successful. For example, a communication tool is a tool that will only work if staff and students communicate effectively. How this tool is then applied in a teaching context is a matter of individual preference, be it to foster collaboration or to pose questions.

## Further Reading

Virtual Learning Environments
Briefing Paper, LTSN Physical Sciences www.physsci.ltsn.ac.uk

Virtual/Managed Learning Environments
Toolkit, LTSN Physical Sciences www.physsci.ltsn.ac.uk
(This publication highlights the VLE comparison tools cited in the 'Technical considerations' section)

Managed Learning Environments Information Pack
JISC series of briefing papers about MLEs www.jisc.ac.uk

A Framework for Pedagogical Evaluation of Virtual Learning Environments
JTAP report 41 www.jtap.ac.uk now archived at JISC, www.jisc.ac.uk

LTSN Physical Sciences Practice Guides are designed to provide practical advice and guidance on issues and topics related to teaching and learning in the physical sciences. Each guide focuses on a particular aspect of higher education and is written by an academic experienced in that field.

The aim of this practice guide is to introduce the concept of an important computer technology that is currently having and will continue to have a big impact on teaching in Higher Education, with an emphasis on science based teaching.

Over the years computer tools have been developed to support teaching, such as assessment or communication tools. In more recent years technology developments have enabled these tools to be combined into single products, called Virtual Learning Environments, or VLEs. Therefore, a VLE can be defined as a self contained computer based (web) environment enabling interactions between lecturer and student.

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