Becta ICT Research

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A REVIEW OF THE RESEARCH LITERATURE ON THE USE OF MANAGED LEARNING ENVIRONMENTS AND VIRTUAL LEARNING ENVIRONMENTS IN EDUCATION, AND A CONSIDERATION OF THE IMPLICATIONS FOR SCHOOLS IN THE UNITED KINGDOM

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1. Introduction and definitions

As a result of the unprecedented levels of government investment in educational ICT since 1998, there has been an exponential growth in networking and connectivity in schools and institutions of FE and HE. This has spawned a recognition that ICT as a medium within education can support virtual collaborative learning environments. Developers have come up with products to exploit this, known variously as virtual learning environments (VLEs), managed learning environments (MLEs), course management systems, virtual campuses, and online learning platforms.

This report examines the evidence of where these tools are being used, and the potential benefits which are being claimed. It looks across all sectors, and takes an international as well as a UK perspective, before considering the potential implications for the UK schools sector – what can be learnt that is transferable to practice in schools?

1.1 What is a virtual learning environment?

There is some interchangeability and indeed confusion regarding the terms applied to VLEs. This section looks at common definitions and delineates the functionality these terms represent.

1.2 Definitions in FE and HE sectors

The Joint Information Systems Committee (JISC) has set up the JISC Committee for Integrated Environments for Learners (JCIEL). A steering group that reports to JCIEL focuses on issues related to VLEs and MLEs.

Part of the role of the JCIEL steering group on VLEs is to oversee the definition of MLEs/VLEs for the FE sector. It recommended in July 2000 that the term 'virtual learning environment' ('VLE') refers to:

> '*the components in which learners and tutors participate in "on-line" interactions of various kinds, including on-line learning*.'
> (JISC 2000b)

The components of a VLE include the following:

- notice-board/bulletin board
- course outline (course structure, assignments, assessment dates)
- email facility
- conferencing tools (asynchronous conferencing or discussion groups)
- student home pages
- metadata (ability to add metadata to resources)
- assignments (ability for tutor to create assignments)
- assessments
- synchronous collaboration tools (such as whiteboards, chat and video conferencing)

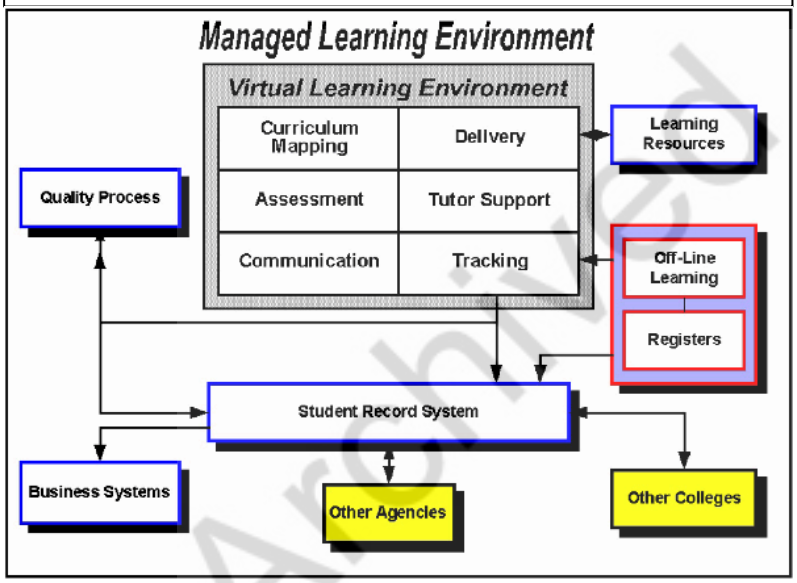
- multimedia resources (accessing, storing and creation)
- file upload area (ability for students to upload their resources to a shared area)
- calendar.

JCIEL defined 'managed learning environment' ('MLE') as the term which is used to:

> *'include 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*.'
> (JISC 2000b)

This useful distinction is indicated schematically in Figure 1.

Figure 1 Schematic of a VLE as a sub-system of an FE college's MLE



Britain & Liber (1999) in their evaluation of VLEs for the HE sector state that their definition of VLEs describes systems which are known as online learning environments, learning management systems and collaborative learning software.

These definitions imply a high level of interaction between the VLE and the surrounding MLE. The principal functions of this interaction would be:

- controlled access to the curriculum, which has been mapped to elements that can be separately assessed and recorded
- tracking of student activity and achievement against these elements, using simple processes for tutors to define and set up a course with accompanying materials and activities to direct, guide and monitor learner progress
- support of online learning, including access to learning resources, assessment and guidance; the learning resources might be self-developed or professionally authored and purchased, and can be imported and made available for use by learners
- communications between the learner, the tutor and other learning support specialists to provide direct support and feedback for learners, as well as peer

group communications that build a sense of group identity and a community of interest

- links to other administrative systems, both in house and externally.

In addition to these features, it is generally regarded that:

- there will be a level of security built into the system, including a form of password protection
- VLEs normally provide two views of the system, one for the tutor and one for the student
- tutors will have access to a wide range of tools and privileges in a VLE that allow them to add materials, create tools and track student progress
- MLEs and VLEs will be browser based and use web technologies, but will not require a knowledge of HTML in order to use or contribute content to the system
- the use of web technology for VLEs means that the system can be accessed anywhere, including at school and home; with portable technologies, the 'any time, anywhere' learning model will be possible
- the elements that go together to make up the system should interrelate and be interoperable, allow for the sharing of data, and provide a consistent interface for students and staff.

The above definitions of MLEs and VLEs are relatively recent, and involve two significant changes. First, until the definitions were clarified as above, most people (including suppliers) used the term MLE to refer to what is now considered to be a VLE. Secondly, the definition of the term VLE has been narrowed, at least in the FE/HE context. Given the functions above, a system which was purely a conferencing and communications system, with no place to put courseware, would not qualify as a VLE, nor would a system which had content, but no way of tracking student activity and achievement against that content. To be a VLE, a system must contain, at least to some extent, all the principal functions defined above. However, the last function – the links to other administrative systems (and the interoperability implied by this) – is the least developed, and something on which VLE suppliers and the JISC MLE Steering Group are currently working. For more details see http://www.jisc.ac.uk/mle/interop/.

1.3 Definitions in the commercial sector

The commercial sector has, on the whole, not adopted the terminology of VLE or MLE to describe the systems it is developing or supporting. Products used in the school sector which are widely regarded as falling into these categories have been described by their developers as:

- a web-based curriculum-management platform, VLE and connected learning community (Encarta Class Server, Microsoft)
- an internet-enabled client/server application offering business web-based solutions and a web-based tool (Knowledge, Knowledge Business)
- an online education community (Schoolmaster.net)
- delivering broadband educational content (Espresso, Espresso Productions)
- a learning community and communications environment (Learning Village, IBM)
- an online learning environment (Pioneer, SCET/LT Scotland)

- a collaborative learning community (Think.com, Oracle)

For the purposes of this report, these will be treated as VLEs, as they all demonstrate some of the functionality of a VLE as defined by JISC. MLEs are not available as off-the-shelf commercial products having become largely notional in the sense that each institution has its own distinct set of needs when it comes to integrating a VLE with management and administrative systems. Consequently the MLE 'solution' for one institution is bespoke and not applicable to other organisations.

1.4 Interoperability

Essential to a revised definition of a VLE and to the eventual development of an MLE is interoperability of data and content. These are extremely important, but remain areas that are often overlooked and not always understood. Interoperability has two distinct aspects:

- **Content**: this should be produced to Instructional Management Systems (IMS) standards. Briefly, content should be indexed and classified using agreed terms (metadata and meta-tagging). This benefits staff because they can quickly find the relevant content they need to deliver their courses. The standards also mean that content is portable – a teacher can buy IMS-compliant content from a vendor, and incorporate it into any VLE. Also, the tools that teachers use to produce content, whether these tools are stand-alone or part of a VLE, should generate content in an IMS-compliant format. More information on IMS standards is available from the Centre for Educational Technology Interoperability Standards (CETIS) (http://www.cetis.ac.uk/).

- **Student administrative and tracking data:** it should be possible to transfer data about students to and from college administrative systems easily and seamlessly. This allows the VLE to be incorporated into the surrounding MLE. Without interoperability, the VLE is a stand-alone environment, which, however useful, is still separate from the college administration systems. The awkwardness of this is illustrated in the Leeds College case report about WebCT:

> '*If a VLE is to be used with a large number of students across a range of provision, some interface with MIS (management information system) is vital. Thus far our system has involved no interface with MIS, and the data entry involved in setting up what is now 650 students has been problematic. A link between MIS and the VLE will be necessary in the future, especially when we look to have all courses offering online support.*'
>
> (Chohan & Nichols 2001)

JISC has funded a series of interoperability pilots in FE (in England), and final reports are now available on the JISC website (http://www.jisc.ac.uk/index.cfm?name=programme_mle_pilots). These pilots sought to explore the use of IMS educational specifications to allow for data interchange. They came about after JISC had sought agreement from VLE vendors in 2000 to an approach to systems integration which was based on the IMS standards.

Several of the current JISC-funded projects in HE are also concerned with interoperability, for example CoMantle and SMILE (see Appendix 1). JISC (in 2003) has also recognised the need for joining up systems between FE and HE sectors so that they follow learners as they move institutions. Large consortium-based projects are the focus for developing these cross-institutional architectures.

An example of interoperability work in Canada is illustrated by Norman & Little (2001). The authors describe work by the Open School, a service of the Open Learning Agency in British Columbia, which is developing K-12 content for WebCT for use by the nine distance education schools, alternative learning centres and the regular classroom-based schools.

They have undertaken an initiative to implement standardised general markup language/extensible markup language (SGML/XML) as an underlying technology for course development. They maintain that the concept of developing digital content using this standard is starting to take off within educational circles around the world, through the implementation of standards such as IMS, Dublin Core (http://dublincore.org/) and Advanced Distributed Learning (http://www.adlnet.org).

In addition, the application of metadata is allowing learning objects (content), to be shared and reused by other database systems and potential users. In turn, this allows organisations to leverage their content in new ways. Further work on interoperability may be found in the e-government interoperability framework (Office of the e-Envoy 2003), which describes the technical specifications and policies that will act as the foundation for the e-government strategy. These standards are intended to facilitate the flow of information seamlessly across the public sector and provide citizens and businesses with better access to government services.

2. UK research

Most of the evidence of benefits, even in the case of the more established systems such as WebCT and Blackboard, still tends to be anecdotal, although studies in HE are beginning to investigate the impact of the various functions of the more established products in more detail.

