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Return to SENDA[1]?
Implementing accessibility for disabled students in virtual learning environments in UK further and higher education

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October 2003

[1] Special Educational Needs and Disability Act

Abstract

A virtual learning environment (VLE) is a form of e-learning software that allows online interactions of various kinds to take place between tutors and learners. Within the last five years, over 80% of UK further education (FE) and higher education (HE) institutions have acquired a VLE.

During this period, the Special Educational Needs and Disability Act (SENDA) has been introduced, which requires UK education institutions to ensure that disabled students are not treated less favourably than their non-disabled peers.

With appropriate use of web technologies and an understanding of user requirements, learning material presented on a web-based VLE can, in theory at least, be made accessible to disabled students.

This study, which combines an extensive literature and web review with a survey and interviews, reveals a widespread lack of accessibility in VLE materials. The inaccessible elements are both within the VLE software itself, and within the content the institutions put into the VLEs. This lack of accessibility is shown to have a number of origins, principal amongst them:

- a lack of awareness within FE and HE about the needs of disabled students
- a lack of user-centred design processes (on the part of VLE developers and education institutions)
- a lack of knowledge of web technologies on the part of VLE content authors
- a general 'skills gap' in the area of instructional design, and
- a lack of strategic leadership within institutions in tackling the overall issue of inclusive learning and teaching.

A series of recommendations for ways to tackle these and other causes of inaccessible learning provision is addressed to the principal VLE stakeholder groups.

This report is also available in HTML, Word 2000 and PDF formats at http://www.saradunn.net/VLEproject/index.html

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Acknowledgements

Many thanks to Helen Petrie for her help while supervising this research, and to all interviewees and questionnaire respondents.

Thanks also to everyone who provided additional information, insight, practical advice and support: Shirley Ambrose, Paul Bailey, David Bootle, Roseanne Bower, Anny Brackx, Alison Briggs, Anise Bullimore, Kevin Carey, Dianne Ceresa, Angie Donoghue, Nel Druce, Ruth Goodison, Wolfgang Greller, Beverly Hetherington, Sue Lobb, Geoff Minshull, Chloe Morrow, Derek Newton, Simon Norris, Norman Octon, Sharon Perry, Susannah Quinsee, Daniel Ross, Anne-Marie Sharman, Sarah Stone, Neil Thurman, John Traxler and Penny Yates-Mercer.

Particular thanks to Chetz Colwell and Pete Rainger for their expertise and generosity.

Finally, thanks to the City University 2002/3 master's students in electronic publishing who piloted the questionnaire.

Executive summary

Aims

The aim of this research is to investigate the current state of knowledge concerning the accessibility for disabled students of virtual learning environments (VLEs) in UK further education (FE) and higher education (HE) institutions, particularly since the introduction of SENDA –the Special Educational Needs and Disability Act 2001.

The study builds on existing research on the accessibility of the 'end-product' (i.e. the VLE course itself) - for example Stiles (2001), Evans and Sutherland (2002). It maps the points along the 'critical path' of VLE-based courses where accessibility problems originate, and makes recommendations about ways in which accessibility for UK students using VLEs can be improved.

Methodology

The study combines an extensive literature and web review with an online questionnaire and a series of interviews. Relevant literature is drawn from academic research in the fields of e-learning and of web accessibility, as well as from educational policy and technical guidelines from the educational and commercial sectors.

The online questionnaire elicited information regarding the processes used in FE and HE institutions to create courses delivered via VLEs, including what provision was made for ensuring the accessibility of those materials. The survey was circulated via three UK academic discussion groups with a specific interest in either VLEs or web accessibility (or both) in FE/HE. A number of individuals from four contrasting FE/HE institutions across the UK were also interviewed face to face. The total survey sample was 57.

Definitions and scope

UK further and higher education
Higher education (HE) refers to academic education above A level (and its Scottish equivalent), provided by universities and colleges of higher education, collectively known as higher education institutions (HEIs). There are approximately 170 higher education institutions in the UK.

Further education (FE) consists of all education after the age of 16, other than higher education. FE courses are mostly technical, vocational and professional training. There are 483 FEIs in the UK.

Virtual learning environments
The UK Joint Information Systems Committee defines a VLE as a place where 'online interactions of various kinds take place between learners and tutors'. VLEs incorporate the following tools and functions in a single software environment:

- teaching materials - for example reading lists, module notes, handouts; also multimedia content such as audio or video
- communication tools –for example e-mail, newsgroups, mailing lists and bulletin/discussion boards
- assessment tools –for example electronic submission of assignments, self-tests, assessed tests such as multiple choice.

Most VLEs also include shared student work group areas, student tools such as web pages, diaries and calendars, and tools for the management and tracking of students – for example password protected areas and logging of student usage of VLE. All this is combined within a single interface – customisable to a certain extent by the educational institution and by individual students.

There are currently approximately 500 VLEs in use by FE and HE institutions in the UK.

Accessibility
There has been a considerable amount of work dedicated to making the web accessible to people with a range of disabilities, including those who have visual impairments, hearing impairments, motor impairments or various forms of learning or language disabilities.

An accessible web page allows users to access it in a format that suits them – for example in audio format, or in large print, or on a coloured background. In order for the disabled user to be able to manipulate the material to their requirements, the 'raw content' must conform to certain accessibility specifications, standards or guidelines. The best-known of these guidelines are produced by the W3C Web Accessibility Initiative. There are also some accessibility guidelines specific to the production of web-based e-learning materials.

SENDA
The Special Educational Needs and Disability Act is in the process of being introduced in the UK. The legislation 'aims to ensure that disabled people have equal opportunities to benefit from, and contribute to the learning and services available in education institutions'. SENDA requires all education institutions:

- to make reasonable adjustments to accommodate the needs of disabled students
- not to treat disabled students less favourably
- to act in an 'anticipatory capacity' (i.e. institutions should not wait until a disabled student asks in order to implement good practice).

Results
The literature and web review and the online survey all found similarly low levels of accessibility in VLEs. The accessibility barriers were within the VLE software itself and within the content.

Aspects of the VLE software shown to be particularly difficult were synchronous communication tools (chat and whiteboard), navigational structure (over-complex frames-based architectures), and assessment procedures. Many respondents pointed to generally poor usability hindering accessibility, so that even if the product was technically accessible to a user with disabilities, it was still too complex to use with any effectiveness or efficiency.

Accessibility barriers within the content were often caused by invalid HTML code being produced by authoring tools used by non-technical authors. A general lack of understanding of the principles of instructional design and the technical issues involved in web accessibility, coupled with a lack of effective content development processes within institutions, led to a poor level of VLE content accessibility. It was also clear that very few institutions made provision for testing VLE courses with students.

Broadly, the following reasons all contributed to inaccessible VLE-based learning:

- a lack of awareness within FE and HE about the needs of disabled students
- a lack of user-centred design processes (on the part of VLE developers and education institutions)
- a lack of knowledge of web technologies on the part of VLE content authors
- too narrow a focus on technical standards compliance at the expense of broader learner-centred design principles
- a general 'skills gap' in the area of instructional design, and
- a lack of strategic leadership within institutions in tackling the overall issue of inclusive learning and teaching.

Principal recommendations

VLE developers

- Adopt user-centred development processes, in particular ensuring that the needs of a broad range of learners are at the heart of the design and development of VLEs.

- Consider developing much simpler, non-frames based VLEs, and stop assuming that a more complex product is a better product.

Technical bodies

- Adopt a more pragmatic approach to guidelines that acknowledges the constraints under which developers operate and the conditions under which the majority of users access the web.

- Produce plain-language, practical and short guidelines that are easy for non-technical authors to assimilate.

National educational institutions

- Further consider the creation of an e-learning conformance authority to monitor and enforce adherence to technical standards, including accessibility standards, in e-learning.

- Continue to take steps to delineate and address the skills gap in e-learning; in particular to support the development of instructional design as a recognised discipline with learner-centred design principles at its heart.

Individual FE and HE institutions

- Recognise the range of skills needed to develop quality e-learning, in particular:
    - consider creating learning development specialist units, responsible for the overall planning and management of e-learning in close collaboration with academic groups
    - support the development of instructional designers within these units.

- Ensure that strategies for information and communication technologies, learning and teaching, and widening participation are joined up and consistent.

FE and HE staff

- Understand the pedagogical underpinning of VLE courses, and define carefully the goals and outcomes of learning experiences that incorporate VLEs.

- Adopt a student-centred approach to creating VLE content by encouraging structured feedback on VLE materials from students, making changes accordingly, and testing new courses with a range of students, including if possible students with disabilities.

- Try to ensure that the perspectives of specialist instructional design and web development staff are adequately represented at the early stages of curriculum design, and that communication between teaching staff, IT specialists and learning technology specialists is open and constructive.

Aims and objectives

The aim of this research is to investigate the current state of knowledge concerning the accessibility for disabled students of virtual learning environments (VLEs) in UK further education (FE) and higher education (HE) institutions, particularly since the introduction of SENDA –the Special Educational Needs and Disability Act 2001.

The study builds on existing research on the accessibility of the 'end-product' (i.e. the VLE course itself) - for example Stiles (2001), Evans and Sutherland (2002). It maps the points along the 'critical path' of VLE-based courses where accessibility problems originate, and makes recommendations about ways in which accessibility for UK students using VLEs can be improved.

The study is based on:

- an extensive literature review
- an online survey, and
- a series of interviews with individuals from a number of contrasting FE and HE institutions.

It uses both quantitative and qualitative data to elucidate the (mainly) non-technical factors that influence the accessibility of VLE-delivered courses in FE and HE institutions.

This report first defines the terms used in the research, and the scope of the study. Sections 4 to 6 map the broad issues in post-16 education, in disability in education, in e-learning and in web and VLE accessibility. The focus narrows in section 7 to the specific results of this research. The final sections outline conclusions and recommendations.

This report is also available in HTML, Word 2000 and PDF formats at http://www.saradunn.net/VLEproject/index.html

2. Methodology

2. 1 Literature and web review

Literature germane to this research comes not only from the field of academic research, but also from educational and social policy, and from educational and technical guidelines produced for the various stakeholders - both academic and commercial – in the production of VLE-based courses.

Hart suggests that a literature review should comprise:

> The selection of available documents (both published and unpublished) on the topic, which contain information, ideas, data and evidence written from a particular standpoint to fulfil certain aims or express certain views on the nature of the topic and how it is to be investigated, and the effective evaluation of these documents. (Hart 1998, p.13)

The evaluation undertaken here consists of both critical readings and the synthesis of disparate findings arising out of different disciplines or professions.

VLEs, like many aspects of information and communication technologies (ICTs), tend to transcend traditional academic and professional boundaries, and so what is common knowledge in one discipline may not be known in another. This may be one reason why, as several commentators have noted (see for example Seale and Rius-Riu (2001)) there is a lot of 'reinvention of the wheel' in e-learning.

This report therefore follows Wolcott's injunction to 'draw upon the literature selectively and appropriately as needed in the telling of the story' (quoted in Silverman (2000), p.230).

Most of the literature reviewed in this study is from the United Kingdom, although some relevant work from the United States, Australia and the EU has been included.

2.2 Survey

A web-based survey was developed in July 2003. The full text of the survey is in Appendix 1.[2]

The survey was drafted after the first phase of literature review and interviews, which informed the scope and direction of the survey, as well as appropriate questions.

The survey was developed using HTML and CSS, with simple text based responses returned by e-mail to the author. The form was compliant with level A of the W3C WAI guidelines (W3C WAI 1999). (Preece *et al*. (2002) point out that potential inaccessibility is one of the major disadvantages of web-based surveys.)

The survey was limited to an approximate 15-minute completion time to encourage the response rate. It contained a mix of open and closed questions, rankings and multiple choice questions.

[2] An archive version of the online survey is at http://www.synergy-communications.co.uk/vle-questionnaire/

The survey incorporated automated validation, 'enforcing' either single or multiple choices via check box and radio button functions, and returning an error page if the user had inadvertently missed a question.

Preece *et al.* (2002) note the above validation functionality as an important strength of web-based questionnaires. Other advantages include speed of response, lower cost (compared to paper), ease of data transfer (no re-keying of raw data), reduced analysis time and speedy correction of design errors after piloting.

The survey was first piloted on five electronic publishing masters' students at City University to check functionality. It was then piloted on three potential survey subjects –i.e. people who had knowledge of the domain in question –to check terminology, logic and scope. Amendments were made after each pilot stage.

An introductory web page described the context of the questionnaire and the confidentiality policy, and offered an incentive for completion.

Information concerning the survey was distributed via an e-mail containing the survey URL posted to three JISCmail[3] lists of particular relevance to the domain:

- Ferl-VLE list: run by Ferl (Further Education Resources for Learning) 'promotes discussion about VLEs, their implementation and use. Ferl provides an information service for all staff working within the post-compulsory education sector. Ferl supports individuals and organisations in making effective use of ILT'. (Ferl-VLE 2003)[4]
- CETIS-accessibility list: run by CETIS (Centre for Educational Technology Interoperability Standards) Accessibility Special Interest Group, 'aims to make implementers of content and systems for learning technology in the further education and higher education sectors aware of accessibility issues'. (Perry 2003)[5]
- JISC-MLE list: run by JISC Managed Learning Environment team; 'JISC funds large development programmes that are enabling organisations to try out MLE technologies in their own settings and share their findings and experiences with the sector'. (JISC 2003)[6]

One of the main disadvantages of web-based surveys, according to Preece and colleagues (2002), is finding a representative sample of respondents. To a certain extent, the existence of specialist interest groups within the field of enquiry is an asset to the research, but it should also be remembered that this potentially skews the data. Respondents are likely to represent the knowledgeable/enthusiastic end of the spectrum of stakeholders involved in VLEs. Attention is drawn to this issue at appropriate points during the analysis.

The initial screening/cleaning of the data –to eliminate wrongly keyed responses, duplications etc –was carried out during the data collection process. The survey was 'live' between 01/08/03 and 02/09/03. A 'reminder' e-mail was sent to the lists on 26/08/03.

A total of 46 survey responses were received. It was recognised that this was in some ways not the optimum time of year to conduct an academic survey in the UK,

[3] Academic mailing lists run by the Joint Information Systems Committee –see glossary
[4] Ferl-VLE archives at http://www.jiscmail.ac.uk/lists/vle.html
[5] CETIS-accessibility archives at http://www.jiscmail.ac.uk/lists/CETIS-ACCESSIBILITY.html
[6] JISC-MLE archives at http://www.jiscmail.ac.uk/lists/Jisc-MLE.html

as many potential respondents take holidays during this period. Conversely, respondents who were available may have had more time to undertake the survey. The relevance and detail of responses received justified the approach, and returns represented just under 10% of the VLEs estimated to be currently in use in the UK (JISC/UCISA 2003).[7] There was an even mix of FE and HE institutions, and the relative spread of types of VLEs was representative of FE and HE nationally.

Nonetheless, given the small sample size, analysis and conclusions are necessarily tentative and partial. Recommendations arising from this sample would need specific research with a larger sample size to enhance their sector-wide validity.

2.3 Interviews

Six face-to-face thematic interviews, and one telephone interview were undertaken. These were with individuals from a number of contrasting educational institutions:

- an urban university in south east England
- an urban university in southern Scotland
- an English university delivering distance learning across the UK
- a distributed higher education institution serving a rural population in Scotland.

There were also a number of e-mail exchanges with experts in the field (referenced individually in the bibliography), and follow-up e-mails/phone calls to face-to-face interviewees.

The interviews were each conducted according to a semi-structured schedule based on the survey questions. This allowed individuals to comment in depth on the topics under discussion, and to raise unanticipated data, which could be followed up during the interview. The interviews ranged from 45 minutes to 90 minutes in duration, and were conducted at the interviewee's place of work. Each interview was digitally recorded and subsequently transcribed.

2.4 Analysis[8]

The combination of literature review, survey and interview data allowed triangulation of data, aiding robustness of findings and analysis.

Table 1 (p.15) outlines the data analysis processes undertaken. The data consisted of qualitative data from:

- face-to-face (f2f), telephone and e-mail interviews
- open questions in the online survey
- results of previous studies included in the literature review

[7] A recent JISC/UCISA (2003) report cites 83% of responding colleges as users of one or more VLEs. Latest DfES figures show 152 HEIs and 483 FEIs (inc. 6th form colleges). This implies approximately 500 institutions currently use a VLE.

[8] The audit methodology of the IDEAS project (Integrating Disability into Educational Arenas) (University of Aberdeen 2001) provided useful guidelines on methodology and data analysis targeted in this particular field.

and quantitative data from:

- scores, ratings and rankings from the online survey
- results of previous studies in the literature review
- statistical sources such as HESA (Higher Education Statistics Agency) LSC (Learning and Skills Council) and DfES (Department for Education and Skills).

2.5 Some methodological issues in e-learning research

The accessibility of materials published on the worldwide web can be subjected to standard testing methods and measurements, both qualitative and quantitative. Jacob Nielsen (Coyne and Nielsen 2001), Michael Paciello (2000) and a number of others have developed consistent work on testing web usability and web accessibility for disabled users, and standardised guidelines such as those developed by the World Wide Web Consortium's web accessibility initiative (WAI) (W3C WAI 1999, 2003b) provide accepted benchmarks.

As outlined in the previous section, this research does not undertake accessibility testing *per se*, but summarises existing research on accessibility of VLEs, and examines more broadly the context in which VLEs are created and used, with a view to pinpointing where accessibility problems originate. As such it conforms to Silverman's formula of a 'descriptive study based upon a clear social problem' (Silverman 2000, p.33).