It is necessary to stress that the evidence tends to be inconclusive and open to debate. For example, where a benefit is reported, to what extent may this be product specific, and how much does it provide a finding that reflects the benefits of VLEs as a whole? After all, functionality is not consistent across all products. In addition, it may be that an institution has decided to concentrate on one or two aspects of the VLE they are reporting on, and have not experienced its full potential. This would lead to results that are not a true reflection of a product's capability. Similarly, the manner of implementation is likely to have a direct effect on the outcome of a VLE's introduction. References are provided, and are a means for the reader to investigate further.

2.1 Higher education

2.1.1 Current situation

VLEs began to appear in the second half of the 1990s. They were initially not web based – and some remain so. However, the web has now taken over. VLEs have been in use in HE in the UK for several years, although their take-up has not been universal. Some universities have embraced the idea of online learning and VLEs by imposing a single system across the whole institution. Coventry University, for example, decided in 1998 to provide a campus-wide online learning environment by 1999-2000. Students at the university now have access to all their modules online (Deepwell 2001). Following a four-month feasibility study into the use of Blackboard at Bristol University as part of the VIOLET (Virtual Integrated OnLine Environment for Teaching) project, the decision was made to extend the use of Blackboard. A gradual approach was chosen, with the Learning Technology Support Service (LTSS) initially providing intensive support to selected pilot departments (Greenwood 2002).

According to Lewis (2001), the advantage of adopting one solution is that the product can be well supported by learning technology or IT services in the university. The disadvantage is that it may not provide for all possible uses. Also, the very features that make it easy to create an online course impose patterns of thinking on the way that courses are built in these environments. This factor, together with issues of interaction with other university systems and the different demands of local and remote use, poses some difficult decisions for central services. Faced with this situation, some institutions have decided to build their own system, either from scratch, or from component applications. This approach offers flexibility but commits a university to providing greater levels of technical support than might be the case with an off-the-shelf solution.

While some universities have purchased site licences for a particular VLE product, others have tested a range of different products and waited to see whether a market leader emerges, or whether different VLEs are better suited to different subject disciplines. It remains to be seen whether this pattern is repeated in the school sector.

JISC is funding several projects through the Building MLEs in HE Programme (http://www.jisc.ac.uk/mle/). The specific objectives are:

- demonstrating to the FE and HE community the possibilities of MLEs
- identifying the generic and transferable aspects of the development projects

- demonstrating the benefits of a student-centred approach to service provision

- enriching the educational sector's understanding of the cultural and organisational issues encountered when developing MLEs

- creating technical and organisational guidelines to support the introduction of MLEs.

See Appendix 1 for further details.

2.1.2 Research findings from higher education

VLEs are more established in the HE sector than in schools, but their implementation and use continues to develop. Lewis (2001) notes that HE in the UK is still learning both how to use the existing tools effectively and what new tools may be needed in the future. When making judgements about VLEs, Lewis considers that it is unhelpful to compare VLEs with traditional ways of learning as this misses the point. These are new tools offering new ways to learn. While HE has learnt a little about how to use VLEs and the tools they include over recent years, they are still largely unexplored, and most use is still anchored in the print and speech paradigm.

> '*The best approach for HE would seem to be an intelligent combination of traditional combination of traditional and new media. It doesn't end at course design and creation – how many of us have used these environments as students? Academics have as much to learn as online tutors as the students as online learners*.'
> (Lewis 2001)

Communication

Focusing on the use of VLEs to support student discussion and debate, Wilson & Whitelock (1997) used FirstClass to enable students on a computing course to communicate with one another. Common uses included:

- help with problem solving (49 per cent)
- keeping in touch (29 per cent)
- contacting tutors (20 per cent).

Although all the students were distance learners, only four per cent claimed they used the system for online chat.

Selinger (1997) evaluated the use of FirstClass at the Open University for a postgraduate initial teacher education course. The study found that extensive use of the system encouraged collaboration among students. There was a recognition that FirstClass can support and enhance good practice, leading to the development of an electronic community of teachers capable of encouraging long-term professional development. Another study of FirstClass involving PGCE students at the Open University by Kyriakidou (1999) concluded that:

- electronic conferencing can be used as a tool in enhancing student teachers' learning and teaching
- electronic conferencing enables students to gain some technological skills

- the medium enhances student teachers' professional development by promoting reflective discussion on educational issues

- problems in the use of the medium exist, and further research should propose alternative solutions

- the success of a conference depends on certain criteria, including the nature of the interaction and level of collaboration among participants; the moderators' input is crucial for the success of the activity, and further research is required on conference moderation.

A study of psychology students (Light *et al.* 1997), although not directly related to a VLE system, does involve a function of many VLE products – email discussion groups. The researchers found that the main benefit of 'skywriting' – the use of multiple reciprocal email with message archives to support academic discussion – was that students valued being able to read others' postings. However, some were concerned that everyone else could see their messages and most were almost obsessional about preparing them before posting.

In a study of undergraduates taking a philosophy module, Gibbs (1999) used coMentor (not dissimilar to FirstClass) to provide multi-user discussions online. This included supporting debate, discussion, group work and resource-sharing and learning. While there was no unequivocal evidence of gains in final assessment in those using the system, students learned from seeing each other's work, from having to write down their ideas and from sharing them with others. As a result, they adopted learning styles that were considered beneficial to learning a theoretical subject. Results from a learning style inventory scale showed that users of coMentor displayed higher levels of deep learning (seeking meaning, relating ideas, use of evidence, interest in ideas) and significantly higher levels of strategic learning (organised studying, time management, alertness to assessment demands, achieving, monitoring effectiveness) than those who used the system little.

Virtual Departments for Minority Languages (VDML), is a collaborative project between language teachers from University College London, the University of Edinburgh, and the University of Hull, who developed a prototype virtual department using WebCT. An initial survey of 400 language students and 60 language teachers (Hughes & King 2001) found that most students believe computers are only suited to developing skills in grammar and writing. A subset of the sample, who used computer applications frequently, as directed by their teachers, had more confidence in the computer as a generally useful tool for language learning. They considered it useful for acquiring reading, talking and listening skills. Danish students appreciated the opportunity to interact with real Danish institutions via the web. They valued the chance to communicate with one another and to be part of a larger student body than they were in their individual institutions. Teachers using the virtual department considered that they benefited from the opportunity for collaboration. It enabled them to pool resources, develop new materials collaboratively and give feedback on each other's ideas through a discussion board. It was noted that offering your materials to others in this way involves an element of risk.

For further studies relating to the use of WebCT to support group discussion on a Master of Education course, see Pilkington *et al*. (2000); for studies on the use of online course resources and a discussion board to support a Master's degree in geographic information at City University, see Quinsee (2001).

Curriculum mapping

A VLE may open up new routes of communication between departments, supporting an improved and developing relationship. At the University of Sheffield, the library management system Talis has been linked with WebCT, enabling the electronic distribution of conventional reading lists and improved collaboration between academics and the library (Stubley 2002). Both sides have seen the potential for providing added-value services through this link, and the 'reading list' is now known as the 'resource list'.

> '*For the first time 'resource lists' can be organised in the way that academics want, to fit with course delivery and to include annotations, rather than in a format imposed by the library's systems.*'
> (Stubley 2002)

Links can be made to electronic resources, leading to the library organising access to an increased range of digital objects, and easing the location of resources by students.

2.2 Further education

2.2.1 Current situation

Through the National Learning Network (NLN), every FE college in the UK has been given funding (amounts vary between colleges) towards the development of a VLE (FEFC 1999). According to the latest Becta survey available (Powell & Davis 2001), in 2001 about half the colleges in England already had VLEs in place, though few were using them with large numbers of students. Most colleges were still trying to decide which VLE to purchase, amid concerns about the costs of staff development involved in VLE implementation, and the risks of course materials becoming tied in with a specific tool, which may not be the long-term solution. Although current figures about VLEs in colleges are not available at the time of writing, a new survey has recently been conducted and the results will be published on the Ferl web site (http://ferl.becta.org.uk/).

There has also been considerable interest in how VLEs can be integrated with other college systems to form MLEs. In June 2001, JISC issued Circular 1/01 – 'Managed Learning Environments for Lifelong Learning: Building MLEs across FE and HE' (JISC 2001). It invited proposals from established consortia of FE colleges and HE institutions to develop and test improved institutional processes and methods for exchange and sharing of data, and for the interoperability of information systems, the outcomes of which will result in demonstrable benefits to the learner. JISC subsequently funded 12 projects in FE colleges to test aspects of interoperability. The individual pilot programmes have reported back and these reports, as well as the overall project report, are available at http://www.jisc.ac.uk/index.cfm?name=programme_mle_pilots.

A comparison grid of VLEs from various developers has been compiled by the Combined Higher Education Software Team (CHEST) and is available at http://www.chest.ac.uk/datasets/vle/checklist.html. See Appendix 2 for examples of VLEs used by colleges in the UK.

2.2.2 Research findings from further education

The following findings are all drawn from case reports on the Ferl website.

South Birmingham College (Sisk 2001)

LearnWise has recently been piloted at South Birmingham College. A Ferl case report describes the pilot that involved predominantly adult learners with a mix of gender, ethnicity and levels of ICT skills. However, the numeracy content was targeted at the students aged 16–19. LearnWise was only available within the college, yet a significant number of users (learners and tutors) looked for home access.

Evaluation feedback from users indicated the following:

- the VLE was perceived as a useful tool to assist with learning alongside face-to-face learning and teaching
- a large majority of users thought that the system was easy to use

- active engagement with content rather than access to information was seen as the most appealing aspect of the environment

- learners wanted to be able to access good quality, relevant learning; the provision of customised, quality content was thought to be key to the success of the VLE

- learners identified a wide range of possible uses for the environment.

The pilot provided opportunities to explore the interactive elements of the product and web page interactivity through content creation. Interactivity was seen as positive in terms of allowing active engagement with the environment and providing instant feedback.

Communications tools within the environment were not fully explored as the email function was not enabled, but, within the functionality of chat and forums (discussion groups), users were positive about using these tools for collaboration.

Although the amount of content available to learners varied widely, most learners thought that they had increased their learning as a result of participating in the pilot. This finding includes staff that participated in the staff training programme.

Leeds College of Technology (Chohan & Nichols 2001)

Another case report on the Ferl website describes the use of WebCT at Leeds College of Technology. WebCT is being used to support teaching of key skills, and most of the online content has been created in house by the relevant course tutor. Student feedback on using the VLE for key skills has been varied but enthusiastic overall:

- students appreciate access to the full range of tasks needed to finish the course, some enjoying the opportunity to work independently from their teacher

- regular opportunities for self-assessment are enjoyed.

The vulnerability of online course delivery has been illustrated though; there has been learner dissatisfaction when teaching materials have been unavailable due to technical problems.

Teaching staff have also been mainly positive in their response to the VLE, and their feedback has highlighted several benefits:

- online provision provides teachers new to a course with ready-made notes

- online materials make cover for absent staff straightforward and effective

- the curriculum is transparent to students

- the WebCT bulletin board has become used for discussion within the college

- hosting the key skills course on WebCT makes it accessible to additional students outside the college, generating further income

- editing and updating by tutors is straightforward, requiring only an internet-connected computer.

There are problem areas, however, principally the demands on staff to learn new skills and techniques, and the time taken to develop courses. A specific level of IT competence is required – as a minimum, basic web page editing skills. Tutors designing online materials also need a high level of communications skills.

City of Sunderland College (Ellis 2001)

A case report describes how the City of Sunderland College implemented Blackboard. Again, the general feedback from students was that they like the medium of a VLE. The motivation of instant feedback for online assessments was a significant confidence-builder. Students are accessing the materials throughout the week, at college and at home. There is evidence that students have been referring to online lectures and other course material as part of their revision programme. Staff are reporting multiple benefits, which relate to administrative efficiency: for example the ability to refer students to course information online, and tracking of student use of course materials. See Appendix 3 for a summary table of the benefits of the system for students and staff.

2.3 Schools

2.3.1 Current situation

Experience of VLEs in the school sector is both immature and volatile. Their use is often still short lived, and based around LEA initiatives such as in Knowsley, Nottingham, Newcastle and London, rather than individual school purchases.

The Smethwick Learning Network provides an interesting case, being a link between primary and secondary schools, and also six community centres, using the Discovery VLE (http://www.smethwicktoday.com/learning/project.htm).

Twenty-four schools in South Yorkshire are taking part in the South Yorkshire E-learning Project. The project aims to stimulate demand for the use of ICT and learning content through schools, colleges, community groups and learning centres. The VLEs being tested are Fretwell Downing LE, Apple DLCMS, Teknical and Blackboard. An example of involvement in this project is the South Sheffield City Learning Centre, based within Newfield Secondary School. Content for the VLE has been purchased from third-party suppliers including NETg. The VLE's integration with the school's management information system (in this case SIMS) is being developed during the project, which is now known as e-sy.info. For more information see http://www.e-sy.info/default.asp.

The London Grid for Learning (LGfL) VLE is Digitalbrain. The VLE serves 1.2 million students and their teachers, and offers possibilities for collaboration and interaction throughout London. Features include personal web space, customisable personal portal sites for each user, email, online calendars, discussion groups, working groups and a live news feed. It also makes available content, which is both created by local users and purchased from commercial providers. Part of the vision is that the teacher will have more time for the classroom if learning materials are more easily created and shared. In turn, students may be able to benefit from the availability of learning materials online, and opportunities for communication.

The Chapeltown and Harehills Assisted Learning Computer School (CHALCS) project provides community-based tuition and support out of school hours to pupils who attend school irregularly, or who need further support (http://www.chalcs.org.uk/). Using WebCT, the VLE provides support in maths, English, science and ICT. For further information on this project see Barker (1999) and Barker & Pilkington (2000).

A number of sixth-form colleges in the UK are also experimenting with VLEs. They are eligible for NLN funding in the form of money for VLE licences, and this largely accounts for a greater take-up of VLEs by sixth-form colleges than by schools. Sixth-form colleges are, in the way they teach and are structured, in some ways closer to schools than traditional FE colleges, and have lessons for VLE implementation in schools. The case study of Havering Sixth Form College on the Ferl VLE Focus area illustrates some of the issues relating to the implementation of a VLE (Taylor 2001). These include the need for significant investment in staff training, and the time-consuming nature of course development within WebCT.

North Lanarkshire has adopted FirstClass to run its intranet. All teachers and secondary school pupils have dedicated accounts on the system while primary school children are granted access by class accounts. The Isle of Man's Department of Education is also implementing FirstClass as the basis for its online learning environment. Further examples of VLEs in use are listed in Appendix 4.

Apart from these examples of testing or adopting of VLEs (and these are by no means comprehensive), there are very few pilot projects and published independent reports which investigate the use of VLEs specifically in schools – independent evaluations of VLEs in the schools sector are scarce.

2.3.2 Research findings from schools

Delivery

Many products provide specifically targeted content and associated learning activities as a means of curriculum delivery. In the case of Spark Island, the company was started because it considered that there was a gap in the market for quality online materials that are both appropriate and linked to the National Curriculum (Brooks 2001). In addition, Dorner *et al*. (2000) considers that Think.com offers support for learning outcomes planned for pupils' age and maturity. Similar findings have been claimed utilising the SCHOLAR programme developed by Heriot-Watt University and a consortium of secondary schools and FE colleges in Scotland, launched in June 2000. It provides common educational resources and a 'virtual college' support network for Advanced Higher, Higher National Certificate and Heriot-Watt University first-level courses. Designed to improve student choice and flexibility, it helps students progress between school, college and university. The Open Campus Learning group at Glasgow Caledonian University gauged opinion of SCHOLAR's first year of operation, contacting students, staff and managers in many institutions. The report says:

> '*There was widespread agreement on the benefits of SCHOLAR for education authorities and schools. The primary attraction was the potential for curriculum enhancement but there were considerable financial, partnership and staff development reasons for using the new programme*.'
>
> (Open Campus Learning 2001)

Comments from school and college staff include:

> '*We joined the SCHOLAR programme mainly 'to try it and see'. First impressions have been positive. Staff and students have been pleased with it. Staff in other departments have decided to get involved next year because of what they heard about it. That's a very strong recommendation*.'
>
> (Musselburgh Grammar School)

> *'A key success factor is the flexibility – teachers were also impressed by the quality of the materials. Disadvantages? ...none, it's a plus*.'
>
> (Gracemount High School)

Other qualitative data from teachers also tended to be positive. Similarly, SCHOLAR students responded favourably, picking up many of the same points as teachers:

- authenticity of content
- ease of use
- support for self paced study

- instant feedback from assessment.

One of the key benefits of curriculum delivery through a VLE appears to be increased motivation. This is borne out by an independent classroom evaluation of Espresso for Schools, one of the few rigorous assessments of the learning and educational benefits of VLE functionality (Watts & Lloyd 2000). The evaluation compared five primary schools using Espresso with five non-Espresso schools, within the context of studying a discrete part of the literacy framework. The study collected quantitative data on test scores to track pupil attainment, as well as recording teachers' and pupils' perceptions of the impact of Espresso on teaching and learning, through classroom observation and interviews.

The main findings were:

- pupils enjoy using ICT and are motivated and engaged when doing so
- the use of Espresso improved children's general ICT skills and journalistic writing, understanding and presentation skills
- teachers' opinions were generally positive, and in some cases very enthusiastic, particularly among those with high ICT confidence and competence.

Teachers identified specific benefits:

- increased pupil motivation
- the positive nature of the collaborative nature of the activities.

Pupils saw the advantages of Espresso over other forms of ICT centring around:

- the video material, the games and on-screen activities
- the ability to control the pace of learning through rewind and fast-forward controls was seen as the strength of Espresso materials.

Teachers saw the advantages of Espresso over other forms of ICT centring around:

- the video material
- up to date nature of content
- the fit of the activities and materials to their needs.

From interviews with teachers, the following gains were identified for those pupils using Espresso:

- high levels of motivation
- good keyboard and software navigation skills
- layout and linguistic skills.

Specific factors were seen as being associated with an environment where pupils were highly motivated and work progressed smoothly:

- effective instructions were provided at the beginning of a lesson
- teachers checked for understanding and made additional class inputs throughout the lessons
- classroom materials supported pupils in their tasks

- teachers and pupils were confident with the technology.

However, the researchers noted a number of issues that should be taken into account when considering the findings:

- differences between the schools chosen make it difficult to make generalised claims on the basis of the findings

- the sample was relatively small.

Motivation is often linked to ease of use. Many developers claim that their systems are simple to learn and use for staff and students. The ease with which systems integrate text, images, audio and video, and allow students to create professional-looking online projects and interactive web pages, using facilities such as guided text fields or cut-and-paste links, can bring improvements in confidence and the provision of incentives to produce more interesting and readable documents and projects (Dorner *et al*. 2000).

Whether VLEs and associated systems motivate all students is unclear, however. There are broader issues here about whether e-learning and computer-assisted approaches in general will appeal to all learners, or whether less able students will have the self-discipline and concentration spans that individualised online learning requires.

Communication

The combination of various networked technologies accessible through VLEs has provided a number of new opportunities for schools in the way in which learning can be extended beyond school and term-time, enabling pupils to explore subjects of interest in greater depth and at their own pace. In some cases this has involved electronic document sharing, supported by conferencing and discussions. The discussion of topical and sensitive issues has been facilitated by VLEs. Topics that have been discussed within and between communities include racism, religious bigotry and gender roles.

Levy (2002) demonstrated the benefits of collaborative projects and the bringing together of different communities that may result: a project was set up involving two schools in Northern Ireland. The schools undertook a study of the local seashore. Using email, video conferencing and word-processing packages the pupils shared and discussed the work they did at the seashore. This formed part of a programme of cross-curricular work in maths, English, art and science. ICT was seen as bringing about closer relationships between the two communities, with video conferencing offering the facility for children to talk about their similarities and differences. Video conferencing was also seen as assisting the development of communication skills.

> '*Children who are so keen to use video conferencing have to learn to present themselves well – making key points in a clear an concise way with no rambling.*'
>
> (Evelyn O'Neil, Vice-principal of Bushmills Primary School, Northern Ireland; in Levy 2002 p.15)

These findings are similar to those reported for various VLE systems, and suggest that the learning benefits are not a function of specific systems but of the general functionality that they provide, in this case video conferencing.

Material from Learning and Teaching Scotland (LT Scotland 2000) describes a range of role-playing and online activities carried out using Pioneer in the Virtual Oilspill and Versailles Experience projects. The Versailles Experience project took place between October and November 1999. Thirty-nine Scottish schools, 19 English schools and one Indian school participated. The four-week project entailed fourth- and fifth-year pupils collaborating and role-playing to rewrite the Treaty of Versailles. The activity involved the use of several functions within Pioneer:

- searching online content
- authoring web-based materials
- communications tools – email and discussion forums.