It should be noted, however, that some research in e-learning –particularly on its benefits - has come in for criticism. Seale and Rius-Riu point out that:

> There is evidence to suggest that, in a bid to gain scientific acceptability, some learning technology research has used scientific methods inappropriately. (Seale and Rius-Riu 2001, p.23)

Similarly, Mitchell (2000) argues that inaccurate design and inappropriate analysis mean that some e-learning research is 'pseudo-scientific'. Concerning VLE research specifically, a summary by the ICT Research Team at BECTa (British Educational Communications and Technology Agency) points out:

> Most of the evidence of benefits [of VLEs]… tends to be anecdotal … inconclusive and open to debate. For example, where a benefit is reported, to what extent is it product specific, and how much does it provide a finding that reflects the benefits of VLEs as a whole? (BECTa 2003a, p.11)

E-learning research is relatively young, and VLEs are still younger. As VLEs mature and become embedded in educational institutions, VLE research will become correspondingly more diverse and robust. For the purposes of the current study however, the relative scarcity of large-scale, conclusive research needs to be kept in mind.

Data	Quantity	Process
Response to open questions	Interviews (f2f, e-mail, phone) n=11 Surveys n=46	Classification/coding Analysis Interpretation (textual)
Check box questions	Surveys n=46	Checking Data formatting Analysis Interpretation (textual/graphical)
Ratings	Surveys n=46	Checking Data formatting Analysis Interpretation (textual/graphical)
Multiple choice/ radio buttons	Surveys n=46	Checking Data formatting Analysis Interpretation (textual/graphical)
Interview tape recordings	F2f interviews n=6	Transcription Analysis Interpretation (textual)
Interview notes	phone + e-mail interviews n=5	Analysis Interpretation (textual)

Table 1. Data analysis processes

3. Definitions and scope

This section introduces and contextualises the principal themes and concepts addressed in the study.

3.1 Further education and higher education

In the UK, education is compulsory until the age of 16. The general term for education provided thereafter is 'post-16 education' or 'post-compulsory education'.

Post-16 education includes all vocational and non-vocational courses for school leavers and adults, and is divided into 'further education' and 'higher education'.

Higher education (HE) refers to academic education above A level (and its Scottish equivalent), provided by universities and colleges of higher education, collectively known as higher education institutions (HEIs). The Department for Education and Skills (DfES) latest published figures, for 2000/1, show 152 HEIs in the UK (DfES 2002). The Higher Education Statistics Authority estimates the current figure (September 2003) to be 170 (HESA 2003b).

Further education (FE) consists of all post-16 education other than higher education. FE courses are mostly technical, vocational and professional training. Latest DfES figures, for 2000/1, show 483 FEIs in the UK (including 84 sixth-form colleges) (DfES 2002).

Since the 1992 Further and Higher Education Act, which enabled former polytechnics and other colleges of further education to designate themselves universities, many institutions have offered a mixture of HE and FE courses. Policy shifts towards a culture of 'flexibility', 'inclusiveness/widening participation' and 'lifelong learning' have also contributed to the blurring of the previously 'binary' system of post-16 education, and a shift towards what educational sociologists term 'mass higher education'.

The impacts of advances in information and communication technologies (ICTs) generally, and e-learning technologies specifically, are felt across all sectors in education. The interview subjects and survey respondents in this research are drawn from both FE and HE, and the literature survey also covers both areas. There are some differences between further education and higher education in relation to e-learning development, which were revealed in the current study (see section 7) and evidenced in previous work (e.g. Jenkins *et al*. 2001, and JISC/UCISA 2003).

3.2 Virtual learning environments (VLEs)

Virtual learning environments (VLEs) are a form of e-learning technology. E-learning is an umbrella term referring to the use of new digital technologies, including the internet and worldwide web, to enhance the quality of learning. While e-learning is a seemingly straightforward concept, its implications are various and complex.

E-learning is based on relatively simple information and communications technologies. But it has potentially profound impacts on pedagogy – on the ways people teach and the ways people learn. E-learning is a social process – it involves new forms of collaboration and networking. And the adoption of e-learning also involves organisational change within education institutions.

The rise of networked technologies, in particular the internet and worldwide web, has impacted enormously on e-learning. As Seale and Rius-Riu (2001) point out, until the mid 1990s, many e-learning developers were focusing on software and multimedia programmes. Then the internet and the worldwide web took off, and became the primary focus of e-learning.

There are a number of basic tools that feature in web-based e-learning:

- teaching materials - for example reading lists, module notes, handouts; also multimedia content such as audio or video
- communication tools – for example e-mail, newsgroups, mailing lists and bulletin/discussion boards
- assessment tools – for example electronic submission of assignments, self-tests, assessed tests such as multiple choice, image-matching.

A virtual learning environment (VLE) incorporates all the above tools within one single software environment. A VLE is not an instructional system *per se*, but a 'focus for learning activities' (Stiles 2001). The Joint Information Systems Committee (JISC) defines a VLE as an environment where 'online interactions of various kinds take place between learners and tutors' (JISC 2002).

In addition to the basic tools outlined above, most VLEs also include:

- shared work group areas – for students to upload and share files
- student support – for example course information, communication with tutors, FAQs
- student tools – for example student web pages, diaries and calendars
- management and tracking of students – for example password protected areas, logging of student usage of VLE
- a standard interface – customisable to a certain extent by the educational institution and by individual students
- navigational structure to support the structured delivery of information. (O'Leary 2002)

All educational institutions also use information management systems (IMS) to support the teaching of students – these include student records, finance, library systems, administration and course management. A single software environment that supports both the VLE functions and the IMS functions is known in the UK as a managed learning environment (MLE).

Terminology and definitions can be somewhat interchangeable, and indeed confused, in this area. The academic and commercial sectors use different terms, and there are also differences between the UK and other countries. The JISC MLE Steering Group oversees definitions of VLEs and MLEs in the UK FE and HE sectors (see JISC 2002), and also provides a diagrammatic explanation of the relationship and functions of MLEs and VLEs, shown in Figure 1 below.

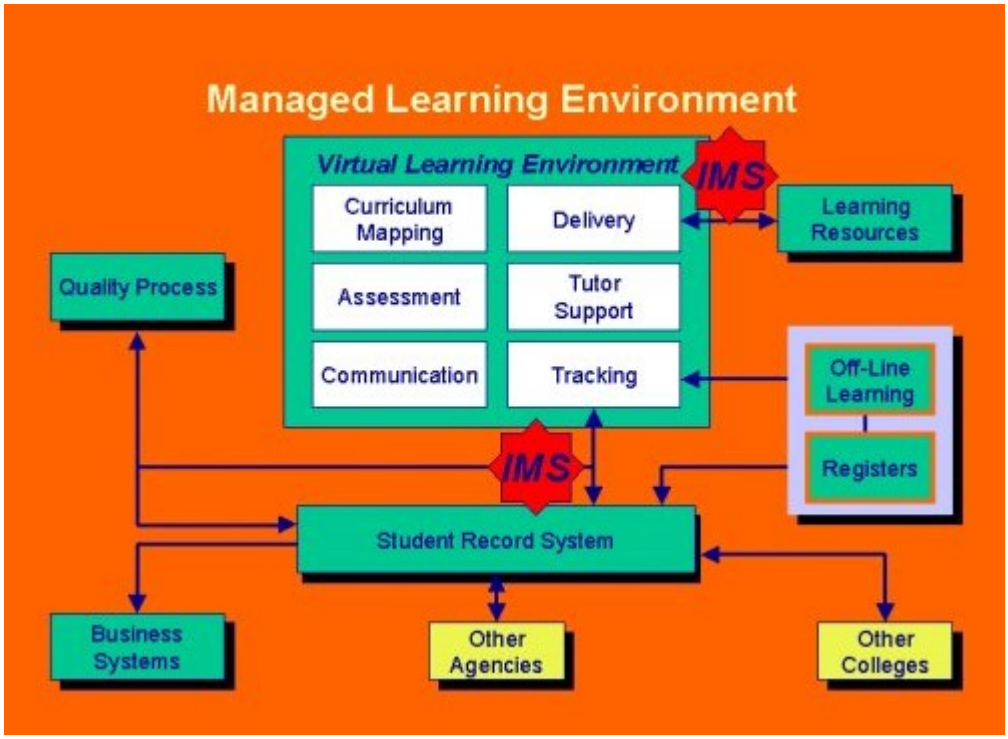

Figure 1. MLE and VLE sub-system (JISC 2002, reproduced by kind permission of BECTa)

The influence of commercial software developers in further and higher education has increased with the rise of proprietary virtual learning environments (Seale and Rius-Riu 2001). In addition, some academic institutions have developed their own VLEs. Appendix 2 lists the principal UK VLEs.

This research focuses on VLEs rather than MLEs, as it is primarily concerned with the delivery and direct support of learning related content – i.e. the 'six white boxes' in Figure 1.

3.3. Accessibility

Accessibility is another term that has some ambiguity within UK education. Accessible education is sometimes understood as part of the current UK government's policies for 'widening participation' in education (DfES 2003b). These recent policies are generally concerned with what is termed 'fair access' and address socio-economic issues in student admissions (see section 4.3).

In its narrower, technical sense, however – and the sense in which it is used in this research - accessibility is concerned with making learning, in this case e-learning, barrier-free for disabled people.

New information technologies, including the worldwide web, represent both opportunities and challenges for disabled people. Because the technologies rely on digitising data, the potential to transform the data from one format to another means that disabled users can, in theory, access the information in a format that suits them. There has been a considerable amount of work and research dedicated to making the web accessible to people with a range of disabilities, including those who:

- are blind
- are visually impaired
- have a learning disability
- are profoundly deaf (and may have low levels of literacy in English)
- are hearing impaired
- have a mental health problem affecting concentration
- take medication affecting concentration
- have specific learning difficulties related to reading/writing such as dyslexia or dyspraxia[9]
- are colour blind
- have epilepsy (which may affect their ability to look at screens)
- have dexterity problems (and find it difficult to use printed documents or keyboards).

Difficulties in accessing a web site can also be due to a number of reasons not necessarily connected to disability. A user may have a very slow internet connection; they may not be fluent in the language in which the site is written; they may have an unusual browser or operating system, or they may be using a palmtop. Making a site accessible means it is easier for everyone to use, whatever their circumstances.

Many of the processes that can enhance accessibility are not technically complex. For example a person with dyslexia can manipulate font style and size, background colour and other aspects of web-based text to the style that best suits them, using functions within standard web browsers (Draffan 2002). (However, user skills come into play here (see section 7.7i); a certain level of ICT skills is needed to take advantage of these options.)

Other processes require additional technologies –known as assistive technologies (ATs). For example, a person with a visual impairment can, with the use of a speech output system, transform textual input into audio output (Neumann 2002). Or a person with a physical disability who cannot use a conventional mouse can input text through a specialised device (Henderson 2002).

There are a large number of assistive technologies available to help students with all kinds of disabilities.[10] For the web-based e-learning via VLEs under consideration in this research, the principal technologies include:

- screen magnification systems
- speech output systems (i.e. text to speech)
- Braille output systems (i.e. text to Braille)
- speech recognition systems (i.e. speech to text)
- predictive text systems
- alternative input devices such as joystick, trackerball, touchpad

The potential for reducing or eliminating barriers to accessing learning content is immense. However, for this potential to be realised, the 'raw content' must be free of accessibility errors. The most common web accessibility errors are:

[9] See Rainger and Draffan's (2003) papers on dyslexia and related learning difficulties and web development at http://www.techdis.ac.uk/seven/papers/colour-index.html
[10] An extensive database of assistive technologies used in education is at http://www.niad.sussex.ac.uk/

- invalid HTML[11] or style sheet coding
- lack of a site map
- lack of text alternatives for images
- structural mark-up used for presentation
- poorly labelled forms and frames
- poor presentation and writing
- use of PDF without alternative outputs
- Javascript or other programming code with no alternative
- inaccessible multimedia.

The World Wide Web Consortium (W3C) develops interoperable technologies to 'lead the web to its full potential' (W3C 2003). One aspect of this is the Web Accessibility Initiative (WAI), which promotes web usability for people with disabilities. In coordination with organizations around the world, WAI pursues accessibility of the Web through five primary areas of work: technology, guidelines, tools, education and outreach, and research and development.

WAI has produced a set of guidelines for web content accessibility, which have a hierarchical structure with three levels of accessibility:

- priority 1 is a minimum level that removes the fundamental barriers to accessing web materials, but may still exclude many disabled users
- priority 2 removes more of the barriers, though will still not be accessible to some users
- priority 3 ensures that web based material is accessible to the great majority of disabled users. (W3C WAI 1999)

A summary of the Web Content Accessibility guidelines is in Appendix 3. It should be noted that the WAI guidelines are generic guidelines for the web; they do not take into account the particular example of web-based e-learning, and they certainly cannot guarantee an accessible learning experience. TechDis[12] has developed seven 'precepts of accessibility' specific to web-based learning:

- clarity of web site navigation, design and page layout
- attention to design, colour and presentation issues, including the requirements for user control
- implementation and appropriate use of various tags or attributes for images
- use of appropriate mark-up language to achieve accessible elements
- use of clear and concise, recognisable language conventions and configuration of letters, words, sentence and paragraphs
- provision of accessible multi-media (e.g. video and audio files) and accessible documents formats (e.g. PowerPoint and PDF document files)
- provision of contextual help, help in dealing with errors. (Rainger 2003a)

There are a number of automated accessibility checkers and validators designed to aid the development of accessible material on the web. The best known is Bobby/Watchfire,13 an automated programme that checks web pages against the

[11] See glossary for definitions of technical terms
[12] TechDis is the JISC-funded Technology for Disabilities Information Services at http://www.techdis.ac.uk/
[13] Bobby/Watchfire (2003) Bobby Online Free Portal

WAI guidelines and produces a report on aspects of the pages that are inaccessible. Another testing programme is LIFT, developed for specific use with web authoring software such as Dreamweaver and Frontpage. [14]

3.4 The Special Educational Needs and Disability Act (SENDA)

The Special Educational Needs and Disability Act (SENDA) 2001 is an amendment to the 1995 Disability Discrimination Act (see section 4.2a). The legislation 'aims to ensure that disabled people have equal opportunities to benefit from, and contribute to the learning and services available in education institutions' (DRC 2003b). SENDA requires all education institutions:

- to make reasonable adjustments to accommodate the needs of disabled students
- not to treat disabled students less favourably
- to act in an 'anticipatory capacity' (i.e. institutions should not wait until a disabled student asks in order to implement good practice).

In sum, it would seem that the technology, the guidelines and the legislation are all in place to ensure accessibility within virtual learning environments. Despite this, all the research, including this study, reveals low levels of accessibility. This study attempts to tease out some of the varied reasons for this, and suggest some possible ways forward.

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http://bobby.watchfire.com/bobby/html/en/index.jsp

[14] LIFT accessibility testing software supplied by usablenet.com http://www.usablenet.com/.

4. Disability and UK further and higher education

4.1 Disabled students: facts and figures

The latest published figures for numbers of disabled students in higher education, for the academic year 2001/2, show 4.6% of the student population had a declared disability (HESA 2003a). In further education, the figure for the academic year 2000/1 was just over 6% (LSC 2003).

According to the Disability Rights Commission, 'one in twenty disabled people are in further or higher education, compared to one in ten of the rest of the population' (DRC 2003c). The National Bureau for Students with Disabilities (Skill) has commented on the rate of increase of the numbers of disabled students year on year, saying 'only half as many disabled people as would be expected according to general population trends are entering higher education' (Skill 2003a).

A Disability Rights Commission survey found that 17% of disabled respondents who went to further or higher education felt they were discriminated against because of their disability. Of those respondents who did not enter post-16 education, 30% felt they were prevented from doing so for a reason related to their disability; over half of these did not feel they would be given support by the education institution to complete their course (DRC 2002).

Further education and higher education institutions do not collect exactly comparable figures for disability, but some general trends are discernable across both sectors, and are set out in Table 2.

Student's declared disability[15]	*Percentage in further education*	*Percentage in higher education*	*Approximate percentage across FE and HE*
Dyslexia[16]	0.43%	1.68%	1.05%
Deaf/hearing impairment	0.24%	0.30%	0.27%
Mobility difficulties	0.24%	0.23%	0.24%
Multiple disabilities	0.16%	0.32%	0.24%
Blind/partially sighted	0.18%	0.15%	0.17%

Table 2. Percentages of students with five common disabilities in UK FE and HE

Many of the students with the disabilities listed in Table 2 may require adjustments to the provision of information, including that provided through a VLE. In addition, students in other categories termed 'unseen disabilities' (HE) and 'other physical disability' or 'other medical condition' (FE) – which will include, for example, epilepsy – may also have specific requirements concerning the provision of digital information. For the full categories and percentages for disabled students in FE and HE, see Appendix 5.

[15] The terminology is taken from HESA (2003a)

[16] FE statistics subsume dyslexia into a more general category of 'learning difficulties', which has no direct equivalent in the HE statistics. The apparent difference in percentages of students with dyslexia across HE and FE may be an artefact of the varying categorisations. See Appendix 5

Students in higher education are eligible for the disabled students allowance (DSA). This is a non-means-tested grant, payable to both full-time and part-time students, from the student's local education authority (usually after a needs assessment has been undertaken). The DSA covers three areas:

- general allowance – to cover, for example, insurance, Braille paper
- non-medical helper allowance – for example note-takers, interpreters
- equipment allowance – including for assistive technologies such as speech output systems, speech recognition systems, alternative input devices. (Ferl/TechDis 2003, 1, p.1)

In a 2001 study, Hall and Tinklin analysed the experiences of twelve disabled students in higher education in Scotland, including their use of ICTs:

> Most of the students in the sample have their own computers bought with money from the DSA. All the students who have their own computers have found them very useful, and they appreciate having access to their own machines…[Two students with dyslexia] found that using computers to produce their assignments has improved their grades…[Two students with visual impairments] have computers with a voice synthesiser…to produce files in Braille or ink print.... [A student with a motor impairment] which affects [their] ability to hand-write and to type…. uses a voice-operated computer. (Hall and Tinklin 1998)

As Hall and Tinklin show, 'the use of information technology can be one very helpful way in which students with disabilities can be supported in their studies'. However, they also point out that institutions might begin to see information technology alone as a sufficient means of supporting students with disabilities, when in fact disabled students need a range of support services, which may or may not include information technologies or assistive technologies (Hall and Tinklin 1998). As Rainger (2003b) points out 'study skills and strategies need to be developed, along with assistive technologies, to allow disabled students to make the best use of e-learning materials'.