The main learning benefit cited by one of the teachers concerned was the high quality of debate. This was attributed to the focused nature of the online activity concerned. By contrast, a subsequent exercise using an internet chat tool saw online discussions rapidly deteriorating into social chit-chat. The students clearly enjoyed the novelty of the Versailles Experience project, but also claimed a greater understanding of the subject matter involved as a direct result of the online experience.

LT Scotland claims the Versailles Experience project demonstrated that online learning, even when based on textual computer conferencing, can work well with school students. The success of this project was attributed to its time-bound nature and the setting of clear learning objectives from the outset. Comments from the students involved indicate the development of skills such as empathy, and the ability to listen to others and to question one's own knowledge and understanding.

Scrimshaw (1997) identifies findings relating to the motivation of able students in the Superhighways Teams Across Rural Schools (STARS) project, part of the Educational Departments' Superhighways Initiative (EDSI). The project created a network of 18 primary schools and two secondary schools in an isolated rural area of Scotland. In addition to email and online chat, a closed-conference system (FirstClass) was used by pupils. Specific benefits for able pupils were identified:

- the opportunity for pupils to take greater responsibility for their own learning
- increased confidence and enthusiasm
- the chance to share ideas with high-ability pupils in other schools
- a new awareness that peers from other schools could out-perform them
- a greater attentiveness to the needs of others in the school, and willingness to help them.

Benefits such as these seem to be symptomatic of a more general potential benefit of networked technologies that they can allow schools to access and share resources outside the school. This may be in the form of specialists and experts in particular subjects or virtual visits to otherwise inaccessible locations.

3. International research

This section outlines findings from research on the use of VLEs in HE and schools in countries other than the UK. As in the UK, however, there is very little robust evidence for school use of VLEs. No international evidence of VLE usage in a sector comparable to the FE sector in the UK has been identified, and consequently there is no consideration of that phase in this section.

3.1 Higher education

3.1.1 Current situation

WebCT and Blackboard are both widely used throughout universities in the US, Canada and Australia (http://www.webct.com/company/viewpage?name=company_webct_customers, http://company.blackboard.com/clients/index.cgi). There is consequently a greater amount of evidence on these products than those from other developers, and this report reflects that. This, however, does not imply endorsement of these products, nor does the omission of other products imply the opposite.

3.1.2 Research findings

Most of the studies identified to date seek to evaluate specific aspects of WebCT and Blackboard. International differences and the anecdotal nature of much of the evidence necessitate caution when assessing the wider applicability of these findings.

Delivery and curriculum mapping

In the evaluation of Blackboard at Haverford College (USA), tutors stress both the ease of system management and course creation:

> '*It took me very little time to figure out how to do what I wanted to do without even having to resort to documentation… It was very easy to add most forms of content. Adding or subtracting elements/tools from a course is pretty easy. Administration was easy to understand*.'
>
> (Course Management Systems Evaluation Committee 2001)

Adelaide University (Australia), reports positive feedback from the testing of Blackboard, and highlights specific features:

> '*the personalised portal interface that provides quick access according to enrolment and/or your role in the institution;*
>
> *easy navigation and use for students accessing material and staff uploading material;*
>
> *the flexible interface and ability to use Blackboard as the front-end that then provides links to further material;*
>
> *the integrated nature of the software e.g. e-mail, calendar, discussion forums, course material, online chat rooms, announcements and staff details are all accessible within the one package*.'
>
> (DVCE 2000)

At the University of Western Sydney, a comparative review of WebCT and Blackboard was carried out to assist in strategic decision-making and planning in the choice of a course management system (Rankine 2001). In regard to WebCT, the report highlighted its customisability and flexibility, which make it suitable for both beginners and the more advanced online teachers and learners.

At the University of Texas at Austin, WebCT was chosen again. This time the features that allow complete creation of online courses were praised:

> '*Of the products recommended, WebCT is the most feature-rich and provides the closest approximation of a package that allows complete creation of online courses*.'
> (Center for Instructional Technologies 2001)

The ability of a VLE (specifically WebCT) to enable distance learning, and the value of specific features, is examined by Musgrove (2001). Musgrove sees the growing sophistication of WebCT in its latest incarnation as assisting universities in their delivery of web-based learning, through such features as an improved designer interface, a rich variety of communication tools and the capability to customise course delivery to suit individual preferences.

A broad implementation of WebCT as a support to traditional teaching techniques within 20 courses at Creighton University (USA) was the subject of a study during 1997-98 (Morss & Fleming 1998). A survey based on the results of the first semester of use drew these conclusions about WebCT computer-aided instruction:

- it is not time-consuming; most students connected to WebCT for four hours a week or less, though some students printed off pages to read at their desks rather than on screen. Student opinion was split in terms of the workload imposed: older students thought it increased yet the same proportion of younger students believed it did not
- the level of use of the system matches students' computer abilities, although the system does require a number of skills that are not achieved without training
- the central tools (Path Editor and Bulletin Board) are relatively easy for students to use
- the younger students perceive the system as helping the learning process
- using WebCT supports the perception of both younger and older students that computer-aided instruction is important for success in their future careers
- lack of unambiguous evidence made the researchers cautious in drawing conclusions about the efficacy of the WebCT tools.

Another study of WebCT's use in course delivery was made by the University of British Columbia, where the computer science department involved 730 first- and third-year students in the use of WebCT (Goldberg 1997). It investigated student acceptance of the system, and the academic effectiveness of various modes of course delivery. Web-based aspects of courses were presented using the WebCT course tool. Courses for both year groups included complete course content online and access to the same set of WebCT tools. The results for student use were as follows:

- third-year students made more use of the online resource and conferencing system than first years
- approximately 30 per cent of the access to the online resources came from outside the university labs, indicating extensive use by students offsite.

Students considered that the online resources had improved their understanding of the course materials.

Away from the university environment, Follows (1999) described the use of Thirst for Knowledge, a VLE that simulates the workplace of the Quaker Oats Company, used as part

of an introductory marketing course. It was found that using the system to simulate a workplace environment outside the classroom saved time and reduced risk. In addition, the system:

- provided the students with a context for the learning process to take place within
- allowed the students to control the learning process
- developed an ability to solve high-level problems
- made learning a personal experience for the student
- modelled the complexity and uncertainty of working in the real world
- could accommodate a wide range of students' learning styles
- was many students' preferred way to learn.

Assessment

At the University of Calgary, WebCT was used to construct, administer and mark a mid-term examination made up of randomly selected items from an item bank, as part of an undergraduate course in computer science. Jacobson & Kremer (2000) reported that the students identified benefits including:

- the flexibility of 'any time, anywhere' access
- being able to sit the exam at a time most convenient to them
- being able to set up their work space for the exam
- the open-book nature of the exam, with some students reporting increased confidence because they could access their textbooks and notes

However, students also perceived certain disadvantages:

- the potential for unethical conduct among their fellow students in an unsupervised exam
- difficulty in contacting an instructor during the exam, despite contact information for the instructor being made available
- inability to jot calculations in the margin (unlike the paper-based exam)
- confusion over time elapsing during the exam and uncertainty about how to set up the workstation
- problems with home internet access
- weaknesses of multiple-choice questions as a style, for example it is not possible to demonstrate the thought processes that lie behind an answer, and there is no opportunity for partial marks.

It is clear that if an existing course is redeveloped for online provision via a VLE, technical design and delivery issues will come to light, but training of both staff and students will also need to be addressed. Many of the issues that arose here are related specifically to online assessment. Since online assessment is a function that many will expect a VLE to perform, it is valid to consider its effectiveness. Robertson & Klotz (2001) highlight five specific issues which came to light when converting a course for delivery by WebCT:

- students' technological capacity to function as online learners
- technological support for students and instructors
- time zone and international server problems
- the compatibility of America Online (AOL) with WebCT
- firewall protection blocking the chat function.

Communication

Curtis & Lawson (2001) carried out a study of the use of the computer conferencing component of Blackboard Classroom, with 24 students at the University of South Australia, on a Bachelor of Education course. They investigated the extent to which components of collaborative learning that had been found in studies of face-to-face interactions could be identified in the online interactions of students. An analysis of participants' postings revealed many of the behaviours associated with face-to-face situations. Challenging others and offering explanations were absent, though this may have been as a result of students' unfamiliarity with each other. More social interaction and online self-introductions might help overcome this barrier. The researchers concluded that the medium did influence the students' interactions. They all undertook the course as an off-campus course, and without the Blackboard Classroom software their interactions would have been limited to email. While it would have been possible to set up an email discussion list, to have provided the range of interactions required (group email, the discussion board, file transfer and chat) would have necessitated a range of software tools. Blackboard provided a consistent interface for all the interactions. It was concluded that successful collaboration as described in face-to-face situations is possible in online learning environments.

Nine volunteers from a teacher education programme at Queens University (Canada) participated in a study of how a private WebCT forum may foster self study (Russell 2000). Conclusions were that:

- individuals that took the time to participate showed a tendency to reflect on their personal professional learning
- the forum gave the participating teachers insights into reactions to his/her teaching that would have been difficult to gain in any other way, providing a valuable opportunity to improve teaching.

Participation in the forum was voluntary, and had it not been so, the end result might have been very different. Russell notes that willingness to participate in discussion is not universal, and that patterns of access and use vary widely. While he continues to encourage his students to participate in the forum, he is seeking meaningful alternatives for those who do not wish to take part.

Communication tools were also highly appreciated at the University of British Columbia (Goldberg 1997), with 85 per cent of third-year students and 62 per cent of first years claiming that online conferencing produced a greater feeling of community. Similarly, the majority of students in both groups found the course more personal as a result of using the conferencing tool. It was also found that students lacking confidence to participate in class discussions were willing to contribute to an online discussion.

3.2 Schools

3.2.1 Current situation

Although VLEs are not used widely in UK schools, this is not the case in other countries. For example, information on the websites of WebCT and Blackboard suggests that these products are used extensively in high schools in North America and Australia. These include:

- Ouverture Computer Technology Magnet Elementary School (Blackboard) http://louverture.usd259.org/
- McDonogh School, Maryland (Blackboard) http://www.mcdonogh.com/view.cfm?Cat=13
- San Marino High School, California (Blackboard) http://www.san-marino.k12.ca.us/~smhs/
- Cool School (WebCT) http://www.coolschool.bc.ca/webct.htm.

In Australia, the curriculum report of the 30th Annual Conference of the Isolated Children's Parents' Association (McLellan 2001) describes the Schools Online Curriculum Content Initiative. Part of this Commonwealth-funded initiative involves designing a professional development programme that will prepare teachers for using WebCT to move into online delivery at various levels.

Blackboard and WebCT are not the only VLEs in use, however. For example, IBM Learning Village is used by Coláiste Muire, Cobh, Cork, Republic of Ireland (http://www.iol.ie/~cmuire/) and Outram Secondary School, Singapore (http://schools.moe.edu.sg/oss/default.htm).

In European schools, the use of in-house or open source VLEs is becoming more popular. A European Schoolnet survey in 2002 (Vuorikari 2003) found that only one-third of VLE users used a VLE from a commercial developer. Of the 17 education ministries and national agencies surveyed, VLEs were a high priority for 60 per cent of them.

3.2.2 Research findings from schools

According to literature searches to date, only developer case studies have attempted to investigate in depth the benefits and the impact on teaching and learning in schools, and those case studies are not included in this research report. It seems likely that school-based developments, even in the USA, are still at an early stage (especially since WebCT and Blackboard have been developed for FE and HE), and consequently other projects have yet to be fully evaluated and disseminated.

The European Schoolnet survey cited above does, however, give some indication of the nature of VLE use in European schools. Over 500 schools responded to the survey, conducted between September and December 2002. Findings suggest that teachers use VLEs as part of a mixture of different teaching styles, combining computer-based instruction with face-to-face teaching to form a 'blended learning' approach. Teachers use VLEs more than students, making use of their administrative and communicative capacities: they communicate with staff in their own and other schools through VLEs, often as part of international collaboration programmes. In teaching, VLEs are used most often to teach ICT and other cross-curricular subjects.

The national agencies and ministries who put VLEs high on their agenda were generally found to expect VLEs to facilitate pedagogical change, enhancing interactivity and leading to a more learner-centred approach. However, the survey suggests that these expectations have not always been met: teachers seemed to use VLEs more to communicate with each other and assign tasks to students than to directly support learners' acquisition of knowledge and skills. Interoperability and reusability of content were also found to be of concern to the

majority of national agencies and ministries, indicating that e-learning standards and data exchange will be increasingly important issues in the development of VLEs.

European Schoolnet will publish a report on this study 'Virtual Learning Environments for European Schools: a Survey and Commentary', during 2003.

4. Implementation issues

Based on the experiences of FE colleges, interview data from staff at schools in South Yorkshire collected as part of the research for the development of the functional specification (see Section 4.15), and material in the literature, a number of issues have been identified. Whether or not they will all be relevant to every institution will depend on the system chosen, what it is used for and the size of the institution. In some cases a school may wish to appoint a VLE administrator – a designated person to have overall responsibility for the VLE. In some FE colleges, a number of teaching staff have taken on the role of mentors, answering staff queries and generally raising awareness of the VLE.

VLEs employ web-based architectures and are often deployed across local area networks (LANs), being accessed at the client level via a web browser. Robust and reliable LAN infrastructure is crucial for a local implementation if a VLE is to be deployed and used successfully. Client and browser issues will also need to be addressed. A VLE may require that specific versions of browsers are used, both for the institution's desktops and for machines accessing the VLE from elsewhere, such as the home. Particular types of course material may also require particular plug-ins and media players.

4.1 Models of ICT access and use

All VLEs and associated products share one feature: they are web based. Maccoll (2001) notes that VLEs were initially non-web-based, citing the example of Learning Landscape, developed by the University of Wales Bangor, which depended entirely on client software when it was released in 1998. It is now known as Colloquia and is moving to a web platform. Indeed, in networking, the web has taken over as the dominant form, and it is easier to provide networked PCs with web browsers than to set up the same machines with specialised client software. The web browser also offers the potential of universal access, not limited by physical boundaries.

> *'Being browser-based, MLEs have the potential to enable controlled access to information by teachers, pupils and parents from any location over the Internet, as well as the seamless and efficient exchange of data with the DfES, their LEA, and other schools. As one teacher expressed it: "pupils, teachers and members of the surrounding community would be able to register to use the system, access and complete their work online, send it back to the teacher electronically – so that it can be either teacher-marked or auto-marked and then returned to the pupil for review. Electronic mark books and statistical analysis would automatically track pupils' progress."'*
>
> (DfES 2002a)

Services such as Think.com and Schoolmaster.net, which are web-based and require no proprietary software or plug-in, are accessible to the user from any internet-connected computer. There is, however, the issue of the extent to which making full use of the more sophisticated functions in VLEs, such as accessing video material, requires a high speed connection that not all schools or homes may have. This is important when assessing to what extent these systems can involve parents and be used from home. If broadband connectivity is a prerequisite for full use of a VLE, including the extension of use beyond the school to the home, then there is an obstacle to be overcome. In May 2003, just eight per cent of all UK households had a broadband connection, defined by Oftel as speeds in excess of 128

kilobits per second (kbps) (Oftel 2003). What is more, not all schools have a broadband connection, although progress is being made towards a target of 40 per cent by August 2003. Almost 90 per cent of secondary schools have a connection of at least 2 megabits per second (Mbps), but lower levels among primary schools bring the total figure down to just over 0.25 Mbps (DfES 2003). Any institution should therefore check carefully the potential demands on their network which may be generated by the implementation of a VLE, and ensure that their infrastructure can cope before committing to a purchase.

Despite the recent significant increase in ICT resources in schools, often as a result of funding from the National Grid for Learning (NGfL), internet access is often an important issue for schools, especially when dealing with a web-based resource such as a VLE. How, where and when ICT is delivered in a school is determined by the practicalities of the classroom. In turn, schools operate a range of models of ICT access and the demands to be placed on any software package such as a VLE vary. In the context of access to a VLE, Dorner *et al*. (2000) identifies four models of ICT management and use:

- between one and four computers as a classroom resource
- a computer suite, often managed by a particular subject or department
- computers in a library or resource centre alongside books and other material
- a data projector and a screen or whiteboard, managed by a teacher, and generally used in the context of whole-class teaching.

4.2 Speed of access

Speed of access will depend on the type of connection to the internet and the amount of network traffic. Dorner *et al*. (2000) states that schools and other educational establishments are likely to have access to fast connections such as an asymmetric digital subscriber line (ADSL) or an integrated services digital network (ISDN) link, and that there should not be any degradation in speed as a result of network traffic. Anecdotal evidence from schools using Digitalbrain suggests that broadband access is essential if teachers and students are to make the best use of the services – the LGfL is supported by a broadband network offering secondary schools 10 Mbps access and primarie schools 2 Mbps. In the case of Espresso, the system requires a satellite dish to receive broadband, and Netherhall School, using Think.com, is investigating the use of technologies such as ADSL to provide greater capacity and faster access. Dorner notes that the typical home user would be connected via a modem and ordinary telephone cable. The connection speed would depend on the speed of the slowest modem between the user and the internet service provider.

4.3 How will broadband affect the use of VLEs?

The HE and FE sectors have benefited from the Super JANET high-speed network supplying broadband to support the use of VLEs. Not all schools have broadband access (DfES 2003), which raises the issue of infrastructure in the potential take-up of VLEs. How is broadband defined? Is an 8 Mbps connection sufficient for intensive usage in a secondary school? Is 2 Mbps enough for large-scale use in a primary school? Will the introduction of caching systems and content-delivery networks by schools reduce the need for increased bandwidth? Where LEAs are taking the lead on issues such as infrastructure and technical support, this may have implications for how individual schools can implement their VLEs.

4.4 Frequency of access

An important element in a VLE is the online communities, and unlike software tools and content-rich CD-ROMs, these require members to go online frequently to read what has been written and to send new messages. Access once every couple of weeks will not sustain interest and can frustrate the communities. Dorner *et al*. (2000) note that the schools that have been most successful in introducing Think.com are those that have identified the

limitations of and opportunities provided by their internet provision. Schools may need to aim for a successful project with just one class or year group of pupils who can access the system at least once a week, rather than making the service available to all, of whom only a small group ever manage to access the material.

4.5 Home access

A number of VLE developers stress the potential that their product offers for home access and out-of-hours use by pupils. Students can see and add to the work that they were doing at school when they are at home. Assignments can be completed at home, or work can be set specifically as homework to be completed on the system. Since time at home may be less constrained than in school, this could have distinct advantages.

Parents may be granted access to a range of information about the school including parents' organisations, school announcements and holiday schedules, report cards, curriculum overviews, homework, due dates for assignments and testing dates. They may be able to participate in discussions about students' progress.

4.6 Parental involvement

VLEs have the potential to allow parents to become more involved in the school community through:

- improved communication with teachers and school administrators
- engaging with parent teacher association (PTA) issues through the PTA chat room.

Where pupils are boarding, there may be additional reasons for encouraging this form of parental involvement. There may even be a fundraising dimension, for example under a schemes where parents are encouraged to make use of the free dial-up facility from home, thereby contributing to a reward scheme. Points earned on this scheme can be redeemed for computer equipment.

However, home access by parents or students obviously requires internet access at home, and a recent report indicated that just 56 per cent of children use the internet at home (DfES 2002c). While home access to a computer and the internet is not universal, there are clearly significant equal opportunities issues for schools pursuing this course of action. In addition, time spent online is not a trivial matter for parents who may be concerned about the cost of the phone calls, and by the fact that the home phone line is being monopolised. Making computers available after school and at break times may go some way to helping those who lack access at home. Parents and children may also require training before they can make use of a home connection to their school's VLE.

In addition to access issues, it is important to consider what level of training parents and home users will require in order to use the various systems currently on offer to schools effectively. The need for comprehensive training for teachers is discussed in Section 3 of this report, and consideration of similar training for home use would seem to be equally important if learning in the home is to developed. Enquiries and literature searches to date would seem to indicate that this aspect of training has yet to be addressed by both schools and system developers.

4.7 Enrolling the pupils into the class

If pupils are organised into virtual classes, they need to be enrolled into the virtual class and given passwords. Currently, this is often done manually, but as VLEs become more integrated with school administrative systems, it should be possible for this to be done automatically.

Password entry might lead to some practical difficulties if students lose or forget their passwords.

4.8 Backing up content and pupil data

As online learning and VLEs become increasingly important to the work of a school or college, it will not be acceptable for the environment and data to be inaccessible for lengthy periods. It is essential to keep back ups of VLE content and data. One of the advantages of having systems hosted externally is that this should be done by the provider.

4.9 Out of hours questions for staff

In many VLEs it is possible for students accessing the system from home to post questions to staff. Depending on the level of use, this aspect of the system may need careful management, as answering significant numbers of questions from students working at home may not be an efficient use of a teacher's time.