4.2 The legislative background

The most important piece of legislation affecting disabled students in UK FE and HE is the Special Educational Needs and Disability Act (SENDA). This legislation is an extension of the Disability Discrimination Act (DDA), so a little background to the DDA is given here in order to contextualise the scope and intentions of SENDA. The Human Rights Act and a piece of relevant US legislation are also briefly considered.

4.2a. Disability Discrimination Act 1995

The Disability Discrimination Act (DDA) was passed in 1995 to introduce measures aimed at ending the discrimination which many disabled people face. Part 1 of the Act says a person has a disability if they have 'a physical or mental impairment which has a substantial and long-term adverse effect on their ability to carry out normal day-to-day activities'.

The DDA protects disabled people in the areas of:

- employment – employers have a duty to make 'reasonable adjustments' for disabled employees where they are placed at a substantial disadvantage

- access to goods, facilities and services – providers are required to make 'reasonable adjustments' to ensure their goods/facilities/services, including those for which no charge is made, are accessible
- transport – minimum standards to assist disabled people to use public transport.
  (HMSO 1995)

When the Act was first passed, education was excluded.

The provisions of the DDA are understood by many to cover the requirement for accessible web sites, which could be defined as a 'service' under the Act. Despite the fact that many web sites fail accessibility tests (RNIB 2003), as yet, no provider of a web site has faced an action under the DDA.[17] The Disability Rights Commission has commissioned a survey of the current state of accessibility of UK web sites (HMSO in press).

4.2b. Special Educational Needs and Disability Act 2001
In 2001 the Special Educational Needs and Disability Act (SENDA) was passed, and the provisions of the DDA were thereby extended to include education. Part 2 of SENDA requires higher and further education institutions to make 'reasonable adjustments' to ensure:

- 'in relation to the arrangements….for determining admissions to the institution, disabled persons are not placed at a substantial disadvantage in comparison with persons who are not disabled'
- 'in relation to student services provided for, or offered to, students…, disabled students are not placed at a substantial disadvantage in comparison with students who are not disabled'.
  (HMSO 2001, 28, 1(a), 1(b))

The duty of responsibility is to disabled people in general, not to individual students who may enrol on a course; institutions therefore have a duty to make 'anticipatory' adjustments. Those adjustments that are regarded to be a matter of good practice, for example providing electronic versions of paper handouts, are expected to be implemented whether or not a disabled student is in attendance (Ferl/TechDis 2003, 2, p.2).

SENDA has a number of exemptions; adjustments may be considered not 'reasonable' if they:

- would undermine or lessen academic standards
- would place the institution in financial difficulty
- contravene health and safety legislation
- substantially adversely affect other students.
  (HMSO 2001)

Governing bodies of institutions rather than individual practitioners are accountable under the law, but all staff are expected to assist their institutions in complying with the law. In the case of teaching staff, this means being required 'to make reasonable adjustments to their teaching practice and teaching materials to

[17] At the time of writing [August 2003] it was reported that RNIB were planning an action against an unnamed web site provider ('The costs of failing the accessibility test' *Marketing Week* 28 August 2003).

ensure disabled students can participate in the learning environment' (Ferl/TechDis 2003, 2, p.3).

SENDA is being introduced in phases. Since September 2002 all institutions have been expected 'to change policies and practices' and from September 2003 institutions will need to provide 'auxiliary aids and services'. Specific ICT issues include:

- provision of assistive technology such as magnification software or screen readers; additional training and support for assistive technology
- provision of accessible institutional services, including departmental, faculty and institutional websites
- provision of accessible educational services, such as intranets, virtual and managed learning environments and other digital resources.
  (JISC 2001a)

Sloan (2002) expands on this last point:

> It is clear that the many instances of online learning, including virtual learning environments, will come under the scope of 'student services' under the Act….In relation to a VLE, reasonable adjustments would mean that accessibility should be incorporated into the project's design. (Sloan 2002)

As Wilder highlights, everyone in the 'critical path' of learning technologies such as VLEs is covered by SENDA:

> The Act and responsibilities under it affect the whole spectrum of those involved… those providing the information, those providing the media for the information, and those involved in IT services and strategy all have equal responsibility. (Wilder 2002)

Referring to the implications of the anticipatory nature of SENDA, Sloan comments that 'institutions need to be making the necessary adjustments by issuing guidelines and training staff for the provision of online resources and VLEs' (Sloan 2002).

4.2c. Human Rights Act 1998

In 1998 the Human Rights Act enshrined some of the rights under the European Convention on Human Rights into UK law. Of particular relevance to education are:

- Article 2 of the First Protocol: 'No person shall be denied the right to education'
- Article 14 of Schedule 1: 'The enjoyment of the rights and freedoms set forth in this Convention shall be secured without discrimination on any ground'.
  (HMSO 1998)

These rights are binding on all public bodies in the UK.

4.2d. Americans with Disabilities Act/US Rehabilitation Act (Section 508)

While not directly influencing UK education institutions, two pieces of American legislation have nonetheless had an impact on e-learning in the area of accessibility, because they have influenced the development of the US products that dominate the commercial e-learning market.

The 1990 Americans with Disabilities Act (ADA) gave federal civil rights protections to Americans with disabilities, guaranteeing equal opportunity in public accommodations, employment, transport, state and local government services, and telecommunications. In 1994 the Department of Justice produced ADA Standards for Accessible Design (USDoJ 1994), which commercial e-learning companies began to incorporate in their products.

In 1998 the Rehabilitation Act of 1973 was strengthened in line with the ADA, with provisions covering access to information in the federal sector for people with disabilities. As amended, Section 508 of the Rehabilitation Act requires access to the federal government's electronic and information technology. The law applies to all federal agencies when they develop, procure, maintain, or use electronic and information technology. Federal agencies must ensure that this technology is accessible to employees and the public, including persons with disabilities. The law directs a Federal Access Board to develop access standards that will become part of the federal procurement regulations (FAB 2003). To compete in the US market, e-learning products need to be 'Section 508 conformant'.

The Section 508 standards are broadly consonant with the W3C WAI guidelines previously discussed (see section 3.3), but not completely. Each set of guidelines contains components not in the other, so developers need to address both separately (see Appendix 4).

4.3 Educational policy and regulatory frameworks

4.3a. Educational policy

A number of reports in recent years have influenced educational policy in the area of disability.

In 1996, the Tomlinson Report was the first national inquiry in England into FE provision for students with disabilities and/or learning difficulties. It reported the overall quality of learning for students with disabilities was poorer than for other students, and many disabled people were not receiving any further education at all. It identified the need for a more inclusive further education sector (Tomlinson 1996).

In 1997 the Dearing Report argued that access to higher education should be widened in order to include students previously excluded – whether because of socio-economic status, gender, ability, location, ethnicity or special needs. Dearing looked at higher education specifically in the context of the 'learning society', and emphasised the 'scope for the innovative use of new communications and information technologies to improve the quality and flexibility of higher education and its management' (Dearing 1997).

In 1998 the Kennedy report on widening participation in further education condemned the inadequacy of the policies which had achieved significant growth in learning post-16 but failed to include those who experience social and economic disadvantage. The report pointed to the part ICTs had to play in widening participation (Kennedy 1998).

More recently, the DfES published a white paper on the future of higher education which emphasises issues of 'fair access'. A follow-up proposal on widening participation proposed the creation of an Office of Fair Access in education (DfES 2003a, DfES 2003b). These DfES reports have focused on socio-economic status, and

have not addressed the broader inclusion agenda raised by Dearing and Kennedy. Some disability organisations consider this to be an omission:

> The great emphasis and awareness of the Government's current push to widen access for students from lower socio-economic backgrounds could be harnessed to improve opportunities for other groups also currently under-represented in higher education such as disabled people. (Skill 2003a)

Specific e-learning initiatives are examined in section 5, but it is worth noting in passing here that the DfES e-learning strategy proposal (DfES 2003c) incorporates 'universal access and accessibility' and 'removing barriers to e-learning' within its seven proposed 'action areas'.

4.3b. Regulatory frameworks and disability
Standards in FE and HE are principally overseen by the Adult Learning Inspectorate (ALI) and the Quality Assurance Agency (QAA) respectively.

The ALI's Common Inspection Framework, which is used to assess all publicly funded work-based training for people over 16 and learning for post-19s**,** includes as one of its criteria:

> the extent to which provision is educationally and socially inclusive, and promotes equality of access to education and training, including provision for learners with learning difficulties or disabilities. (ALI 2001)

JISC identifies four underlying principles to ensuring quality in FE as exemplified in the Common Inspection Framework:

- equality of opportunity through better access to learning
- a socially inclusive curriculum
- accurate diagnosis of individual learning needs
- understanding of the concept of inclusive learning.
  (JISC 2001a)

In 1999 the Quality Assurance Agency produced a code of practice for students with disabilities in higher education (QAA 1999). The code has 24 'precepts' which the QAA auditors use as benchmarks when assessing HEIs. The precepts cover all aspects of teaching and learning for disabled students, and of most relevance are:

- ensuring disabled students have access to appropriate computer facilities (precept 3)
- accessible web site and intranet sites, and alternative formats (precept 4)
- adaptation of course material (including electronic material) and course delivery to ensure access (precept 10)
- allowing disabled students to use ICT for assessment (precept 13)
- training staff to use relevant technology and to produce accessible electronic courseware; ensuring IT staff have time and skills to support assistive technology used by disabled students (precepts 15, 17).
  (QAA 1999)

5. E-learning in UK further and higher education

5.1 The e-learning revolution

The phenomenal rise of e-learning in the last ten years has taken place against a complex backdrop of cultural and social change, advances in technology and shifts in educational theory and practice.

5.1a. Social and political changes
Further and higher education institutions in the UK are facing a number of pressures. There is pressure to widen access to post-16 education –as encapsulated for example in the Kennedy and Dearing reports (see 4.3a). The Fryer Report (1997) introduced the concept of a 'universal learning culture', and the 1998 green paper *The Learning Age* set out the government's determination to ensure Britain's place in the 21st century 'knowledge based economy' by encouraging 'lifelong learning' and lifting barriers to learning (DFEE 1998).

A corollary of this drive towards inclusivity in education is that learning is expected to be more 'flexible', in order to address the needs of a more diverse student population. The current Department for Education and Skills white paper on higher education, for example, enjoins HEIs to provide 'more flexibility in courses, to meet the needs of a more diverse student body and improve support for those doing part-time degrees' (DfES 2003a).

Education, along with all public services in the UK, also faces calls for greater accountability. Bodies such as the Adult Learning Inspectorate (FE) and the Quality Assurance Agency (HE) oversee standards and assessments, and incorporate both inclusive learning and teaching strategies, and effective use of information and learning technologies (ILT), within their remit (see 4.3b)

There is also increased competitiveness in education, both within the UK and internationally, especially with the potential for 'global e-universities'. Part of the UK's response to this challenge has been the creation of the UKeU, a virtual university aiming 'to deliver the best of UK university education online across the world' in partnership with 13 UK HEIs (UKeU 2003).

All these changes and challenges are set against a background of 'funding stretch' (Hanson 2003) throughout all sectors of education, with a decline in funds per student of 40% between 1967 and 1997 (Dearing 1997) and continuing decline since (Pring 2001).

5.1b. Technological advances
The early-mid 1990s saw an explosion in the development of ICTs for a number of reasons:

- increased digitisation across all media; photography, film, television and audio, as well as text, all began to move from analogue to digital
- growth and penetration of increasingly powerful, and increasingly cheap, personal computers
- development of user-friendly interfaces
- the development of networking hardware and software
- the development of web technologies
- growth in bandwidth and improving compression technologies
- diffusion of computing technologies across both commercial and public sectors.

In 1998, the Higginson Report investigated the potential of these new technologies for learning. The report stressed the importance of these new information and learning technologies (ILTs) in further education, and in particular the need to:

- 'raise staff awareness of the possibilities presented by modern learning technologies', and
- 'enhance the technical capabilities of staff in the use of these technologies, focusing on the teaching and management of learning competencies whereby electronic material can be fully integrated within student learning programmes'.
  (FEFC 1998)

5.1c. Pedagogical shifts
At the same time educational theory has also been changing. Broadly, theories of learning have shifted from 'behaviourist' towards 'social constructivist' models. A behaviourist model sees learning as something that is 'acquired' through a series of linear steps leading to a predefined goal, with periodic questions that test progress, and periodic reinforcement of learned behaviour (CMAL 2003).

In social constructivist models, learning is contextual, affected by the social environment. It in turn affects all aspects of a learner's cognitive, emotional, social and cultural development. Learning is not linear, and it is not confined to changes in observable behaviour, as with the behaviourist model. Learners make choices about their learning within robust but flexible structures provided by the teacher (CMAL 2003).

The implications for pedagogy of the adoption of constructivist theories are the encouragement of student responsibility and initiative, the shared development of learning strategies, the creation of authentic learning contexts and authentic assignments, and the encouragement of co-operative support, between learners and between learners and teachers (Grabinger and Dunlap 1995).

In the UK, Laurillard's 'conversational model' began to outline how constructivist theories of learning might be applied to higher education through the use of communication technologies, with the emphasis on individual interactions between learner and teacher (Laurillard 1993). Then, along with the rise of networking technologies such as the internet and worldwide web, came an increasing emphasis on the shared social context of learning. Mayes summarises these changes thus:

> First, there has been a shift from a representational view of learning, in which an acquisition metaphor guided design, to a constructivist view, in which learning is primarily developed through activity. A second shift has been away from a focus on the individual, towards a new emphasis on social contexts for learning. (Mayes 2001, p.17)

5.1d. E-learning to the rescue
E-learning, it is argued, is a way to address all the social and pedagogical opportunities and challenges outlined above, because it can use the new information technologies to:

- provide flexibility of time and place of delivery
- enable institutions to cope with increased student numbers
- reduce administrative burden
- allow the sharing and re-use of resources

- enable collaborative working
- foster student-centred learning.

(Milligan 1998)

As a result, e-learning has many supporters, both within academia: 'We are convinced that such technology, when combined with effective pedagogy and reflective teaching, will transform higher education' (Garrison and Anderson 2003, p.xiii). And within government: '[E-learning] is important because it can contribute to all the government's objectives for education - to raising standards, improving quality, removing barriers to learning, and, ultimately, ensuring that every learner achieves their full potential' (DfES 2003c).

5.2 The advance of the VLEs

Virtual learning environments are only one form of e-learning technology, but they have quickly come to dominate the academic e-learning market. As outlined in section 3.2 above, virtual learning environments are a single software product combining:

- communication tools (e-mail, bulletin board, chat room)
- collaboration tools (online forums, file-sharing, diaries)
- content creation tools
- assessment tools and activity tracking tools
- integration with institutional management information systems
- controlled access to curriculum resources.

Most of the leading products incorporate similar functionality and tools.

5.2a. Market share and levels of use

According to the most recent sector-wide research (JISC/UCISA 2003), there are approximately 500 VLEs in use in UK further and higher education. The leading commercial products are Blackboard (33%) and WebCT (20%), both products originating from the United States. The leading UK product is Granada Learnwise (18%), followed by bespoke in-house solutions (14%) and TekniCAL Virtual Campus (10%). This study produced broadly similar market shares (see section 7.1).

While VLEs are becoming increasingly similar in what they offer, the use of VLEs varies between institutions and between faculties and between courses. Cook (1999) shows the possible levels of sophistication of use of a VLE, starting with the simple and moving through to the complex:

SIMPLE >

- convenient distribution channel for course materials
- gateway to additional online materials
- means of communication between students, teachers, and external 'speakers'
- a platform for computer-assisted learning resources
- student self-assessment and online examinations
- a platform for collaborative student projects
- delivery of complete online courses with fully integrated activities – for example a distance learning course

< COMPLEX

5.2b. Perceived benefits

The advance of VLEs has been based on a number of perceived benefits to teaching and learning, summarised in Table 3.

Potential benefits of VLEs - students	*Potential benefits of VLEs – teachers/institutions*
flexibility – anytime, anywhere access	flexible online creation and delivery of materials
gains in ICT, writing skills, and presentation skills	anytime anywhere support for student-teacher communication
development of strategic learning styles for students through collaborative working	new communication dimension – e-mail, chat, bulletin board – in addition to lecture theatre/lab
improved motivation and engagement for students	variety of ICT tools in one consistent interface
widened access to learning materials for diverse learners	sharing and re-use of resources
potential for self-testing	reduction in administration through integrated management information systems
	new testing and assessment methods
	enhanced consistency and uniformity of teaching across departments

Table 3. Potential benefits of virtual learning environments (based on O'Leary 2002, BECTa 2003b, Traxler 2003a)

The LEAP (learning environments and pedagogy) project at the Learning and Teaching Support Network (LTSN) presents a number of case studies showing specifically pedagogical advantages of virtual learning environments, including:

- new modes of student-staff interaction
- improved student communication skills
- improved student engagement
- improved peer support
- deeper levels of student discussion.
  (LTSN 2003)

But e-learning generally, and VLEs in particular, face a number of serious challenges in living up to their potential, as discussed in the next section.