4.10 Implications for libraries

In an article which focuses on the use of VLEs in HE, Maccoll (2001) argues that academic libraries need to be involved in the development of these environments, and to assert their role as resource information managers in their institutions. The development of course materials and digital resources in general should involve full and active liaison and the inclusion of librarians alongside course developers. This will be especially important as the relative expenditure on the management of print collections reduces.

> '*Virtual learning environments must also be virtuous learning environments practising resource efficiency through the incorporation of learning resources in institution-wide library resource description systems – which now interoperate globally for the benefit of whole subject domains*.'
>
> (Maccoll 2001)

A JISC-funded research project called InveStigating Portals for Information Resources and Learning (INSPIRAL), carried out by the Centre for Digital Library Research (CDLR) and the Centre for Educational Systems (CES), both based at the University of Strathclyde, conducted a study to identify and critically analyse the issues that surround linking VLEs and digital libraries, focusing on institutional and end-user perspectives (Currier *et al* 2001).

4.11 Generating course content

Many developers stress the ease of authoring and generating of course content as an important consideration. Some systems are customisable, so that an institution can provide a consistent look and feel to the front end. Course templates can be created so that each course has the same basic elements, to which the content is added.

While ease of use with respect to making Word documents and PowerPoint presentations is important, this needs to be kept in perspective in order to encourage the technical empowerment of teachers and lecturers. The time taken to produce resources will need to be balanced against the extent to which they are used and the number of students that will benefit. Also, Simpson (2001) notes that making resources available electronically does not necessarily constitute learning for the student, nor does it empower the academic pedagogically.

> '*I think it is a step forward that these new technologies facilitate the greater involvement of the academic… We, as advocates of teaching technology have a responsibility to ensure that not only are the technical skills developed but the pedagogic skills are too. When purchasing a virtual environment, we need to look at the educationally-orientated features that are supported, not just the technical*.'
>
> (Simpson 2001)

4.12 Training

It is very important not to neglect staff training, both in the technical and pedagogical aspects of using VLEs. A range of training will be required for various categories of staff using the system. This includes training for staff creating content, for delivery staff in online tutoring techniques, for pupils in initial use of the VLE, and for the VLE administrator. In some cases, the content will have been purchased at the same time as the VLE, in which case it should already be incorporated into the system. Additional content might have to be written by the school and teachers and uploaded. Many systems now include content-authoring tools which simplify this process. Placing courses online requires not only that staff have the technological skills, but are also that they are trained in the new ways of thinking associated with the structuring and delivery of courses through this medium. For a description of the various approaches to training developed by Warwick University to support the introduction of Warwick Online Course Construction (WOCC), see Lewis (2001).

Staff training and development associated with the LearnWise pilot at South Birmingham College (Sisk 2001) commenced with participants and technical support staff taking part in a series of training days delivered by Granada LearnWise. The first day provided an introduction, including content development and planning skills, and further training was customised to the needs of the group. The training offered some generic skills and examples of LearnWise tasks. In order to familiarise users with the system, a 'Using LearnWise' topic was developed. This was primarily targeted at students, but was also used with staff. The topic took users through the main functions of the system. A further topic, 'Content Development for the MLE', was developed to introduce staff to strategies for content development. This provided opportunities for users to gain an understanding of how the system worked. These topics were seen as useful in modelling an approach to the use of the system that incorporated aims and objectives, appropriately presented content, and a variety of activities.

The programme of training and staff development took into account the need to access external expertise during training, and to allow time for the development of internal skills to make use of the system. Staff were enthusiastic about the fact that they could attend a training session and have reference manuals which allowed them to continue content development outside training time. The programme of staff development and training highlighted the issue of the tension between ease of use and varying expectations in terms of standards for the system.

The EDSI project (Scrimshaw 1997) provides further important data on general training provision and patterns of staff development with IT and communications technology in particular. The Modern Communications for Teaching project in Argyll and Bute developed an electronic network linking all the schools in the authority using video conferencing, text-based conferencing and fax as the main technologies. The schools were grouped into local co-operatives for curriculum development and mutual support, but with strong central support and control. The authority used electronic networking to strengthen contacts within and between the co-operatives.

4.13 Awareness raising

A further facet of the implementation process is making parents, as well as staff and governors, aware of the benefits of the system. Online teaching and learning will be new for

most people, and institutions need to ensure that everybody involved understands the importance of the system, and how it can be used effectively.

4.14 Role of senior management

In a review of the literature on learning technologies and libraries, Brown & Currier (2001) stress the important role of senior managers in driving through the introduction and implementation of VLEs. They note that unenlightened senior administrators and managers can be a serious threat to the provision of quality information to learners and society as a whole. To have a 'champion' at senior level with 'clout' will help ensure that a project is allowed to develop rapidly and ensure that project outcomes are embedded in the organisation.

4.15 Functional specification for a VLE in secondary schools

The Becta/JISC definition of the functions of a VLE was outlined in the Introduction. All of the functions would be essential in a VLE for secondary schools. The content is even more important. Though not strictly part of a functional specification, it is essential that content is purchased at the same time as the VLE. Further considerations on content include the following:

- Content must be relevant to the National Curriculum and not require significant repurposing.
- Staff must be able to add their own content, as must non-teaching staff who may need to post information of general interest, eg about school events.
- Taking into account technological limitations, content should be filtered in accordance with the school's acceptable use policy (if there is one); a VLE may be a protected environment to a certain extent, but schools are still responsible for the content students post on the system.
- All content must be accessible to pupils who depend on screen readers and other assistive technologies.
- The communications within the VLE should include automatic email address allocation for all pupils (and parents and teachers) to enable it to be used as a teaching and support tool, without the need to install separate email software, or to rely on personal email addresses (invariably ineffective owing to lack of coverage and inconsistent address conventions).
- It should be possible to have moderated communications if required – for example, postings to a given forum would go to the teacher for approval before being made available publicly in the forum.
- There should be a mechanism whereby parents can be given log-ins to the system, and are able to track their child's progress, and communicate with teachers
- To enable full use to be made of the VLE by pupils, and to enable parents to participate, access must be available from outside the school, ie via the internet, using standard browsers.
- To reduce demand on the school's technical resources, and to maximise availability, there should be a third-party hosting option for the VLE (ie so that schools do not have to host it themselves).
- The VLE should provide a customisable home page for each pupil, which provides access to all their courses, but in which they can also add their own

personal content (football sites, photos, etc), so they will be encouraged to log in frequently, if only to see this content.

- It should be possible to customise the VLE – to change styles and logos, for example, or to add/remove individual functions as required.

5. Discussion of the findings and methodological issues

This section draws out and expands upon some of the themes that have been suggested by the evidence gathered in the production of this report. It discusses the future of VLEs and looks at the issues surrounding their implementation in schools.

5.1 Potential benefits of VLEs

Although not all findings are supported by robust evidence, experiences of VLEs across all sectors seem to indicate that there is at least the potential for benefits in the following areas:

Learning delivery
Potential benefits include the ability of web-based systems to offer 'any time, anywhere' access, a protected environment, the ability to link to resources on an intranet or on the internet, user-friendly interfaces and the ease of web page and course content development. The opportunity to develop online courses is another benefit, but one which in practice is generally limited to the use FE and HE sectors.

Learning gains
The potential to share ideas and information and to join in online conferencing can be a powerful motivator for both disaffected students, to help improve the quality of their work, and for less confident students, enabling them to participate in virtual discussion forums. Some products have been associated with developing higher levels of learning through enabling students to engage in online discussions and fostering self-study. Some have also been used to support the development of ICT and key skills.

Engaging parents in the school community
Some school-based systems offer parental access to a range of information and communications with the school via email. In some ways this is an extension of the web-based functionality described earlier. However, home access for students to undertake homework and related tasks will be governed by access to the internet at home and by the nature and quality of the internet connection.

Administrative efficiency and support for teachers
Online conferencing and email have been used to support departmental planning and administration, engaging staff in debate and achieving wider involvement.. Many evaluation reports identify the need for effective training programmes both in the technical and pedagogical aspects of using VLEs in order that products are used to maximum effect. This will be especially important where online courses are to be developed.

Whether these benefits are realised depends of course on a range of factors, some of which are discussed in more detail below.

5.2 Is the VLE concept better suited to HE and FE environments?

Fundamental differences exist between the schools and HE/FE sectors which may militate against the transferral of tools such as VLEs to schools from the HE/FE sectors.

Population

The main difference comes from the contrasting pattern of attendance. Students at colleges (and universities) have a more flexible pattern of attendance and study. Even full-time students are physically in college for fewer hours than school pupils, and part-time students

are there even less. Also, much study is self-directed study, without a lecturer in attendance. Hence the role of the VLE can be seen easily to complement and supplement face-to-face teaching.

However, in a school where all pupils attend full time, and where the great majority of teaching is face-to-face, the role of a VLE, and the advantages over existing ICT-based teaching that currently takes place in schools, are initially less clear – though, as in colleges, it certainly will not supplant face-to-face teaching.

Even within the schools sector, there are differences in likely use of VLEs because of the age of pupils. A primary school will have different needs from a secondary school, because of the age difference of the pupils, the size of the school, and the different pattern of teaching (one teacher per class, rather than many teachers per class). However, even within a secondary school, the emphasis is likely to change – for example, as exam times get closer, teachers would probably want to use the VLE's online assessment tools more, to give their pupils practice. At other times, group/project work using the communication tools would be more important.

In HE/FE sectors there is often an expectation of value for money from courses, as the student frequently pays. Indeed there are many pressures particular to the HE sector arising from quality assessment procedures; competition for students is also tight. These sector-specific dynamics lead Masson to assert:

> '*I would contend that online courses are driving pedagogical evolution in higher education generally, because of the rush to digitize, virtualize and globalize the campus*.'
>
> (Masson quoted by MacColl 2001)

Control over courses

Universities control their own courses unlike UK schools, which are controlled nationally. It is therefore doubtful that the requirement for flexible courses is as great in schools, where there is no local determination of content.

Specific funding

There has been specific funding for VLEs via the NLN money in the FE sector, and a number of JISC-sponsored projects among universities, amounting to a significant degree of 'pump-priming'. Regardless of potential benefits, it is questionable whether VLEs could penetrate the schools sector to the same degree without some equivalent financial support for their implementation.

There are other differences between schools and colleges that have implications for VLE use. Schools are more likely to experience:

- lack of staff time for training in the use of the VLE (and ICT generally) – even more so than in colleges, since teachers tend to teach more hours. This can lead to resistance to the use of ICT
- lack of staff time to develop their own content
- lack of offline learning resources, such as sufficient library stocks (which makes accessibility to the internet via a VLE more important)
- problems of access to hardware and software for both teachers and pupils – in general, colleges have much better ratios of internet-connected computers to users than do schools. This means that out-of-hours access is even more important for schools. It also means that, in the short term, investment in other technology – such as electronic whiteboards – might have a more immediate pay-off, and be more effective as a teaching tool
- schools' lack of experience and familiarity with flexible learning in comparison with colleges'.

5.3 Is 'in-house' content development a requirement only for the FE/HE sectors?

VLEs contain authoring tools, allowing the generation of course content specific to a teacher/lecturer, course, or institution. Will schools seek to take advantage of this or will they seek off-the-shelf content only? A number of factors may come into play here – staff time and expertise in multimedia authoring is demanded; on the other hand commercial content may be too costly. As observed earlier, the school curriculum is fixed nationally, and consequently the need to generate content locally is diminished. The student population is more heterogenous than the pupil one, although the latter is sufficiently diverse to prompt some to seek to produce their own course materials.

Some may question whether online learning is suitable for the school population at all, requiring as it does skills and motivation that suit the more mature learner.

5.4 HE/FE adoption models

A number of alternative adoption models are demonstrated by VLE take-up to date in HE and FE sectors, which may be pointers as to what schools might do:

- single system use – purchase and implementation of one off-the-shelf product;
- mixed economy using a range of products – this may be while the market stabilises, or a reaction to departmental requirements for systems that suit individual subjects;
- use of 'home-grown' products eg Merlin, University of Hull, COSE at Staffordshire University.

Given the different scale of schools from HE/FE institutions, the first model would seem the more likely to be adopted.

5.5 Will some schools ever want a full VLE?

It may be that schools elect to purchase specific tools such as video conferencing or email rather than buying into the whole VLE concept. Differences between sectors appear when you consider how a VLE may be used, leading one to question whether one solution could possibly suit all sectors – primary/secondary requirements for content will clearly differ; the potential links between school and home will only be an issue for the schools sector. Alternative and more flexible approaches to teaching than face-to-face classroom teaching exist in the late-secondary/post-16 years groups. Demands of administration, assessment and tracking differ, as do the sizes of institution, funding available and associated infrastructure to support VLE implementation.

5.6 VLEs and primary schools

There is little doubt now that ICT in primary schools can benefit teaching and learning, and is able to engage the pupils and enhance their learning experience; see, for example, the ImpaCT2 report (Harrison *et al*. 2002). Primary schools are making increasing use of ICT in both administration and content – for example, products such as Encarta Class Server provide a curriculum management tool, while others such as Spark Island provide content related to the National Curriculum, as well as teacher and parent resources and communications products. However, research to date has yet to identify a primary school using VLEs under the Becta/JISC definition, and it may well be that a different solution is more appropriate for them. The main need in primary schools is for high-quality materials and teaching resources, delivered using ICT, to support face-to-face classroom teaching. Links into the administrative systems, for example for pupil-tracking purposes, are possibly less important, and have less impact on day-to-day work than does good content provision.

Also important is that the content provided is accessible from home as well as school, given that pupils spend far more time at home using ICT than they do at school, and that parental involvement in the learning process is seen as increasingly important. According to the ImpaCT2 report of the emerging findings (DfES 2001), primary school children spent three times longer on ICT at home than at school, and secondary pupils spent four times longer. At the same time, the need for high-quality externally provided content is emphasised by findings that many teachers lacked the confidence and skills to integrate ICT into their subject teaching. In addition, Comber *et al*. (2002) found that teachers needed time to reflect on their practice in order to embed innovation and change.

Systems that enhance communications as well as provide content are very beneficial. The ImpaCT2 study (DfES 2001) found that currently 52 per cent of primary and 67 per cent of secondary pupils in the 60 schools in the study had email addresses. Extending this coverage to nearer 100 per cent would almost certainly improve teaching and learning, if only through improved peer group communications. However, a system that only provides communications facilities is going to be much less useful than a combined content/communication system. It may therefore be the case that a fully integrated VLE will not be appropriate for a primary school at this stage in VLE development. A better medium-term solution may be to look at administrative and combined content/communication solutions. These will almost certainly come from more than one vendor. Such a system is likely to be managed and hosted remotely, since most primary schools won't have the technical resources to host internally.

5.7 VLEs and secondary schools

Although content is also extremely important in secondary schools, it is likely that they will make more use of some of the other features of a VLE, such as pupil tracking and online assessment. It is unlikely that secondary schools will want different features within a VLE – more that there will be a different emphasis (compared with colleges) on those features, given the different patterns of attendance and teaching styles. Based on a consideration of the known processes within secondary schools, we can speculate that some uses of a VLE which might differ from those in a college would include:

Minority subjects

Schools which don't have enough pupils to support a particular course (eg GCSE Spanish) would be able to offer the course via a VLE which supported pupils from more than one school, so getting sufficient numbers to justify the teaching resources.

Summative assessment

The online assessment techniques available in VLEs are normally only used for formative assessment in colleges, because of the risk of cheating. However, in the more controlled environment of a school, online assessment – with its concomitant reduction in marking and administration time – could prove useful for summative testing.

Cover

Providing cover for absent teachers – both the personnel and the content – is an issue in schools. If content, schemes of work, lesson notes, assessment etc are already within the VLE, this can make providing cover much easier and more effective.

Extra support

The VLE can be a useful way of providing extra support, outside traditional hours, to pupils needing it. This could supplement (or even replace) expensive home tutoring. The CHALCS project (see Section 2.3.1) for 8- to 19-year-olds in a deprived area of Leeds is an example of this. The capacity to access learning remotely through a VLE could also help pupils with long-term illness in hospital or at home.

Inter-school collaboration

The VLE can be used as a way to foster collaboration and joint work between schools, both in the UK and internationally. Early work with Think.com has demonstrated how the service can link up primary and secondary schools, with primary school children receiving encouraging messages from secondary school pupils about their work. The teaching of modern foreign languages may also benefit from extending links with schools abroad. Fluency in modern foreign languages and cross-cultural understanding may also be improved through students exchanging sound files.

Catching up

VLEs may be used to provide work to pupils who are dropping behind and need to catch up in some way, or to bring pupils up to a common standard – eg in the transition from primary to secondary school.

5.8 VLEs in the context of learning

The use of VLEs raises important issues about the development and use of internet computing technology and of e-learning in general, in teaching and learning. While it is beyond the scope of this report to investigate the literature on e-learning in any depth, to some extent aspects of e-learning have been touched on when discussing the benefits of specific product functions such as email, conferencing or online content. It is important to consider this wider perspective. Are the benefits cited by early users of VLEs the product of the systems themselves, specific technologies, or e-learning in general? As the Post-16 E-learning Strategy Task Force (2002) put it:

> '*E-learning is a relatively new tool with the potential to radically improve participation and achievement rates in education. Benefits include; the ability to customise learning to the needs of an individual and the flexibility to allow the individual to learn at their own pace, in their own time and from a physical location that suits them* best.'
>
> (Post-16 E-Learning Strategy Task Force 2002, p. 6)

It is easy to understand why many people see VLEs as the means of providing these features of e-learning. Indeed, the report itself cites the case of North East Surrey College of Technology (NESCOT) and its adoption of a single VLE to pull together the college's many different ILT activities.

Developers such as WebCT stress the need for 'best of breed learning tools, robust content management, dynamic learning information management, complete learning personalisation, and an enterprise-class application architecture' as part of a unified e-learning environment. Yet there is always a danger, when considering the use and benefits of VLEs, that too much emphasis is placed on promoting the key features, in particular sets of tools and content. As a result, in the words of Simpson (2001), we are 'doing the student and academics a disservice'. Although writing about experiences in HE in the UK, her views are generic and based on products such as WebCT, Blackboard and WOLF (now LearnWise). She argues that it is more accurate to say that we buy into a virtual environment, which gives an institution the technical empowerment and resources and the potential to be a *learning* environment.

> '*Only academic and student interaction can create a VLE from a VE. I think there is a danger that in the eagerness to adopt and implement VLEs, we will produce virtual environments rich in content and tools but lacking in learning…*
> *For me, the definition of whether a software is a VLE or not is how it is being used, not what it is technically capable of doing.*'
>
> (Simpson 2001)

The teacher remains key, and teaching with VLEs is a new skill:

> '*You can't just put material in and hope for the best. One of the key factors is that teachers or tutors have to be visible within the environment*.'
>
> (Richard Wallace of Ballyclare High School, quoted in Kenny 2002)

This point is reiterated by Alan Stevens of Sawtry Community College in the same article:

> '*…basically an MLE must be managed by the teachers…….Any MLE should complement what teachers are doing, not attempt to replace them*.'

5.9 Administrative efficiency and support for teachers

The use of electronic bulletin boards can be a helpful way to disseminate information to teachers and staff, and be a mechanism for conducting post-mortems on major events.

VLEs allow teachers to create content and share it with educators around the world. In the case of Encarta Class Server, the developer claims that the platform minimises the workload for teachers. It is envisaged that initially it will add no more than 30 minutes a week to the teaching load, and on gaining proficiency in its use teachers should realise time savings.

At John Cabot City Technology College, Bristol, FirstClass is used in several ways to support communication (FirstClass 2003):

- making announcements and hosting the ensuing discussions
- distributing minutes of meetings
- holding online conferences allowing staff to engage in debates on a range of topics
- opening up channels of communication between the principal and students.

Where a VLE is linked with the school's administrative systems, ie creating an MLE, there are possibilities for simplifying administration tasks. It is hoped by the DfES that this facility will help to reduce teachers' workloads:

> '*The maturing of managed learning environment systems (MLEs) for schools (together with the integration of schools' curriculum and administration networks) may provide teachers and other staff with the tools to undertake necessary administrative tasks simply and efficiently through a common interface to their school's management information system. They will also allow teachers to undertake a more informed analysis of pupils' performance*.'
>
> (DfES 2002a)

5.10 Assessing the claims made

When making judgements about the validity and reliability of the claims that have been made about the various benefits of VLEs, it is important to consider whether the benefits are:

- only possible or maximised through the use of a VLE as a whole, or whether they could have been achieved through the use of the separate features/applications/functions, such as email or a video conferencing system alone. A number of similar benefits, deriving for example from accessing

materials outside the school, and holding online discussions within and between schools, have been recorded where VLEs did not exist(Scrimshaw 1997)

- only related to the performance of a particular system, given that the various services offer a range of contrasting features

- based on personal testimonial which fails to take account of classroom context, pedagogical issues or curriculum impact

- based on the program rather than the user

- a function of the various schools that have piloted the systems, whether they are primary or secondary, and whether they might be termed as 'innovators' or 'early adopters' with respect to their use and experience with ICT. It could be that they are more prepared to take risks with new technologies and curriculum innovations, perhaps because of the financial and resource opportunities that system developers may offer, and it may be the case that these schools are not representative of schools in general

- related in any way to the maturity of these systems, and may therefore not be sustainable as the various systems mature. Only time will tell whether the novelty or Hawthorne effects may be playing a part in any early findings.