6. The challenges facing VLEs

6.1 Getting e-learning to work

Some of the 'hype' that greeted the arrival of e-learning in the mid-late 1990s has given way, replaced by a more measured understanding of the scale of the task involved in getting e-learning to live up to its potential. The challenge is daunting:

> E-learning has to offer a pedagogical experience equivalent to that of an individual tutorial with a sympathetic and well-equipped teacher to large numbers of learners in geographically dispersed and socially diverse settings. (Mayes 2001, p.17)

Achieving this poses challenges at sector-wide, institutional and individual levels. Across the FE and HE sectors in England, the Joint Information Systems Committee (JISC) is charged with leading the innovative use of technology. In addition to funding the JANET academic network, JISC is also addressing pedagogical issues in e-learning, and work on technical standards and interoperability, contributing to the development of international standards. The seamless movement of both administrative information and learning content between e-learning systems is a major challenge, and of crucial importance if the goal of learner-centred education is to be achieved. (Standards are addressed in more detail in section 6.2)

Another sector-wide issue is the support of best practice in instructional design. Instructional design involves the systematic development of instructional systems. It incorporates the entire development process, from analysis of learning needs and goals through to the development of a delivery system to meet those goals; it is based on a sound knowledge of learning and instructional theory.

As Whitlock (2001) points out, instructional design has been neglected in the UK; there is a 'crisis in supply', and it is an unrecognised profession, with no nationally recognised accreditation. There is a general tendency in education to emphasise the technology-related aspects at the expense of the learning design process, and pedagogical researchers do not help themselves in this regard, because:

> They have tended to focus on general descriptive theoretical models, rather than goal-directed models of immediate use to practitioners… What is required is a plain language designer's practicum using an up-to-date model of instructional design. (Whitlock 2001)

Hanson has highlighted this problem from the other end, pointing out that 'academic faculty complain of a lack of understanding of pedagogical principles on the part of educational designers, who focus on transmission rather than a constructivist approach' (Hanson 2003). This issue is of particular import with regard to the creation of content for VLEs, as this study shows (see section 7).

At institutional level, the problems with e-learning implementation are summed up by Hase and Ellis as 'systemic rather than technical'. What is required is 'alignment' between the three major stakeholders in e-learning: learners, lecturers and administrators (Hase and Ellis 2001).

But this is rarely happening at the moment. There is a tendency for e-learning to 'fall between the stools' of IT and teaching/learning support. As one example of this, Goodison and Lewis report that in a 1999 HEFCE survey:

> We received a number of responses from institutions that had given relatively little thought to the provision of C&IT for teaching and learning, beyond provision of hardware for basic student applications. (Goodison & Lewis 2003)

HEFCE subsequently (2002) surveyed teaching and learning strategies at 101 universities. Only 43 had a strategy that was available to external scrutiny on their web site. Of these 24 had a rationale for ICT in teaching in learning, and 12 addressed the issue of staff training. A number of institutional issues are highlighted by Goodison and Lewis' ongoing research, including:

- lack of clarity about the relationship of ICT to more traditional teaching and learning styles
- the mixture of ad hoc and centrally driven strategies in e-learning implementation
- varying approaches to staff training
- the 'not invented here' syndrome
- limitations (and benefits) of computer-based assessments
- student perceptions of the value of ICTs.
  (Goodison & Lewis 2003)

The general direction of travel does appear to be towards more aligned e-learning, however; recent research for JISC points to 'a significant move towards more strategic developments shaped by institutional policies and sector-wide initiatives' (JISC/UCISA 2003).

Hart and colleagues reported on organisational approaches to e-learning implementation at Queensland University of Technology. For them, the key lessons learned were:

- the visible and energetic support of senior management is critical
- unless management 'forced the issue' on uniting academic and technology support units, there would continue to be a 'dichotomy between the "techos" and the teachers'
- publicising successes and failures of initiatives avoids *ad hoc* unsustainable projects
- universities are fiercely territorial, and senior management need to devote time and sensitivity to negotiations when trying to implement e-learning.
  (Hart *et al.* 1999)

Conole points out that the rise of e-learning has precipitated changing roles for academic and support staff, the need for cross-institutional activities, and an increased need for staff development (Conole 2003).

Individual teachers are expected to shift - in a much-used metaphor – from being 'the sage on the stage to the guide on the side'. The new academic, the 'e-learning pedagogue', needs a broad skill-set:

- conventional pedagogy
- online pedagogy – to understand how different people learn online
- the ability to plan and manage online events and places
- the ability to exploit technology and solve technical problems
- the ability to interweave technology into learning design.
  (Good 2001 p. 173)

Some work on good practice has been done in this area, led by practitioners such as Salmon (2000) and Mason (1999). Once again, however, as this and other studies show, the gap between good practice and mainstream reality is large (see section 7).

Some practitioners are understandably sceptical about the impact on the quality of teaching of these new approaches. The doubts over the validity of research claiming benefits for e-learning has already been mentioned (BECTa 2003a). Jackson and Anagnostopoulou point out that many improvements ascribed to technology are actually due to the teachers anyway:

> Improvements in learning through online technology, when observed, are generally the product of reflective teachers who have conceptions that encourage them to develop effective teaching interventions regardless of technology, rather than features of the particular online pedagogy. Conversely, arguments claiming that pedagogical improvements inherently follow from the use of online technologies are dangerously misleading. (Jackson and Anagnostopoulou 2001, p.62)

There is an *ad hoc* approach to staff training, with some institutions providing little in the way of recognition or support for online teaching skills. Indeed, as one respondent for this research noted:

> There's no recognition given to online materials. You can go away and write a book and that goes down on your CV, as does a research paper. But if you go away and produce an online course you don't get any credit for it at all - either amongst your peers or the academic world as a whole. And online courses take as much work, if not more. (Int01)

Implementation problems apart, some critics have detected technological determinism at work in e-learning, with the techno-political tail wagging the pedagogical dog:

> Collaboration is a problem for networked learning, not an outcome of the new technology or its associated pedagogy. The role of the tutor and the emphasis on learner-centred education is shown to be a cloak for a new managerialist agenda that places additional burdens on the student, and masks the increasing audit culture in higher education. (Jones 2001, p.1)

Stiles makes a similar argument:

> Political, economic and commercial pressures, are leading to a process of selection and adoption of [e-learning] systems that seriously underestimates the pedagogic challenges, and which may lead to [HEIs] becoming constrained by their adopted technologies. (Stiles 2002)

Whatever the motivating forces, what is certain is that e-learning – though its forms and foci may shift – is here to stay in UK education. What of the specific challenges currently facing VLEs?

6.1a. Pedagogical problems with VLEs

As discussed in section 5.2, some studies seem to indicate distinct pedagogical advantages in using VLEs. However, others point to less successful pedagogical

outcomes (e.g. Littlejohn 2002, JM Consulting 2002, Stiles 2002), the principal problems being:

- failure to engage the learner
- mistaking interactivity for engagement
- focusing on content rather than outcomes
- mirroring traditional approaches on the technology
- failure to recognise the social nature of learning
- seeing discourse as the prime collaborative form. (Stiles 2002)

VLEs are not pedagogically neutral; their design assumes certain pedagogical theories, even if they are not explicit. Teachers are more likely to engage with a VLE if they feel it embodies conceptions of teaching that are similar to their own (Hanson 2003, Traxler 2003a). Relatively early during the phase of VLE uptake in the UK, Britain and Liber (1999) developed an extensive framework for the pedagogical evaluation of virtual leaning environments, based on Laurillard's conversational model and an organisational systems model.

However, despite this focus on pedagogy, commercial VLE products, which form the vast majority of VLEs in use in UK FE and HE, are generally characterised as 'content-centred', rather than being aimed at encouraging the active learning embodied in constructivist pedagogies.[18] This apparent contradiction may just be the gap between aspiration and reality. As Traxler points out, teaching behaviour has a number of influences that may override pedagogical theory:

> Lecturers' teaching behaviour was not based on specific known conceptions of teaching… but governed by a number of other considerations such as the expectations of their students, resource constraints and the vocational nature of their courses. (Traxler 2003a)

6.1b. Management issues and VLE implementation

A VLE cannot be implemented effectively in an institution without addressing a number of management issues, and the complexity of organisational structure within further and higher education is impacting on VLE uptake.

In essence, the VLE needs to be 'embedded' across the institution, which involves an understanding of the impact of the VLE on staff roles and responsibilities, the realigning of some traditional disciplinary boundaries (which are an impediment to implementation) and a proper appreciation of the time and resources needed to make these changes.

The lack of integration of ICT policy and learning and teaching strategies cited by Goodison and Lewis (2003) is an indication that, 'on the ground', these strategic changes are slow in coming. Reports by Boys (2002), Condron and Sutherland (2002) and others confirm the rarity of holistic strategies for the implementation of VLEs.

A 2001 study found some identifiable differences in implementation between 'post-92' and 'pre-92' universities. Post-92 institutions have a longer history of engagement, and tend to have more centralised strategic, technical and administrative support. There is a discernable trend across FE and HE towards greater centralisation (Jenkins *et al*. 2001).

[18] COSE and Colloquia are two VLEs aimed explicitly at supporting active learning paradigms. See Appendix 5.

Specific points raised in research include quality assurance processes, systems administration and support, learner support (from academics and IT), and, critically, staff development (Stiles 2003, Traxler 2003a). These issues are all raised by survey respondents in this research (see section 7).

6.1c. Staff skills for VLE use

The advent of VLEs has created a need for new skill mixes and new ways of working. Good (2001), quoted in section 5.1d, has outlined the hybrid skills the 'e-pedagogue' requires. New professionals such as learning technologists and instructional designers are also finding a place in educational institutions.

However, a common issue across numerous reports is the lack of time and resources devoted to staff training and development for using VLEs (Jenkins *et al*. 2001, Stiles 2002, Conole 2003, Hanson 2003, Traxler 2003a), and it is also sharply in evidence in this study (see section 7).

Everett Rogers' diffusion of innovation theory provides a useful perspective on VLE uptake and staff development issues, and has been used by several researchers (Hanson 2003, Traxler 2003a). Rogers characterises individuals' differing attitudes to new technologies as those of innovators, early adopters, early majority, late majority and laggards (Rogers 1995). Hanson (2003) questions whether institutions 'are only supporting the 10% of early adopters, who have different needs to the more cautious majority'.

6.1d. VLE product development

The advance of VLEs is also affected by the characteristics of the industry producing them. Several commentators have suggested that the development process for VLEs needs to accommodate the demands of learners rather than just the educational institutions (Teece 2003, Traxler 2003b).

The institutions themselves, as Jenkins and colleagues point out, tend to measure VLEs in terms of the impact on staff rather than students. Our own survey revealed low levels of user testing for VLE courses (see section 7.3), and this lack of end-user focus is also reflected in the generally poor provision for student support in use of the VLEs (Jenkins *et al.* 2001).

Some non-commercial VLE developments, such as the University of Staffordshire's COSE and Traxler's 'rural VLE' (Traxler 2003b) are employing user-centred design processes - but they are the exceptions. As long as the educational institutions, who are the paying customers, are failing to support the needs of learners, it is unlikely that commercial developers will take the lead.

6.2 E-learning standards

While there may only be faint murmurings about user-centred design in VLEs, there is a positive cacophony about standards and specifications across the whole of e-learning.

In brief, e-learning standards are intended to ensure that:

- learning technology platforms such as VLEs are interoperable with other management information systems – so that, for example, student records can be moved from one system to another

- content developed for a particular learning technology system can be re-used and re-assembled on another system
- vendors cannot 'lock-in' institutions to only one proprietary system
- computer-based learning materials can be catalogued, searched and retrieved, allowing content to be mixed and matched from multiple sources
- there is an open, market in which smaller vendors are able to compete and educational institutions have an expanded choice of suppliers.

A number of organisations are involved in developing e-learning standards. Chief among them are Advanced Distributed Learning, which is responsible for SCORM, and the IMS Global Learning Consortium.[19]

Advanced Distributed Learning is a US government initiative begun in 1997 and designed to meet the training needs of the US military. The Shareable Content Object Reference Model (SCORM) is part of this, and defines a specification for reusing 'learning objects'. Learning objects are stand-alone pieces of learning or performance-support material, typically addressing a single learning objective or supporting a discrete learning activity.

There has been some criticism of SCORM as too focused on infrastructure at the expense of good pedagogy - of directing the e-learning industry towards 'shovelware' (Welsch 2002, CETIS 2002c). This somewhat pejorative terms refers to a kind of mass-produced learning, where repositories of reusable learning objects are presented, from which a course creator –or indeed a learner themselves –can 'pick 'n' mix' to create a course.[20]

However, the concept of re-usable learning objects does not, *per se*, imply a 'reductionist pedagogy'. On the contrary, as Mason argues, certain aspects of a student-centred pedagogy in FE/HE are strongly supported by the learning objects approach:

- the accommodation of learner diversity –for example providing objects aimed at specific sectors of the learner audience
- enhancing learner choice and selection –by actively encouraging students to decide for themselves which objects to complete in depth
- activity-based learning –for example by creating a shared database to which students can contribute their own objects
- collaborative work –for example the use of bulletin boards as a focus to present individual learning assignments.
  (Mason 2003)

The IMS Global Learning Consortium has recently released specifications for simple sequencing and learning design, so that the pedagogic intent of learning objects can be preserved and they do not become a series of disaggregated components. These developments are intended to shift the current standards focus away from the single self-paced learner:

[19] Also involved in e-learning standards are the Aviation Industry CBT Committee (AICC), the Institute of Electrical and Electronic Engineers (IEEE) Learning and Technology Standards Committee (LTSC), Centre de European Normalisation/Information Society Standardisation System (CEN/ISSS) and the Dublin Core Metadata Initiative.

[20] It is worth remembering that a 'pick 'n' mix' approach to online learning is appropriate for many of the situations in which e-learning technologies are used.

> [IMS] Learning Design provides the capability of designing units of learning that simultaneously include several roles, each of which can be played by several actors. It enables their activities to be specified in coordinated 'learning flows' that are analogous to groupware workflows. (IMS 2003a)
>
> The IMS Simple Sequencing Specification defines a method for representing the intended behaviour of an authored learning experience such that any learning technology system can sequence discrete learning activities in a consistent way. (IMS 2003b)

6.5a. Guidelines and specifications on accessibility

The IMS has also produced a set of accessibility guidelines for e-learning developers (IMS 2002). The guidelines cover the use of XML for accessibility (see section 7.3 for discussion of XML), producing accessible text, audio, images and multimedia, and also address accessibility in synchronous and asynchronous communication tools, and online assessment. They are predicated on a set of 'accessibility principles for developers of online learning':

> [These] six principles address accessibility for people who have sensory or mobility disabilities. These principles also address accessibility issues faced by people with cognitive disabilities, though often to a lesser extent.
>
> 1. Allow for customization based on user preference.
> 2. Provide equivalent access to auditory and visual content based on user preference.
> 3. Provide compatibility with assistive technologies and include complete keyboard access.
> 4. Provide context and orientation information.
> 5. Follow IMS specifications and other relevant specifications, standards, and/or guidelines.
> 6. Consider the use of XML.
>
> (IMS 2002)

The IMS has more recently released ACCLIP, a set of specifications for developers on implementing accessibility elements within its learner information package (LIP). These are quite separate from the 2002 accessibility guidelines, because they introduce a new code element <accessforall> to allow learners to set extensive preferences for how information is seen and controlled (IMS 2003c).

The intention is to allow the learner to specify their accessibility preferences, allowing them to define how they want to interact with the computer. Preferences within <accessforall> are grouped into <display>, <control> and <content> elements. The <display> element allows the user to specify how they prefer information displayed – for example, text size, background colour, audio only. The <control> element means the user can describe how they control the device – for example details of cursor control, specialist input devices. The <content> element gives the user the chance to state what alternative content they require (IMS 2003c, 1.1)

The IMS describe the intended use of the ACCLIP specifications:

> A preference file will be created using information gathered from a learner, perhaps in the form of an online questionnaire or at registration time. Learners will be asked to specify their preferences regarding the user interface including the assistive technology they use, the format they require for different types of information, and any auxiliary or alternative

content they need. The preference file can then be used to tailor the user interface and the retrieval and presentation of different types of content to suit the learner's needs. Once the preference file has been created it can be transferred to other compliant learning environments.
Examples may include:

- A student working at a public workstation could set <systemSounds> to "desktop, required" in order to receive visual alternatives (desktop flashes) in place of audio system alert sounds.
- A student with a learning disability could set the <contentDensity> to "bigPicture", in order to avoid an overload of information from a content-rich lesson.

(IMS 2003c, 3.2)

These specifications are a recent introduction and there is no data yet from UK developers attempting to implement them. [21] Colwell points to some possible ambiguities in the intention of the specifications:

> The intention is to encourage developers to provide customisable interfaces, to support different learning styles and learning abilities. It is not necessarily clear in the specifications which bits can be held at the server, which bits by the individual learner, and which bits need to be addressed to the author of the content. (Colwell 2003)

Until developers begin to implement the specifications, it will remain unclear how they work in practice. [22]

Finally, it is worth noting also that there are no compliance tests for e-learning specifications. (Because they have the status of specifications rather than standards, strictly they are 'complied' with rather then 'conformed' with.) SCORM offers developers self-testing software, but there is currently no cast-iron guarantee for the purchaser that the standards are adhered to. The UK government's e-government interoperability framework (e-GIF) version 5 incorporates e-learning standards, including IMS, SCORM and IEEE (Office of the E-Envoy 2003). But while all public bodies are encouraged to comply, there is as yet no sanction to ensure this.

[21] CETIS called in August 2003 for feedback from UK developers attempting to implement the ACCLIP specifications (CETIS 2003b).

[22] Some significant work on accessibility metadata is being undertaken by the TechDis Metadata Project (http://www.techdis.ac.uk/metadata/), which has designed a set of accessibility metadata to be included in the digital learning materials repository at JORUM+ (http://www.jorum.ac.uk/). The aim is to enable teachers and learners to share knowledge about the accessibility of materials, and be aware of what skills or technologies students need to access those materials (Rainger 2003b).

7. Implementing accessibility in VLEs: research results and discussion

This section maps the results of the survey and interview data gathered during this study, and compares them with existing research. The study utilises data from a total sample size of 57 (46 survey respondents and 11 interviewees). The data represented graphically in this section is drawn solely from responses to the online survey (which is set out in full in Appendix 1). Data from interviews is included in the textual analysis.

Represented in the online survey were:

- 23 higher education institutions (HEIs)
- 19 further education institutions (FEIs)
- 4 independent consultants.

Individual respondents were:

- a majority of ILT specialists, with a range of job titles such as 'e-learning adviser', 'instructional designer' or 'learning support adviser' (n=37)
- ICT specialists such as 'C&IT support officer' or 'IT manager' (n=5)
- lecturers (n=4).

For ease of display and interpretation, some data is presented in the following sections as percentages, but it should be borne in mind that, with a sample size of 46 this may produce distortion. As discussed in section 2 on methodology, the small sample size of this study means results and conclusions are necessarily tentative. As will be evident, however, the results are consistent with other studies.

7.1 Overview of respondents' VLEs

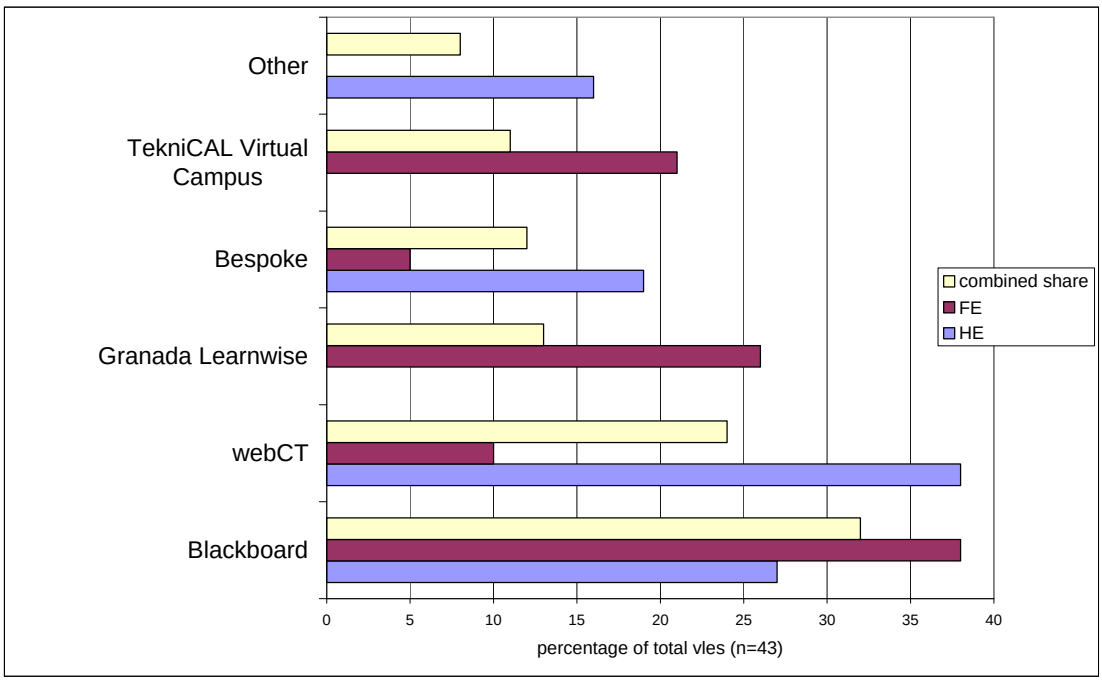

Figure 2. VLEs by type/vendor

Figure 2 shows the relative market penetration of various virtual learning environments based on the data from the 43 survey respondents whose institutions had a VLE. The market leader (32%) across FE and HE is Blackboard, a US product. Second (24%) is WebCT, also a US product.

The VLE market is quite young, and so there are few sources against which to compare this data. However, Jenkins and colleagues (2001) showed Blackboard entering the VLE market around 2001, and quickly reaching a dominant position. The most extensive recent research, a national survey of MLEs in FE and HE (JISC/UCISA 2003), shows Blackboard as currently having the leading share of the VLE market at 33%, and WebCT second at 20%.

Next in this study is Granada Learnwise, a product from a UK company, with 13%of the market, followed by bespoke in-house VLEs at 12% and Virtual Campus from UK company TekniCAL at 11%. These figures are also similar to the national figures from JISC/UCISA (2003).

The survey showed differences between FE and HE, with FEIs showing a preference for Blackboard, and HEIs for WebCT. Granada Learnwise was used only by FEIs in our sample. Once again this finding is broadly consonant with findings from JISC/UCISA (2003).

The category of bespoke VLEs in Figure 2 includes Colloquia, Bodington Common and WOLF, examples of VLEs developed by individual academic institutions for their own use, some of which have subsequently been taken up by other institutions. The VLEs subsumed in the category 'other' are commercial products Doddle, First Class and Fretwell Downing. (See Appendix 2 for more information on individual VLEs.)

These comparisons imply that our sample, though small, is representative of the products currently used across UK FE and HE.

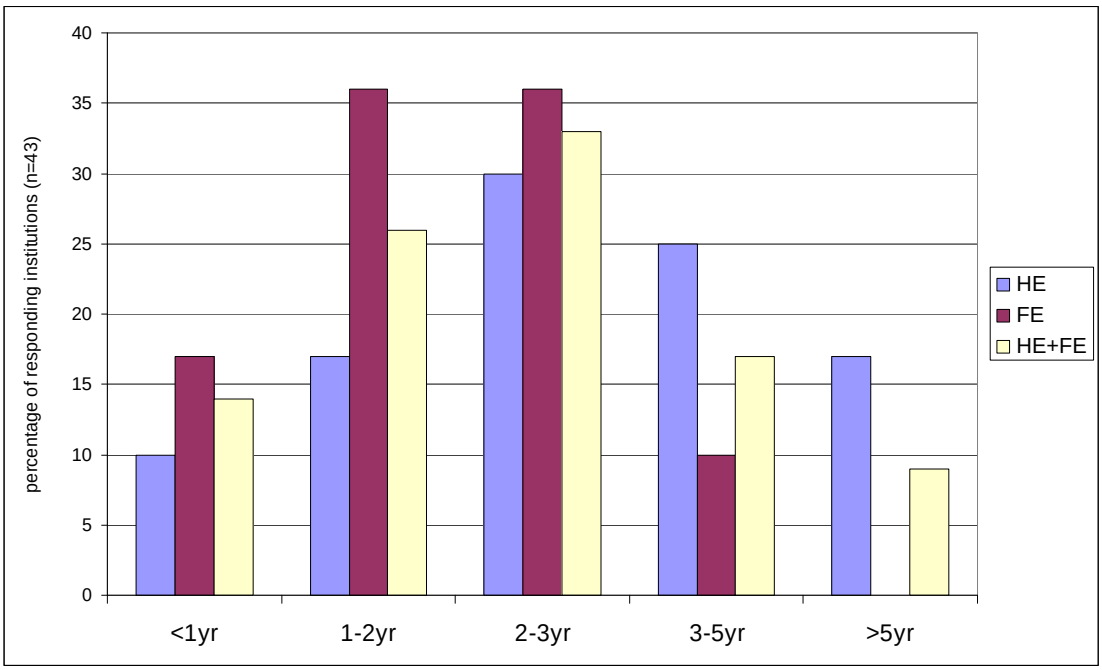

Figure 3. Uptake of VLEs over time (as at September 2003)

Figure 3 indicates uptake of VLEs over time in this sample, with a surge of uptake between 2000 and 2002, slowing in the last twelve months. With over 80% market penetration in FE and HE at present, this pattern would be broadly in line with Rogers' S-curve pattern of adoption of new technologies (Rogers 1995).

7.2 Importance of accessibility

Respondents were asked:

As a criterion for your choice of VLE, was accessibility for disabled users:

- not important
- considered but not primary
- of primary importance
- a necessary pre-condition since the introduction of SENDA.

(Question 12)

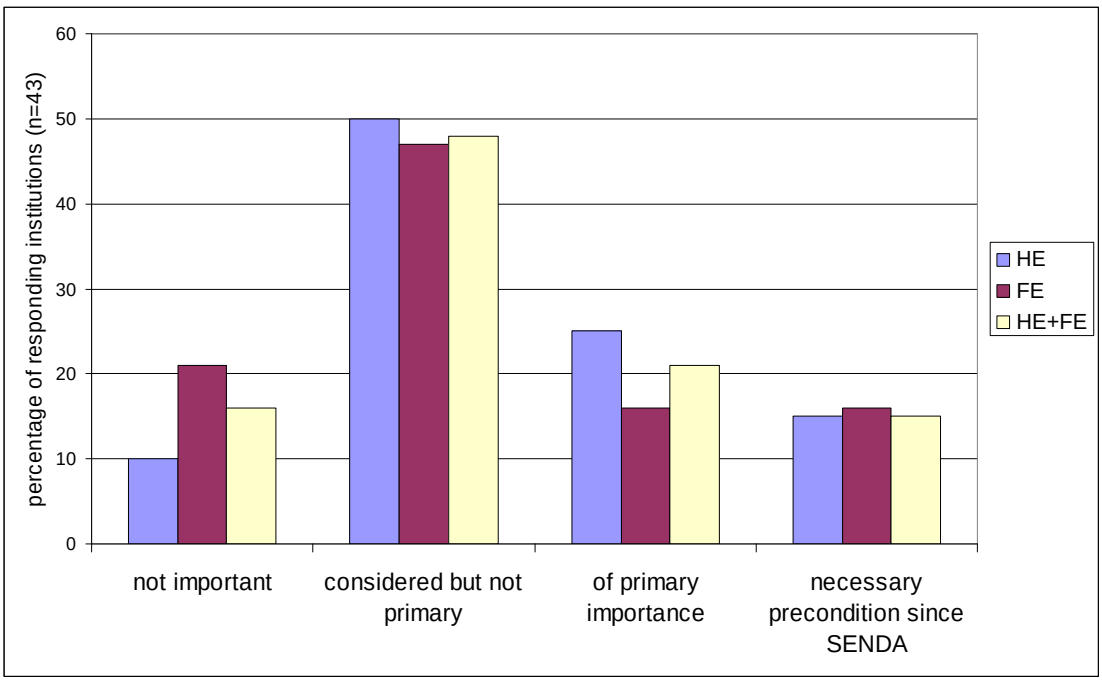

Figure 4. Relative importance of accessibility in choice of VLE

Reponses are shown in Figure 4. Fifteen per cent of respondents cited the accessibility of a VLE as a necessary precondition for their purchase/development, but the same percentage cited VLE accessibility as 'not important'. All but one of those considering accessibility to be unimportant had chosen VLEs after the introduction of the SENDA. The largest group (48%) of respondents cited accessibility as a consideration, but not a primary one.

Clearly this data is open to a number of interpretations. It could be that because all the main commercial developers claim to comply with the latest accessibility guidelines - being what they term 'SENDA compliant' and 'Section 508 conformant' - then this in itself is not a criterion on which institutions can differentiate between competing products.

Equally, it could be that the implications of the SENDA are not yet fully understood or embraced by FEIs and HEIs, and so accessibility is not yet seen to be an important distinguishing attribute.

Other data from this study – in particular the perceived need for increased awareness of disability and accessibility issues on the part of both teaching staff and management (see section 7.7a) - supports the latter interpretation.

It is possible that the lack of awareness about disability generally means that the issue of accessible e-learning falls between the stools of disability services, ILT services and ICT services, with nobody taking ownership, and consequently the issue not being incorporated, for example, into institutional procurement processes.

A number of initiatives have been directed at improving levels of awareness about disability and accessibility issues in education. For example, the Teachability project (University of Strathclyde 2001), the IDEAS project (University of Aberdeen 2001) and the DEMOS project (DEMOS 2003) all address issues of disability awareness in the HE environment. The University of Wales Institute Cardiff has produced an extensive good practice guide on inclusive education (Doyle and Robson 2002), and Ferl have produced a series of 13 short guides on inclusive learning and teaching (Ferl/TechDis 2003) with a focus on information and learning technologies.

Despite these and other initiatives, lack of awareness is still seen to be a major issue by our survey respondents:

> [There is] a general lack of awareness about accessibility issues: a narrowness of view about what constitutes a disability (often fostered by accessibility advocates identifying closely with one form of disability); and lack of resources or strong guidance from the top to give this work priority. (f19)

> I can't think of any reason at the moment why teaching staff should be particularly aware about disability or accessibility other than when it hits them personally and individually. Nothing has come at department, school or university level to say 'When you design a VLE page you must remember the following about accessibility'. (i03)

> Most staff should be aware of accessibility as an issue, even if not the details. At the moment, not all staff consider it to be important. (c05)

> There needs to be a lot more sharing of expertise across institutions and between governmental agencies to ensure that academics are aware of [disability issues]. I don't think that some academics are even aware that putting printed handouts on coloured paper can make a difference – never mind how to change the web pages! (f02)

7.3 Accessibility testing

Questions 13 and 14 asked whether the VLE and/or its content had been evaluated for accessibility. Figure 5 indicates the responses.

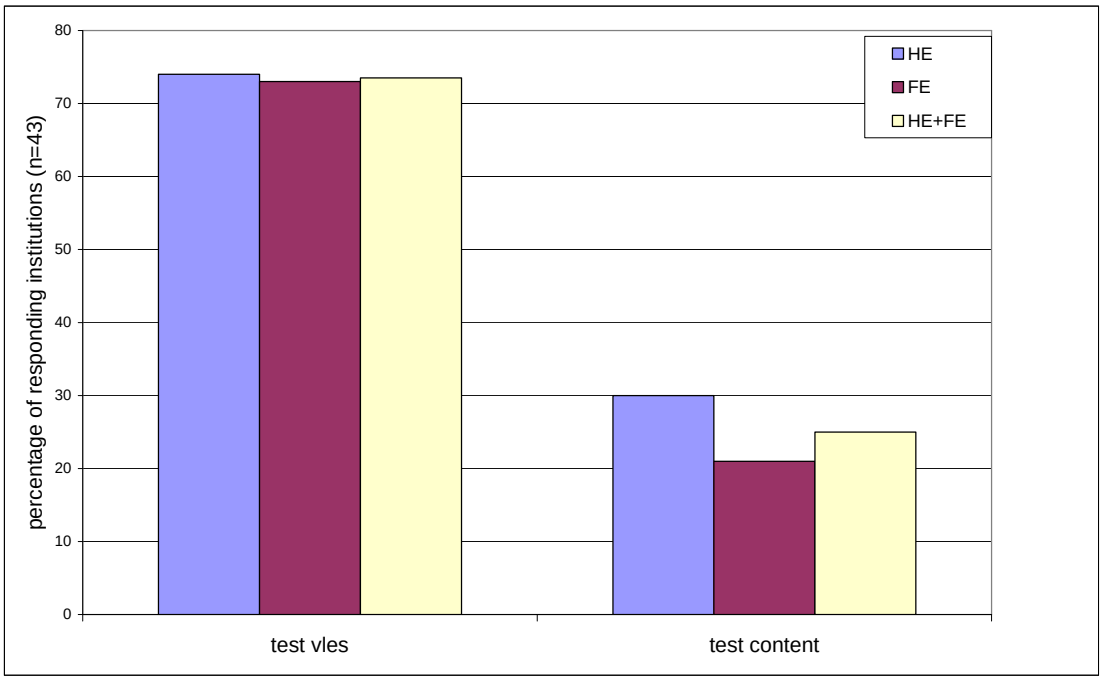

Figure 5. Percentage of institutions testing accessibility

Just under three-quarters (73%) of all FE and HE respondents with VLEs said they tested their VLE for accessibility. The testing processes cited included automated checkers such as Bobby/Watchfire and LIFT,[23] testing by expert reviewers within the ILT or ICT departments of the institution, and in four cases, 'brief evaluations' by screen reader users. Only one institution, a specialist college for disabled students, specified formal accessibility testing by students.

Recent research by the Skills for Access project found that 68% of their respondents tested at least some of their e-learning resources for accessibility, although for many this was only 'when time permits' or 'when there is a disabled student' (Skills for Access 2003).

A quarter of respondents in this study said that they tested the content put into the VLE. None of the respondents tested content accessibility as a matter of course, but rather described testing as 'ad hoc', 'when requested' or 'checking of odd samples'.

The study sample, which was addressed to specialist VLE and accessibility interest groups, is likely to be more aware and active around accessibility issues than the mainstream of post-16 education. It is possible that the incidence of VLE content testing across the whole sector is lower than the figures in this small sample suggest.

[23] An EduServ grant made LIFT available at no cost to all FEIs and HEIs in May 2003 (http://www.chest/ac/uk/software/lift).

7.4 Accessibility of the VLE

Question 13 asked those 35 respondents who had tested their VLEs 'Has your VLE proved to be accessible?'

- Yes: 22%
- No: 14%
- Partially: 64% (n=35)

Of the 22% who said their VLE was accessible, two verified this using automated checkers (Bobby and unspecified), two had done their own accessibility testing, including using screen readers, and four relied on certification of W3C WAI and/or Section 508 compliance by vendors.

There has been some comparison between VLE developers on the subject of accessibility. Cann and colleagues (2003) surveyed seven VLE developers on their accessibility policies, accessibility advice, and their views on adherence to relevant guidelines. They were also asked about provision within their product of a series of accessibility features relating to general usage, image maps, tables, frames, applets and multimedia.

The research suggests that US vendors (Blackboard and WebCT) 'have made strong commitments to improving the accessibility of their products in response to the legislative requirements of Section 508' (see section 4.2d). UK vendors, including Granada Learnwise and Fretwell Downing, 'have also made recent strides towards accessibility according to their corporate policies, and are working on programming issues and user guidance to users' (Cann *et al.* 2003).