5.11 Further development of VLEs

It is interesting to note when reading the literature how much VLEs are still in their infancy, and what needs to be done in order to maximise what they have to offer. Poh Meng, school principal of Outram School, Singapore, notes that further work is required in the school in the following areas (Poh Meng & Kumar Puttur 2000):

- *Population*: databases need to be adequately populated and training given to all students and staff; in particular, staff need better web page production skills, to enable more lessons to be available on the web

- *Promotion*: to encourage community involvement and to publicise the service as a tool to enhance teaching and learning; user IDs and passwords will be needed by all parents. Staff will also need to enrol as mentors to guide students in the development of various projects using the system.

- *Participation*: the establishment and development of school-wide discussion groups on topics of direct interest to students, and associated project work and discussion databases.

The school reports that while there had been technical difficulties, not unusual in leading-edge developments such as this, the professional challenges posed by the VLE they were using were more difficult to overcome, as it:

> '*…offers a potential for change that requires new mind-sets and attitudes from staff, students and the community. For instance, teachers must re-examine their role as facilitators of knowledge acquisition; students must review their responsibility in learning; and parents must reassess the priorities they have placed in their child's education.'*
>
> *'The "Old Wine, New Bottle" syndrome must end. Teachers must recognize that technology has successfully removed the constraints of time and space – and has forced us to redefine our basic understanding of where, when and how learning can take place. As with any innovation – be it fire, the wheel or the computer – educators must be brave to re-examine their age – old assumptions about teaching and learning.*'

> (Poh Meng & Kumar Puttur 2000, p. 4)

In the evaluation of Espresso, the researchers make an interesting point that could be held to be true of all VLEs:

> '…*Cost-benefit judgements require schools to balance the overall value of subscribing to Espresso, with the perception that this is a relatively expensive venture. While financial considerations will probably be paramount, teachers' and pupils' time and energy will also feature in the value attributed to using Espresso for Schools. Very high levels of pupil enthusiasm and autonomy are seen as a mixed blessing, while a compact, attractive and well-designed system is seen as a clear advantage.*'
>
> (Watts & Lloyd 2000)

6. Summary and conclusions

The growth of VLEs continues apace in both HE and FE. There are a number of established companies and brands. In particular, WebCT and Blackboard have established a strong foothold in the UK HE sector in recent years. While developments are not nearly as advanced in UK schools, the range of VLEs and products that offer one or more of the functions of a VLE as defined in this report is expanding all the time. However, many of the systems – especially those designed for schools – are very new, and many of the schools using them have only been doing so for a relatively short time.

6.1 The nature of the evidential base

As a result, the evidential base is limited and developers' promotional literature, together with limited case study data from early adopters, which is usually of an anecdotal nature, remain the chief sources of data when it comes to making judgements about the use and benefits of VLEs in UK schools. Given that schools have not been using these systems for very long, it is difficult to be able to identify clear benefits and implementation issues at this point. Often it is only possible to draw conclusions from the more extensive evidence that is available from North America, especially in the case of the more established VLEs such as Blackboard and WebCT, and from FE and HE in the UK. Even in the HE and US literature though, few if any of the findings relate to the impact of a full VLE.

The various case studies available through the Ferl site provide important information about the issues associated with the implementation of VLEs, although not always of the types of systems that are targeted at the school sector.

An attempt has been made in this report to develop a functional specification for a VLE for schools, based on the definition of a VLE currently being used in FE. Care has been taken to appreciate the differences between schools and colleges as institutions in shaping the specification, and between primary and secondary schools.

6.2 Conclusions

Despite the nature of the evidential base from which to make judgements about the impact of VLEs on teaching and learning, the general impression is that VLEs are likely to have a significant impact on the process of teaching and learning in the future. A JISC Assist workshop report suggests that without an MLE, a university is not sustainable far into the 21st century (JISC 2000a). While established products are beginning to emerge in the FE and HE sectors in the UK, the schools market still remains immature and volatile. However, with the improvements in infrastructure associated with broadband developments, the opportunity to exploit to the full some of the more exciting, interactive and advanced elements of the products considered to date becomes a reality for more educational institutions.

The development of Curriculum Online by the DfES is also likely to have implications for the growth of VLEs. £100 million per year of eLearning Credits is being made available to schools from 2004-06 to spend on digital learning resources. Although it is too early to assess the impact of Curriculum Online and eLearning Credits on the development of VLEs, it seems certain that as schools expand their collections of digital learning resources, the need for learning platforms through which to deliver them will become more significant. Many have started by using Learning Content Management Systems, whether at the school, local education authority, or regional broadband consortium levels, but as the supply of interoperable content with appropriate packaging increases there will be a growth in demand for compatible VLEs.

Curriculum Online is also working with the industry to agree an approach to interoperability conformance – metadata is already specified by Curriculum Online; further discussions on

content packaging and software interoperability are ongoing. Both the process of the discussions and the final agreement will encourage greater use of VLEs, which can demonstrate that they will accept and manage efficiently a broad range of suitable content.

Appendices

Appendix 1. Examples of building MLEs in HE programme projects, and their aims

Project name	Where?	Aim
CoMantle	University of Wales, Bangor	Interoperability between learning management systems and administrative systems, using open technical standards
Managed Learning Enivronment Project	De Montfort University	Integrate multiple learning resource and support tools into a single environment
SMILE (Sunderland Manged Interactive Learning Environment)	University of Sunderland	Create a single system for presentation of a variety of support services and act as a test case for application of MLEs in the HE environment
INSIDE (an Institutionally Secure Integrated Data Environment)	Universities of St Andrews and Durham	Produce a reference model of distributed information sharing between administrative units and academic departments
GIMIS (Generic Integrated Management Information Systems)	Writtle College	Establish methodologies for dissemination of MIS information throughout the college

Appendix 2. Examples of VLEs and the colleges using them

VLE	School/LEA/College
Blackboard	Birmingham College of Food and Technology Cardonald College City College Manchester City of Sunderland College Halton College Luton Sixth Form College Motherwell College Myerscough College North Lincolnshire College North Trafford College Northern College Dundee Scottish Agriculture College
Digitalbrain	London Grid for Learning
LearnWise	Leicester College South Birmingham College Stoke-on-Trent College Sutton Coldfield College Thurrock College Shrewsbury Sixth Form College Ridge Danyers College College of North West London North West Kent College
SCHOLAR	Clackmannan College Telford College, Edinburgh Fife College Jewel and Esk Valley College Lauder College Perth College Stevenson College West Lothian College
WebCT	Leeds College

Appendix 3. Summary of the benefits of using Blackboard at the City of Sunderland
(*source: 'Getting started with a VLE - The City of Sunderland College experience'* http://ferl.becta.org.uk/display.cfm?page=13&resID=1336)

FUNCTION	Details	Benefits to students	Benefits to staff
Announcements	Used to inform students about: • key dates in their programme of study • exam entry arrangements • advance notice of assessments • new course material • reminders and deadlines	• they are kept informed • improves communication • all groups are informed • provides support	• improves communication • staff can track student access to the announcement page
Staff information	• staff contact details – base centre • email link • short description of lecturer's input to course – eg modules taught, any special interests • photographs posted	• gives contact information • familiarises students with individual staff input • helps student induction	• contact information • familiarises students with individual staff input • helps student induction
Course information	• course fact sheet • course specification • exam board student guide • ILC resources • scheme of work	• students have access to the full programme and they can chart their own understanding • students can work at an appropriate pace (high achievers)	• staff can refer students to key points in the course information and know they can access this and download for their own use
Course documents	• lecture notes • course handouts • PowerPoint presentations • exemplar material • organised in folder structure to enable tracking	• students have access at all times to course materials • consolidate learning • access to materials for revision purposes • if absent they do not miss course handouts etc	• staff can track student usage • material can be made available and unavailable by staff, helping them to tailor content to individual or specific groups of students • can modify material
Assignments	• multiple choice • surveys • fill in blanks • essays	• consolidation of learning • motivation of instant marking/feedback • allows students to test their understanding	• contact time can be used more effectively • routine testing and marking load reduced • provides testing for high achievers • can set assessments and target at individual students
Communications	• staff unsure about whether they would make some or all of the tools available	• increased opportunity for communication between students and staff	• staff can run virtual lessons • enables staff to stay in contact with students if they are absent
External links	• links to exam boards • description of value of site • careers information • UCAS	• personalised links page related to the course • students can access quality websites validated by staff	• extensive range of information/resources
Student tools	• posting key dates on the calendar • notes for key dates • specific appointments, eg progress reviews • notices to individual students	• keeps students informed of key dates etc • messages can be posted on an individual basis • students learn the habit of keeping a study calendar	• staff can target individual students with messages related specifically to them

Appendix 4. Examples of VLEs and the schools using them

VLE	School/LEA/College
Digitalbrain	London Grid for Learning
Espresso	Rookhope School, County Durham Chenderit School, Northamptonshire Henbury School, Bristol Ashington Wansbeck School, Northumberland Kings' Hill School, Kent
FirstClass	John Cabot City Technology College North Lanarkshire Isle of Man
Learning Alive (RM)	Malory School, Lewisham Colbayns School, Essex Pompey Study Centre (Portsmouth Football Club)
LearnLinc	James Brindley School
LearnWise	Longton High School, Stoke-on-Trent 10 TC Trust schools (trial)
NINE	Northern Ireland, primary and post-primary
Pioneer (LT Scotland)	Many secondary schools
SCHOLAR	Aberdeenshire Argyll and Bute City of Edinburgh City of Glasgow Dumfries & Galloway East Lothian East Renfrewshire Renfrewshire West Lothian Scottish Council for Independent Schools
Schoolmaster.net	claim 20 per cent of secondary schools St Andrews High School, Croydon King's School, Devon Mill Hill School, London Abingdon School, Oxfordshire Fair Oak High School, Staffordshire
Spark Island	around 2600 primary schools 60 LEAs trialling, including Buckinghamshire Chantry Community Primary School Vicarage Primary School, East Ham
Think.com	Valentines High School, Redbridge
WebCT	CHALCS Havering Sixth Form College

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