Other research has tested the products themselves for accessibility. The market leaders Blackboard and WebCT have been the subject of most reported research (for example SNOW 2000a, Johnson and Ruppert 2001, Pearson and Koppi 2001, Evans and Sutherland 2002, Jezierski [undated]). COSE, a VLE developed at the University of Staffordshire has also been assessed for accessibility (Stiles 2001). All these studies revealed problems for disabled students accessing VLE content, problems which are examined in more detail later in this section.

In our survey, 78% of respondents said their VLE was only partially accessible or was not accessible. These respondents were asked what specific accessibility problems has been encountered. Figure 6 illustrates the range of problems cited, and the following sections address each category of problem in turn.

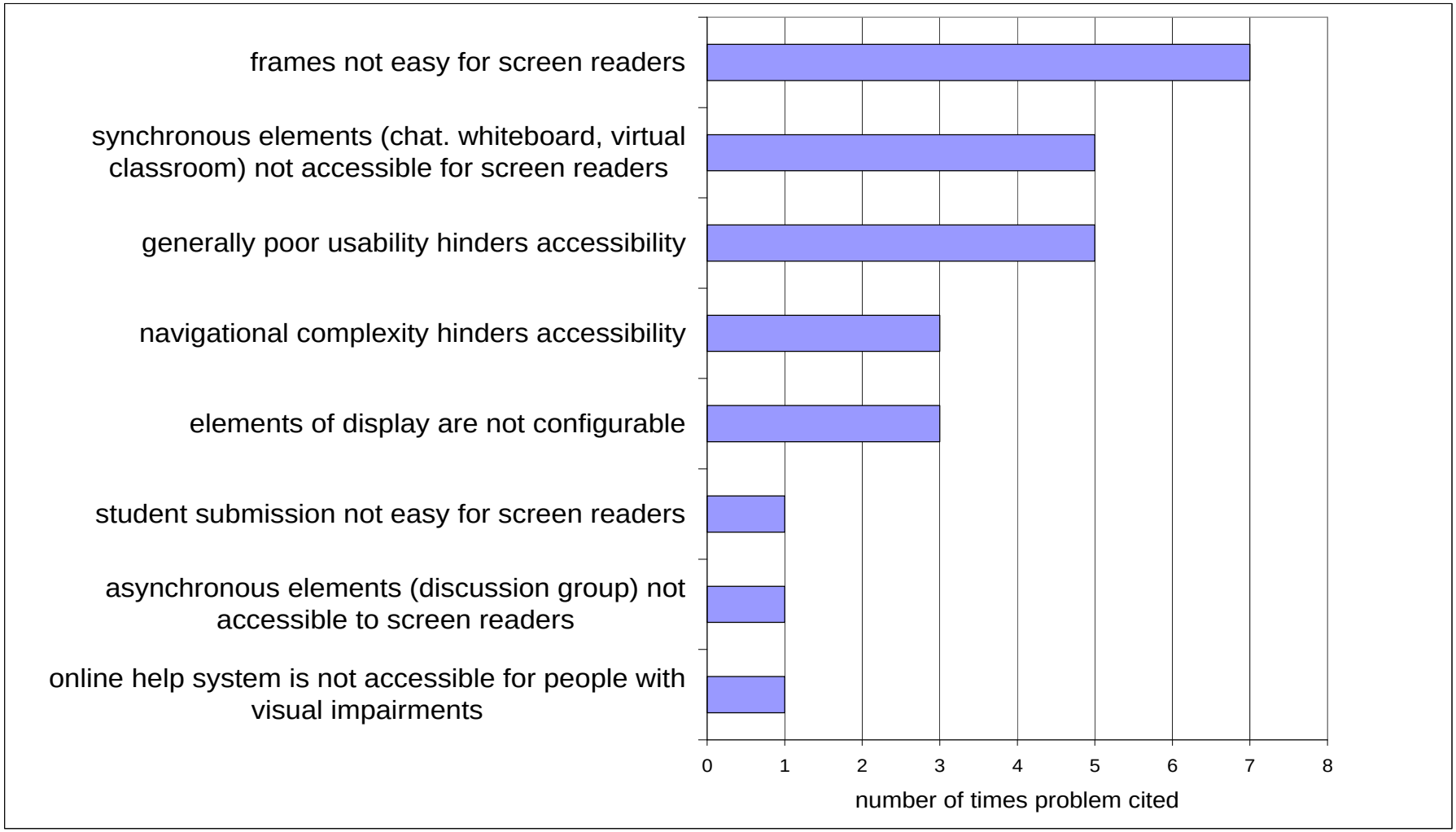

Figure 6. Inaccessible elements in virtual learning environments

7.4a. Frames

The most common reason for poor accessibility was the use of frames, mentioned by a quarter of respondents.

There has been a great deal of discussion concerning frames, much of it originally sparked by usability expert Jakob Nielsen in articles such as 'Why frames suck (most of the time)' where he argued that frames 'broke the unified model of the web….. because the user's view of information on the screen is now determined by a sequence of navigation actions rather than a single navigation action' (Nielsen 1996).

In relation to screen readers, there are two issues regarding the use of frames, one relating to assistive technologies specifically, the other to general usability issues. Before 1997, versions of screen readers such as Jaws could not read web pages presented in frames because they could not determine where the frame boundaries were. Then Jaws 3.31 introduced the 'virtual cursor', which allowed frame beginnings and ends to be spoken. Other popular screen reader technologies also incorporated this function (Octon 2003).

However, these advances do not necessarily mean a screen reader will produce comprehensible results for the user. This still relies on web developers understanding how a screen reader will process the frames, and then constructing their code to present the contents in logical order, and always providing frame names and titles. Commenting on this issue, Norman Octon of RNIB says:

> Frames need not be a problem as long as: they are in logical order; they are marked up properly; and there are not too many of them. I have come across web pages with 15 frames, which is nonsensical. (Octon 2003)

Our respondents encountered both accessibility and usability problems in relation to frames:

> [The VLE] is accessible to most up-to-date screen readers, but there are problems with older assistive technologies (e.g. those that can't cope with frames). (f19)
>
> There are some issues about the frame structure and how this will relate to screen readers. (f02)
>
> The VLE seems to be overcomplicated: too many frames. (c01)
>
> The VLE uses frames, which does not make accessibility easy. (j04)
>
> The system has a frames-free version which addresses some issues, though this is superficial, as screen readers work better with the frames version! (f08)

Craven and Brophy recently tested digital library interfaces with blind and visually impaired students, and looked at the issue of frames:

> While WAI Guidelines advise on the use of frames, it should be understood that the critical issue tends to be the *complexity* of pages and the logical *relationship* between areas on the page. Thus a page containing frames may not itself be problematic; a page containing a number of frames which require a user to make mental links between them will be inaccessible.

> Designers should consider the steps needed to navigate *within* pages since this is the most crucial determinant of accessibility. (Craven and Brophy 2003)

The SNOW project at the University of Toronto makes a similar point regarding WebCT:

> With [each new version of WebCT] there has been a significant increase in the features and utilities available in the student interface. This has caused concern among screen reader users, for whom the complexity of the framed layout significantly increases the cognitive load. While it is technically 'accessible', it is still very challenging for an inexperienced screen reader user to become comfortable and oriented in the WebCT courseware environment. Until such time as screen readers, browsers and courseware are developed to a point of seamless integration with consistent support for access strategies, complex interfaces such as WebCT will continue to be a challenge. (SNOW 2000b)

One of the survey respondents, asked about the most pressing accessibility issue, simply said: 'Tell the VLE developers not to use frames' (j04).

7.4b. Synchronous communication

The principal synchronous communication functions in the virtual learning environments in this research are chat facilities and interactive whiteboards, many of which use Java applets as their underlying technology. As a group these functions were the most problematic in terms of accessibility:

> Online chat and the whiteboard are not accessible to blind users. (f05)

> The live chat space is a real problem. (f24)

> The online chat and virtual classrooms are Java-based, and not accessible to screen readers. Even for the so-called accessible versions, a very high level of IT skills is needed from the users. (f20)

As with frames, there is a basic issue of whether the user can access the content in these areas of the VLE at all, and then when it is accessed whether it is usable for the student. Technical fixes [24] may address the technical accessibility issue, but this may not be sufficient in itself.

The synchronous nature of these tools clearly means that timeliness – speed of access, speed of response – is vital in order to use them meaningfully. Online chat is therefore not just a problem for users of screen readers, but for students who may read, assimilate, compose responses or input more slowly, either because they need to do so in an alternative medium, or simply because of their personal learning style. Technical fixes will not address all these problems, so while a function may be accessibility standards/guidelines compliant, it does not make it universally usable. As the last respondent above also points out, a very high level of IT skills is needed from users to access these functions using assistive technologies. The issue of user skills is examined in section 7.7.

[24] As Stiles (2002) notes, Java *per se* is not a problem with accessibility if developers follow best practice as outlined in, for example, the Sun Java Accessibility standards; see http://www.sun.com/access/articles

Several respondents suggested realistic approaches to the use of alternatives where tools or functions are not usable by some students:

> We need to acknowledge that some 'extreme' online tools - chat and whiteboard - may not be suitable for all, and alternatives must be provided. (f05)

> The baseline for us at the moment is to build as much accessibility into the main content as we can. Then identify which bits are not accessible, and maybe produce a whole alternative if necessary, but within the context of your learning objectives for that particular activity. If it is just an extra thing that is not central to the progression through the course, then we need to acknowledge it and document it – for example, 'a blind student at this university will not be able to do this activity but that will not have a major impact on them being able to pass the course'. Or to say 'a blind person can't do this but this is central and is not accessible so here is the alternative'. It must all be in the context of overall learning objectives. (i02)

7.4c. Usability and accessibility

Of equal importance to our survey respondents was the issue of poor usability hindering accessibility. Usability is defined at the degree of efficiency, effectiveness and satisfaction with which a user can achieve their intended task/s using a system.

Five respondents in this survey did not rate the general usability of their VLE very highly, for example:

> Many VLE pages have too many links to be usable. (f17)

> The VLE has a non-intuitive interface and poor ergonomics. (f27)

> The VLE is too complicated. This is not disability specific – the general usability just seems poor. (c01)

The web has been estimated to be three times less usable for people with visual impairments than those without (Coyne and Nielsen 2001). VLEs have been shown to be six times as difficult to use 'due to their complexity, and the expectation that learning will take place during use' (Evans and Sutherland 2002).

Proponents of user-centred design emphasise the need to promote good usability – sometimes termed universal design or design for all – as opposed to accessibility in isolation (see for example Frontend 2001, Pearson and Koppi 2001, Neumann 2002, Kelly and Craven 2003). While a VLE resource may be technically accessible, that does not mean it will be usable:

> Our materials are making good progress towards becoming compliant to relevant standards. However, our biggest problem is not strict standards adherence, but… ensuring good, logical usability (it goes without saying that 'minor' visual anomalies, inconsistencies and annoyances generally present a far greater problem when, for instance, accessed by screen-readers). (c01)

As Pearson and Koppi point out, the solution to this is encapsulated by the concept of learner-focused design:

> Learning environments have requirements for accessibility beyond functional considerations and the use of 'alt' tags. Care needs to be taken with navigation, structure, content design and communication aspects, and learner-centred design is crucial to ensure that online learning is accessible to students with disabilities. (Pearson and Koppi 2001)

Stiles, when evaluating COSE, a bespoke VLE from Staffordshire University, also comments:

> The success of the [VLE's] metaphor and the ease with which learners can intuitively navigate between components and functions plays a major role in its success. To be truly accessible, the metaphor and navigation must be independent of disability. (Stiles 2001)

It must be borne in mind that VLEs are intended to help people learn. Usability problems in VLEs may merely be short-term frustrations or annoyances, but they may also be the source of cognitive overload, impinge on the whole learning process, causing 'at least reduced quality of learning and at worst total despondency and reluctance to engage in any further learning experiences' (Evans and Sutherland 2002).

However, one caveat was raised concerning the concept of universal design. One of its central claims is that accommodations made for specific individuals can greatly benefit all. The example of cut-down roadside curbs is often given – a design accommodation for wheelchair users that benefits people with pushchairs, shopping trolleys, bikes and so on. However, one respondent pointed out that:

> A difficulty for lecturers in working with disabled students is that each student is different, and what works for one will not necessarily work for another - despite the much vaunted claim that access work benefits all students. (f06)

As Rainger (2003b) commented to the author:

> Accessibility guidelines and standards focus on sensory disability: 'Does this work with a screen reader?' But accessibility is so much broader than this. As just one example, the accessibility of materials for dyslexic students rarely comes to the fore. It is always assumed that multimedia helps dyslexics, but research[25] shows this is not the case; it all depends on learning styles. Different combinations of media used to present materials to dyslexic students can lead to significant differences in their understanding. (Rainger 2003b)

While good usability will certainly benefit all, the diversity of possible accessibility accommodations for individual students – and the associated time and resources involved in delivering these individual accommodations - is an important issue, which is addressed in more detail in section 7.7h.

7.4d. Navigational issues

Poor navigational design is often included under the general heading of poor usability, but navigational complexity was singled out as a particular problem in VLEs by several respondents, for example:

[25] See Beacham *et al.* 2003

> Screen readers have a minimum of five levels of navigation to cope with when using a VLE. (f20)
>
> There are too many screens to navigate through to reach where you are going. (f28)

Evans and Sutherland (2002) note that navigation was a particular issue for students with visual impairments using WebCT. Stiles also pinpoint navigation as the most problematic part of VLEs, specifying the following requirements:

- grouping and naming of components to allow easy navigation of the system
- code must be logical, as well as the visual appearance of the page
- it should be easy for the user to move the focus (i.e. the part of the screen currently live) easily, and the cycling order in which the focus moves around the screen should be logical
- keyboard navigation – which enables tab and arrow keys to move the cursor – must be logical
- there should be keyboard equivalents for all menu options
- shortcuts must be provided in places where tabbing becomes excessive. (Stiles 2001)

7.4e. Flexibility of display

Several respondents commented that aspects of the VLE's appearance on screen were not accessible in their default settings, and sometimes not changeable because they are 'hard-coded' into the VLE's core programming:

> It's not easy to change the size of the text. (f28)
>
> So far the only problem we have encountered is not being able to make the screen colours different. (f32)
>
> There is a lack of user control over display. (c03)

A fundamental aspect of user-centred web design is to allow the user control over how the content displays. This is one of the great advantages of web-based media for people who have specific requirements regarding, for example, the colour or size of elements on the page. This facility is contained within all standard current browsers. It can be incorporated into the VLE as well. If it is not explicitly incorporated into the VLE, then the VLE coding must allow the user to use their personal settings to override the VLE default. This does not appear to be the case currently with all VLEs.

Giving control to the user also opens up the possibility of 'platform independence' – allowing the user to access the VLE on a palmtop computer, for example. There are some basic web development processes which must be followed in order to achieve this, notably the use of stylesheets (CSS) and valid XHTML. These enable all the display elements associated with a page to be kept separate from the 'raw data' in the page itself. This allows a different stylesheet to be attached to the same data for output in a different style or on a different platform.

There has been much discussion about the potential of XML technologies for enhanced accessibility and platform independence:

> XML allows a range of flexible stylesheet transformations. It allows simple changes to font size and colour as well as the use of complex translation grammars used to translate a presentation into entirely different modalities. Because all content in an XML document is declared and labelled, authors can create content that later can be re-styled in ways that the author never imagined. (IMS 2002)

Commercial developers are aware of XML's potential (e.g. Blackboard 2003a). However, as Franklin (2001) has pointed out, the potential to free content of all design constraints runs the risk of losing some accessibility features, and XML based technologies will only prove accessible if best practice is followed and accessibility is built into the XML schema and the document type definitions (DTDs).

This also raises the issue of open source VLEs. Some non-commercial developers have opened up access to the underlying source code of their VLE. This means that institutions using the VLE are able to make changes and adjustments to suit their own environment and needs. Problems such as lack of display versatility noted in the above proprietary products could be solved by institutions without having to go back to the supplier. More fundamentally, a whole system can be amended and made 'bespoke'. One interviewee, whose institution has opted for open source, explained:

> We are unusual as an institution because we operate right from SVQ level though to PhD, and we need a platform that supports a lot of long-distance collaboration between staff as well as between students and staff. We also have partners with specific non-English language needs, and specific needs for international working. And we are a young institution, so we need a VLE that grows as we grow. All these factors have led us to an open source solution; not building our own from the ground up, but taking an existing open source solution and then customising it to our own needs. (i05)

7.4f. Student assessment

VLEs allow a variety of methods of assessment, including the submission of assessed work online, and a variety of test and quiz formats. Online assessment can bring a number of benefits for disabled students:

- online submission can be helpful for students with mobility problems
- learners with a cognitive disability may benefit from assessed online discussions or group work, where the pressure of contributing face to face is removed
- drag and drop or multiple choice tests may be easier than hand written tests for someone with a visual or motor impairment.
  (Ferl/Techdis 2003, 3)

However, Evans and Sutherland (2002) found the submission of work to be one of the most difficult tasks for students with visual impairments. One of our respondents (ferl06) made specific mention of the submission process being difficult for students using screen readers. Jezierski (undated) also points to submission problems, due to screen readers not recognising the 'submit' button.

Another respondent also raised a problem with anonymity of submission in VLEs:

> There are issues with anonymous marking because you cannot get rid of the student's user ID and name, which are automatically attached to the submission. If you try and remove the name then you lose it in discussion threads too, and of course they may form part of a course assessment. (i01)

While not strictly an accessibility problem, this is nonetheless a usability problem for the institution.

Even if technically accessible, quizzes can pose different problems, most especially if they are timed. Evans and Sutherland (2002) found learners using screen readers to do a quiz spent only one third of their time actually doing the task, and the remainder of the time accessing and navigating the VLE.

Some assessments, such as drag and drop, will clearly never be accessible to some disabled learners. Again, this becomes an issue of taking into account the overall learning objectives and providing suitable alternatives (Ferl/TechDis 2003, 3).

Wiles points out that there is no specific provision within SENDA to ensure accessible online assessment, and that this is potentially serious for the student, who may only get one chance at being assessed. In addition, while there are guidelines for accessibility in more traditional assessments (hand-written, examination halls), there are as yet no accessibility guidelines for online assessments (Wiles 2002).

7.4g. Asynchronous communication

Discussion groups or bulletin boards are a key part of VLEs, providing one of the main foci for group interaction. This asynchronous communication is inherently less difficult than synchronous types, as users can take their time participating, and the technology is relatively straightforward. None of the main commercial products appeared to cause specific accessibility problems in this area, but one in-house product was still developing a discussion group function accessible to screen readers (c05).

Evans and Sutherland note some difficulties with discussion boards for students using screen readers, who tested the tool in both Blackboard and WebCT and found the latter difficult to use. (They did however point out that the comparison was slightly problematic as the students were more familiar with Blackboard than WebCT prior to testing, which may have influenced their experience.)

7.4h. Online help

This problem was highlighted by one respondent:

> The online help is not written to be universally inclusive. The developers need to review and rewrite the help files to ensure all references to purely visual elements such as icons are removed and that the instructions are written to be universally understood. This would save me [an academic/curriculum support co-ordinator] from having to devise complex e-tutorials for blind users quickly, at the time of need, when difficulties are encountered. (f05)

7.5 Accessibility of VLE content

Figure 5 showed that a quarter of all respondents said that they tested their VLE content. They reported the following problems:

- problems with tools used to author the content (2 respondents)
- bought-in content not being accessible (1)
- navigational complexity (1)
- lack of ‘alt’ tags (1).

Authoring tools are a generic category that includes simple office suite programmes such as Word and Powerpoint, through to more sophisticated web-specific authoring tools such as Dreamweaver. They allow content creators to who are not web-experts to put together materials for the web without learning HTML. Three authoring issues were highlighted by respondents: the lack of user-friendliness of web-specific authoring tools, the inappropriate use of these tools, and the bad HTML produced by generic tools:

> The [web] authoring tools that are available are not very user-friendly. As a result, people are often using Powerpoint or Word to create content, then 'saving as HTML' in order to put it into the VLE. This creates very inaccessible materials, which are time-consuming for an expert to make accessible. (f08)

> Our initial checks showed problems with authoring tools – for example people using [Macromedia] Authorware instead of HTML for basic menus and text sections. (c03)

Kelly and Sloan both single out this problem in e-learning:

> We get poor accessibility [in HE e-learning] because people use crude tools and save to HTML, producing bad code. People are reluctant to change to unfamiliar tools, and there are costs involved in changing. (Kelly 2003a)

> Automatically generated code frequently breaks not only W3C Web Content Accessibility Guidelines, but is also often non-valid HTML. The code can also be bloated, making files larger than they need to be and increasing download time. (Sloan 2000)

While the majority of FE and HE teaching staff create their own content, there is a large market of ready-made learning materials. One respondent said that they had bought in NLN (National Learning Network) materials, assuming they would be accessible but then found that they did not provide keyboard shortcuts (f12).

Navigational complexity is already a problem cited with the structure of the VLE (see section 7.4d) but it gains another dimension when the content itself contains another set of navigational elements:

> Screen readers have a minimum of five levels of navigation to cope with when using a VLE: it is difficult to manage both VLE navigation and in-built navigation in course materials themselves. So, our new course materials are allowing navigation to be done by the VLE [rather than adding an additional level]. (f20)

'Alt tags' are the 'alternative text' in HTML that should be added to images, so that when a screen reader, or any browser with the images turned off, accesses the page, a description of the image (and hopefully also its purpose if necessary) is included. They are a 'bare minimum' in terms of web accessibility, and one respondent commented that teaching staff did not incorporate them into their VLE content. In this instance it seems that the content creators lack the knowledge to include them of their own accord, and the authoring tools they are using do not require them to be included.

The results above are only for the content that is actually checked. Of those respondents whose VLE content was not checked, or who did not know if it was or not, it is probably safe to assume that the same problems would manifest. The lack of accessibility of course content is clearly a problem.

As one e-learning adviser in our survey said:

> I check odd samples of content - I perform validation tests and get some expert usability reviews. I usually get very depressed about the results. (f19)

7.6 Content creation process

Figure 7 shows the results to question 16, which asked respondents: 'Briefly, what is the mechanism for getting course content onto the VLE?'.

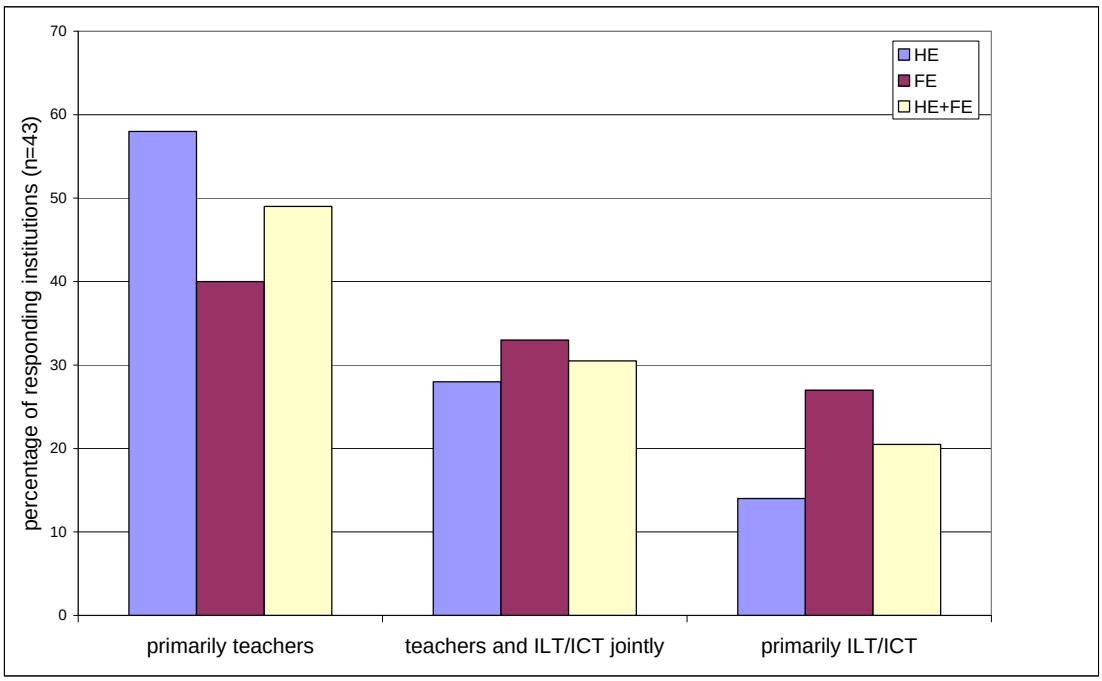

Figure 7. Responsibility for creating VLE content

The responsibility for creating VLE course content lies overwhelmingly with teaching staff in both FE and HE. There are some possibly significant differences between FE and HE, with further education appearing to spread the responsibility a little more, by involving ILT (information and learning technology) or ICT (information and communications technology) staff, either in conjunction with teachers or in taking primary responsibility themselves.

Nonetheless the majority assumption across both sectors seems to be that content is created and uploaded by teachers, with varying amounts of specialist support.

The survey then asked whether any guidance on accessibility was provided for VLE content authors. Twenty-six (60%) of respondents did provide some accessibility guidance for authors, detailed in figure 8.

Almost half of those respondents who provided some form of guidance had produced their own guidelines (see Appendix 6 for more details on accessing some of these guidelines). These took the form of content within the VLE itself, or on

the intranet, or institution website. Eight respondents said that the main form of guidance was individual advice and support from other staff in either ILT or ICT support.

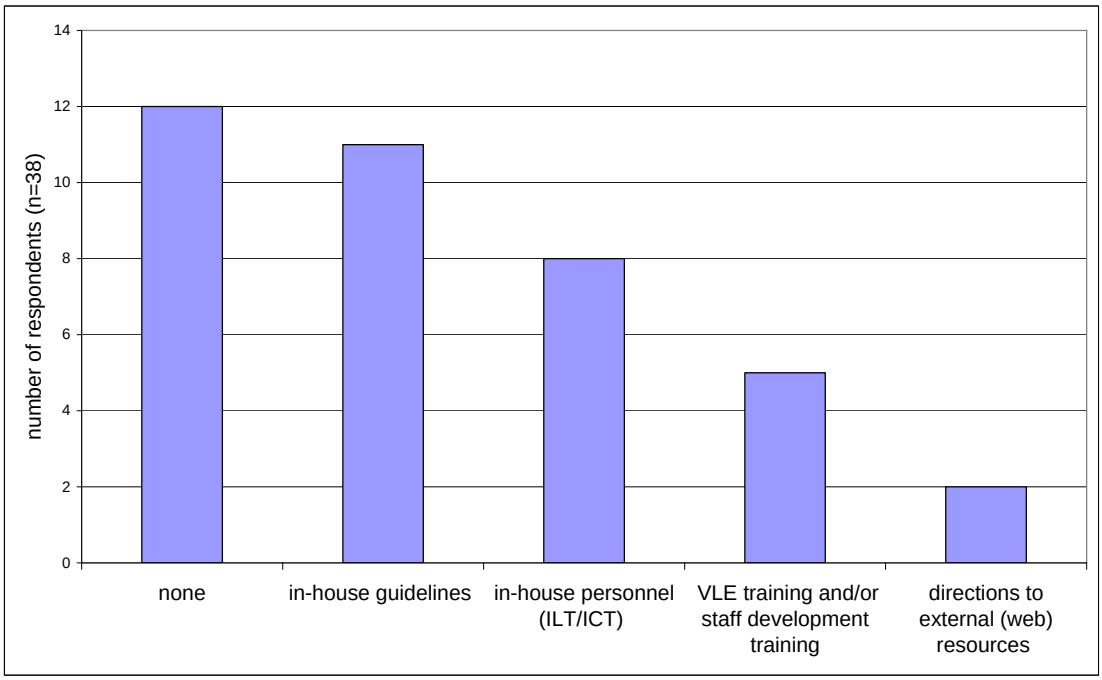

Figure 8. Primary source of accessibility guidance for VLE content authors

Five respondents said that accessibility issues were included in either VLE training, or in more general staff development programmes. In context of the overall sample, this figure implies that about 10% of all responding institutions incorporate web accessibility issues in training for the relevant staff.

Pearson and Koppi (2001) comment: 'There is a paucity of advice available specifically aimed at the design and development of accessible educational courseware for academic developers'.

7.7 Origins and priority of accessibility problems

Question 18 of the survey asked respondents to rate their level of agreement with seven suggested ‘reasons for the lack of accessibility in courses delivered by VLEs’. As Figure 9 shows, the average rating showed agreement to varying degrees with all the suggested reasons. Respondents were also asked if they had other reasons to put forward. The following suggestions were made:

- low level of awareness about disability and accessibility issues
- lack of instructional design skills
- insufficient strategic management support
- insufficient course development time
- developers/vendors not providing technical support related to accessibility
- use of inappropriate authoring tools, producing bad HTML
- lack of co-operation between ICT and teaching staff regarding VLE
- lack of a central resource to check accessibility of VLE courses.

Question 19 asked: ‘Of the problems outlined in question 18, including any additional ones you may have raised, what would you say needs most urgently addressing, and why?’ Responses are indicated in Figure 10; they include the six most strongly supported reasons offered for rating in question 18, as well as some of the additional reasons respondents were given space to add.

The rest of this section examines the nine most urgent problems in turn.

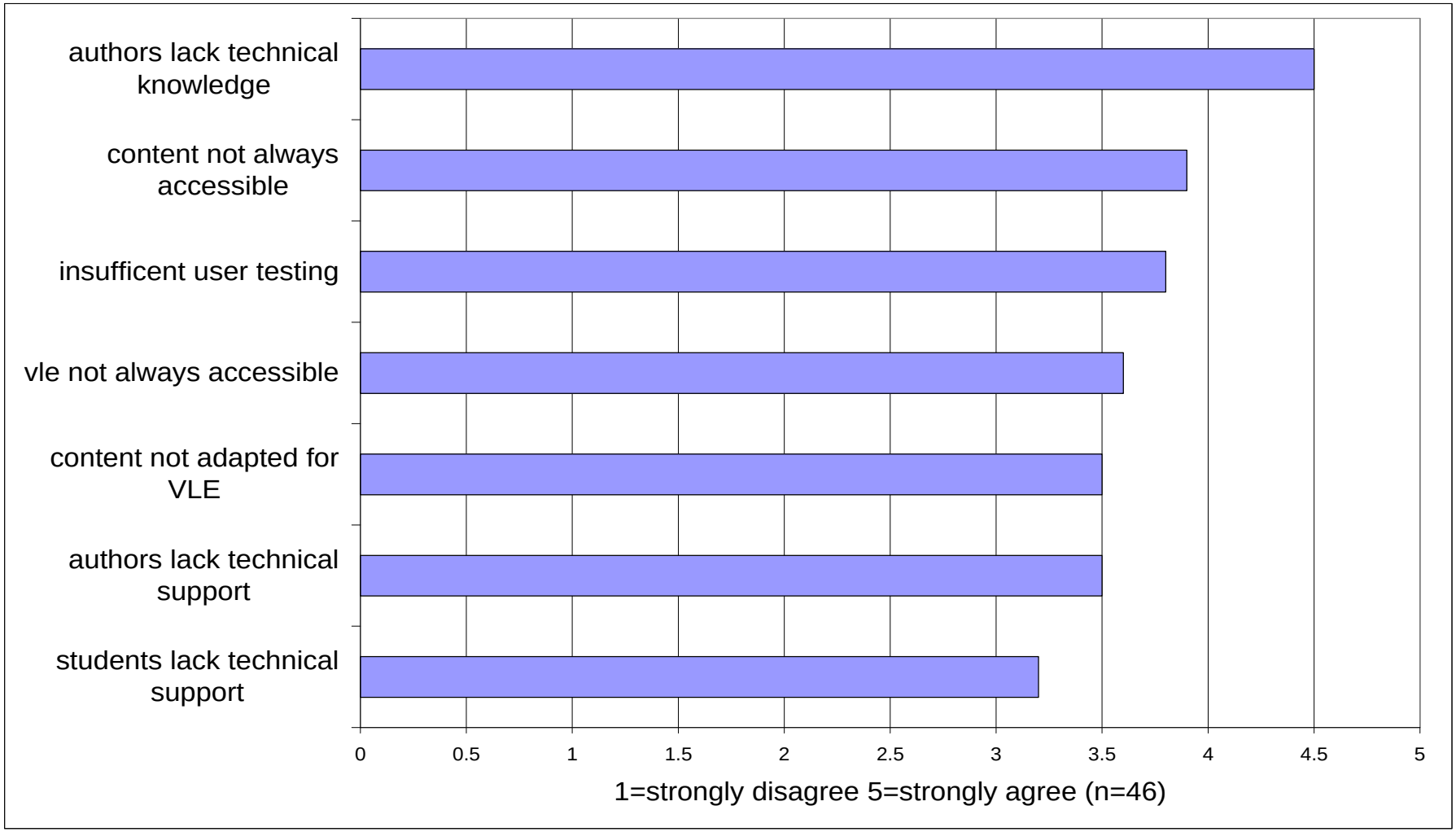

Figure 9. What causes VLE course accessibility problems?

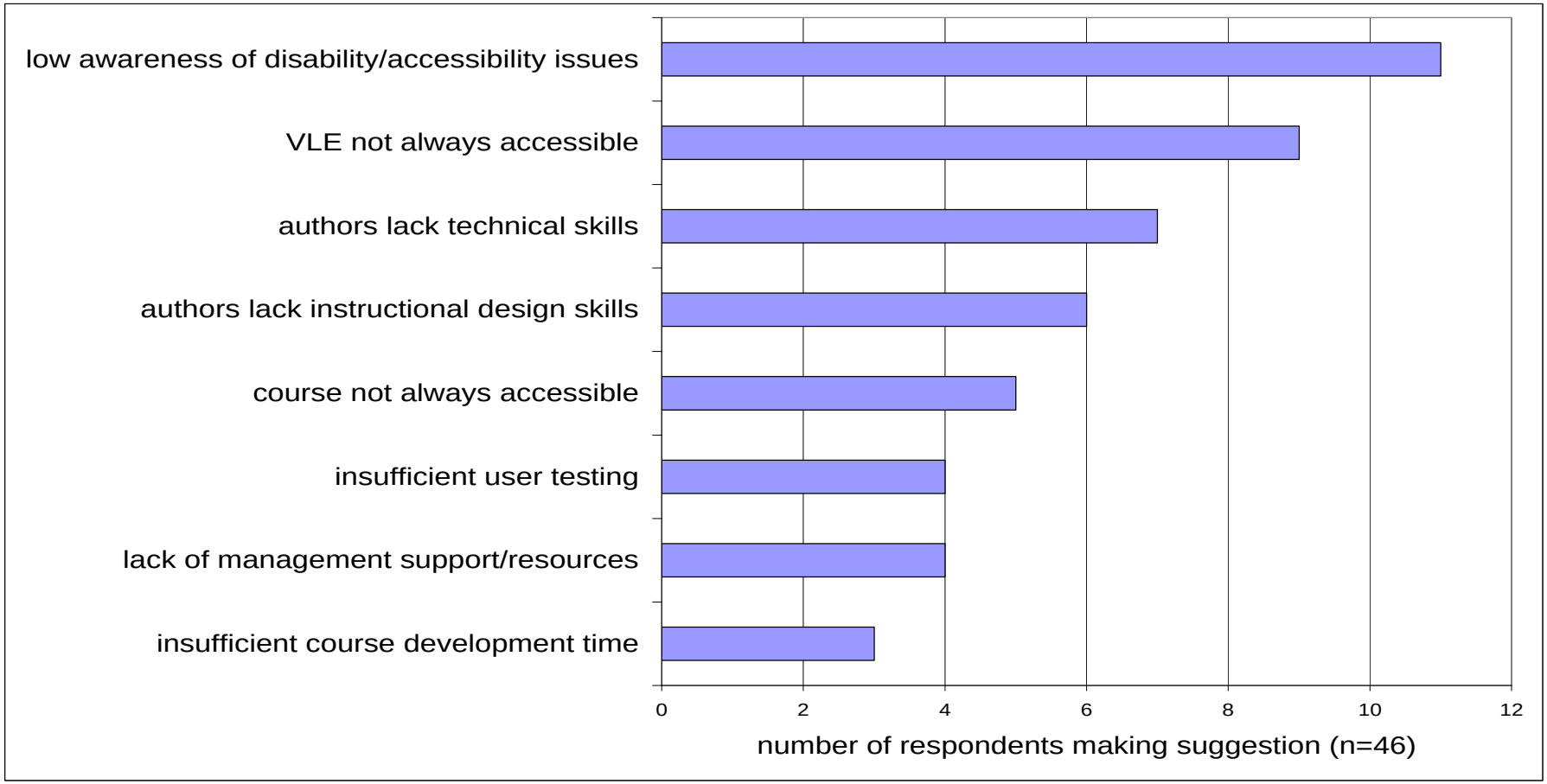

Figure 10. What are the most urgent problems in implementing VLE course accessibility?
(Several respondents cited more than one problem in answer to this question)

7.7a. Low awareness of disability/accessibility issues

As Figure 10 shows, the problem cited most often in this study as being the highest priority was a general lack of awareness in FE and HE institutions about the whole issue of disability access, and how it applied to e-learning generally and VLEs in particular. This finding was cited unprompted - it was not among the seven reasons respondents were asked to rate - by almost a quarter (23%) of all respondents. Typical comments included:

> Awareness is the most urgent problem. Because without that widespread awareness of the general issues and the need to act, there will be no pressure to find resources and mechanisms to make content accessible, whether on a VLE or elsewhere. At present, most people, even if they are willing and interested, would not know where to go for advice, information or support. (f19)
>
> Awareness is possibly the biggest issue. People may be aware of the term 'accessibility' but are not really aware of what is involved in achieving it. (f08)
>
> I believe that raising awareness is the most important issue - making course designers and deliverers aware of what they can do to make material and courses accessible, and making students aware of what we can do with them. (f28)
>
> Unless teaching staff are affected by the issues of accessibility, either in a personal or professional context, the need to adapt or create material to accommodate users of assistive technology is translated into an additional work burden. (f05)
>
> Awareness of accessibility issues for content authors [is the most urgent priority], not least because of the implications of the SENDA. (j02)

This lack of awareness may seem surprising in view of the fact that SENDA has been in force since 2001, accessible learning is part of the sector's quality audit systems, and the issue of widening FE/HE access to disabled learners has been on the educational policy agenda for nearly a decade, certainly since the 1996 Tomlinson report.

Two recent studies seem to confirm a lack of awareness with regard to university web sites – the institution's main point of information access - which were found barely to reach basic levels of accessibility (Kelly 2002, Nomensa 2003). Stiles adds that 'a classic problem [with VLEs] was that unless an institution pays attention to accessibility issues in the design and organisation of its web site, students may not be able to navigate to the page from which a VLE is launched' (Stiles 2001). (In our study, nine of 43 institutions did not have a general web accessibility policy (question 9).)

It should be noted that lack of awareness about disability/accessibility is not restricted to academia in the UK. Recent research by Mediasurface (2003) shows 81% of UK businesses are still not compliant with the 1995 Disability Discrimination Act, and 54% were unaware of the DDA's provisions on web accessibility.

Progress is being made in FE and HE. A JISC/UCISA (2003) survey found that half (51%) of all respondents across FE and HE provided 'online systems which support a

limited range of accessibility needs of students with disabilities'. But despite sector-wide efforts by bodies such as JISC (for example through TechDis) and BECTa (for example through Ferl) to raise awareness, and a number of individual research projects and initiatives - many of which are referenced in this report – this study and other larger studies point to a gap between 'best practice' and 'mainstream reality'.

7.7b. Inaccessible VLEs

The study respondents attached the next highest degree of importance to inaccessibility within the VLE product itself, or a lack of support from the developers to enable users to ensure accessibility (Figure 10). Typical comments included:

> The VLE developers must ensure the VLEs themselves are fully accessible. (f09)
>
> VLE designers need to improve/develop products to be fully user - author and student - friendly and accessible –ASAP. (f27)
>
> It would be better if the VLE producers made accessibility a very high priority…and made the system more user friendly for all of us. (f28)
>
> [The most urgent problem is] VLE not being accessible; companies need to spend more time researching and developing useful interfaces. At the moment [VLE development is] product-driven and not end-user driven. (f31)
>
> [The most urgent problem is] accessibility of the VLE. If this is not addressed then none of the other things will lead to accessible learning experiences. (c07)

The problems caused by inaccessible aspects of the VLE are often outside the control of the institutions, because they are hard-coded into the programming (which is not open to institutions to change themselves):

> [The most urgent problem is] VLE designers needing to address accessibility. Although we can make accessible materials to put into it, we cannot alter the structure/code of the VLE to rectify its failings in terms of accessibility. We encourage academic staff to focus on the pedagogical aims of the online course/materials they are developing, and any usability or accessibility problems we experience with the VLE impede this process as well as making it more difficult for students (whether disabled or not) to access the online courses. (j03)
>
> You can pay the vendor to work on accessibility problems you cannot address yourselves, or if you get enough other users of the system together you can press for them to make the changes. But we haven't got much control –we have to rely on them to do it. (i04)

This potential seriousness of this problem has been emphasised by Stiles:

> Accessibility problems hard-coded into the VLE software… are not rectifiable by the purchasers. This has a profound impact, in that these problems can render inaccessible *all* the content held within a VLE, regardless of whether or not that is accessible in itself. (Stiles 2001)

All the above comments make an interesting comparison with the results of the investigation by Cann and colleagues investigation into the policies and stated intentions of the main VLE developers, who all claim to be addressing accessibility problems. (Cann *et al.* 2003)

The mismatch between manufacturers' claims and institutions' experiences could be because:

- the systems do not actually comply with section 508 or WAI guidelines, though they claim to
- the systems comply with the guidelines, but compliance does not ensure accessibility.

This second issue was raised by two respondents in this study, in relation to VLEs themselves and the content placed on them:

> [There is]… a general obsession with standards compliance in the belief that just because an automated tool says the VLE complies with something, it is therefore accessible. (c01)

> My concern about guidelines is that they are all very well, put together by experts and so on – but do they actually benefit the user at the other end? I have seen developers spending a great deal of time implementing guidelines, and validating their code and so on, and then the end-result not being of any use to the student. I really worry about guidelines – that they don't capture the real world context, how users really work. (i02)

Kelly and Craven (2003) also point out problems with guidelines, saying: 'they are flawed, overambitious or ambiguous'. For example: 'The W3C WAI guidelines assume that implementing their standards works in all browsers. This is not true.' (Kelly 2003a).[26]

All these issues relate back to the point respondents made about accessibility needing to go hand-in-hand with usability (see section 7.4c): unless guidelines take account of user experience, in terms of platforms, operating systems, browsers *and* user needs, then 'compliance' alone will not solve the problem.

7.7c. Authors lack technical skills

While this problem was third in priority for respondents (Figure 10), it was the most strongly supported (Figure 9) of the reasons given in question 18 of the survey for inaccessible VLEs.

Typical comments included:

> Content authors do not always have the technical knowledge/awareness to ensure accessibility: accessibility is still seen as being the domain of specialist disability staff within institutions and not the responsibility of teaching staff, therefore I don't believe that many content authors are aware of the issues. (c04)

[26] Concerning web guidelines (though not specific to accessibility), Perry and colleagues examined the implementation of IMS specifications on interoperability and found: 'Certain data elements were ambiguous… this ambiguity could cause developers to interpret the specifications in completely different ways'. (Perry *et al*. 2002)

> [The biggest problem is] content authors not having awareness of technical issues, or the time or resources to cater for accessibility. (f15)
>
> Problems lie in some of the content posted by teaching staff rather than with the VLE itself. A common example is failing to use alt text for images thus making them unsuitable for screen-readers. (j02)
>
> [The biggest problem is] teaching staff IT skills. Level of IT literacy is worse in the UK than in education in many EU countries, and a long way behind the US. Attitudes in general towards online learning are dismissive and negative. (f17)
>
> [Another problem is] Insufficient technical skills in the majority of tutors to have the confidence to use the VLE to its full extent and insufficient skills to realise that they are not meeting the recommended guidelines. (f32)

A number of studies have pinpointed staff skills development as a critical issue in the implementation of e-learning (for example Jenkins *et al.* 2001, Stiles 2002, Conole 2003, Hanson 2003, Traxler 2003a):

> Most discipline-based academic course developers are stretched to keep abreast of technical developments. Often, online course development is carried out in addition to their normal workload, and they have little time to learn programming skills or understand the technical terminology used in many guidelines. (Pearson and Koppi 2002)

There seems little doubt that teaching staff currently do not have the technical skills required to ensure accessibility in the web-based materials they produce. But should they be expected to? For example, Sloan argues:

> For inexperienced HTML authors, it is vital that all materials are checked by an experienced web designer who is accessibility aware… Institutions should provide a mechanism for checking all resources. (Sloan 2000)

Three of our respondents commented:

> Management [need to] recognise that an in depth knowledge of [technical web skills] cannot be gleaned overnight, and possibly that all tutors do not necessarily need all of these skills. There should be someone available to help - after all, we have reprographics teams to help with paper based solutions. (f32)
>
> A separate unit [is needed in the institution] to work with lecturers, and transform their basic material into VLE-acceptable material. The [institution] should understand and accept that not every lecturer is able to write suitable material - instead of trying to force lecturers to produce something which may be totally unsuitable, the college should investigate buying in ready-made material. (f23)
>
> We are considering having a central service that checks VLE content. We don't have web design expertise amongst the lecturers, and rather than attempting to educate everybody in the latest web design and usability skills, it is much easier to have a central support service that recommends how to do things and then checks the results as well. You need to be

> careful, however, to avoid bottlenecking the process – you need to plan what will be centrally checked, and how often. (i05)

Web accessibility training – or rather a lack of – is not just an issue for teaching staff, but for ILT and ICT staff as well. Skills for Access researched over 200 people responsible for e-learning authoring , including ILT and ICT as well as academic staff, and found:

> Fifty-three per cent were self-taught in accessible design methods; only 64 (30%) had received institutional training in accessible design, and 55 (26%) had had no training at all. (Skills for Access 2003)

This issue is examined in the next section on possible solutions to accessibility problems.

7.7d. Authors lack instructional design skills

A distinction was made by respondents in this study between web accessibility skills and instructional design skills, though the two were still seen as very linked. Typical comments included:

> Just because a lecturer knows how to use a VLE, does not mean they are instructional designers. (f11)

> We need to avoid the 'quick and easy' approach, and instead think through the [content creation] process from the beginning. An approach is needed that does not simply encourage staff to upload existing handouts, but assists them in creating appropriate, accessible materials. (f14)

> [There needs to be] training for lecturers and other content providers on how to write online [e-learning] materials. (c01)

Support for this view was also contained in the agreement (3.5 on a scale of 1-5, see Figure 9) with the statement that 'the course content is not sufficiently adapted for the VLE'.

There has been fair amount of discussion about the teaching skills required for effective e-learning, some of which have been alluded to in section 5.2c. There seems to be a consensus that a variety of skills are needed; Bonk and colleagues divide these skills into the pedagogical, the social, the managerial and the technical (Bonk *et al.* 2001). It is very unclear, however, how this skills should be apportioned between teaching staff, ILT support and ICT support.

7.7e. Inaccessible VLE content

The kinds of problems causing a lack of accessibility of course content are detailed above. Although respondents 'agreed quite strongly' (3.9 on a scale of 1 to 5) that inaccessible content was a problem in VLEs (see Figure 9), it was rated lower down the scale of importance than inaccessible VLEs (see Figure 10).

One of our respondents commented: 'the VLE being accessible will only be useful if the content being uploaded also is' (c01), echoing Stiles:

> Regardless of the issues associated with the use of VLEs as software products and their operation and navigation, unless proper regard is paid to issues affecting the content put into VLEs by tutors for access by students,

> all that attention to other issues by VLE manufacturers will achieve is easy access to inaccessible content. (Stiles 2001)

For the disabled student these distinctions are merely academic - accessible content is useless inside an inaccessible VLE, and an accessible VLE cannot make up for inaccessible content. But for institutions an inaccessible (proprietary) VLE is very much outside their control (see section 7.7b), whereas inaccessible content is – in theory at least – a problem institutions can address themselves.

Respondents had a range of suggestions as to how to address the problem of inaccessible content, which are examined in section 7.8.

7.7f. Insufficient user testing

Section 7.3 showed the levels of accessibility testing being conducted in FE and HE (see Figure 5), with approximately three-quarters of institutions performing some kind of test on the VLE itself, and a quarter testing the content put into the VLE.

Respondents to the survey 'agreed quite strongly' (3.8 on a scale of 1 to 5 – see Figure 9) that insufficient user testing was one reason for inaccessible VLE courses.

The issue of testing begs a number of broader questions about user-centred VLE development and student-centred learning which are addressed later in this section (7.8). Several respondents to this survey felt that properly administered user testing was one of the fundamentals required for the implementation of VLE accessibility, for example:

> User testing informs all other issues. We need examples of successful accessible VLEs that have been tested with users to demonstrate the principles of accessible educational materials in an accessible VLE. (f29)

> The end users must be involved in testing at all stages of development. Only by including their experience and feedback will content authors and developers have any chance of making materials and VLEs accessible and usable. (f20)

Stiles (2002) asked over 100 institutions about their reasons for choosing a particular VLE. Ease of use for staff was ranked second of 26 given reasons. Ease of use for students was equal last.

Attention was also drawn to the fact that VLE developers did not seem to include sufficient testing for the end-users – the students:

> [VLE] companies need to spend more time researching and developing usable interfaces. At the moment they are product-driven and not end-user driven. (f31)

7.7g. Lack of management support

This somewhat general phrase incorporated such comments as:

> Lack of resources from central services/lack of time are the main problems. (f02)

> Accessibility will be improved only when the lecturing staff are allowed time to develop e-learning..... Resources need to be made available to allow them to do this. (f17)

> [There is a] lack of resources or strong guidance from the top to give this work priority. (f19)

> No accommodation is made for teaching staff attempting to implement accessibility. You are given no more time and no more resources. (i03)

> I feel concerned about never having the resources to actually start addressing accessibility properly. We are all aware of the problems, and we want our materials to be accessible, but we get so bogged down – it sounds awful, I know – but you do get bogged down with day-to-day things. And all the time you are worrying 'there is this big issue out there but I don't have the resources to deal with it'. (i04)

One respondent pointed out that the allocation of resources is determined by strategic priorities:

> In academia as a whole there is not enough focus on good teaching. You get rewarded more for research than for teaching. So if you create an online course you get no credit for it – either from your peers, institution or the academic world as a whole. (i01)

Kelly and Craven (2003) have pointed out that, over and above technical considerations, institutions need to address the support implications for staff expected to produce accessible web-based teaching material.

This may well have funding implications, but can also start with improvements in institution's internal communications:

> IT support staff have not been very involved in the VLE, so they do not encourage students to use it; tutors lock their VLE areas so only their students can use them. Everyone does their own thing and there is no coherent, planned college style with interactivity for the students; the IT support staff have had no technical training in the VLE, so they cannot help tutors plan and put up suitable content. (f23)

Because accessible e-learning cuts across teaching departments, ICT support, ILT support and disability support, it can end up being 'nobody's baby'. Queen Margaret University College undertook a 'round table' approach to improve staff awareness and communication concerning accessibility legislation and its impact on online teaching within the institution (Peacock *et al.* 2002) in order to try and address this issue.

As Phipps and colleagues point out: 'Without strategic commitment to developments such as inclusive learning… it is extremely difficult to make the kind of institutional and cultural change that is needed.' (Phipps *et al.* 2002, p33)

7.7h. Insufficient course development time

'Time and resources' are often referred to in the same breath in discussions about organisational change, but time is singled out here by several respondents in relation to specific web development processes:

> Time [is one of the biggest problems] People struggle to keep on top of work as it is. Making materials accessible does take more time, and is not taken into account. (f08)

> There is insufficient development time to make content fully accessible. (f12)

> More time needs to be spent on each project. Fulfilling WCAG Priority 3 adds significantly to development time, whether at the level of careful HTML, using Flash or to provide increased user accessibility. We are exceptionally lucky to have an e-learning development team. In most FE colleges, VLE content is created by enthusiasts - lecturers working in their own time with little in-depth knowledge of issues such as WAI compliance. (f12)

> Although training is always useful, it does not mean content authors will have the time to put what they learn into effect. (f15)

Recent research by the Skills for Access project confirms time as a crucial factor:

> Forty-two per cent of respondents cited a lack of time as the primary barrier preventing them from creating accessible e-learning, by far the most common barrier, ahead of difficulties in developing a prioritised management plan for redesign (10%) and a lack of knowledge of the needs of disabled people (10%). (Skills for Access 2003)

7.7i. Lack of technical support for students

This issue was not volunteered in respondents' priorities, but as Figure 9 shows, respondents did register mild agreement (3.2 on a scale of 1 to 5) with the statement when presented with it. A number of studies have shown that the user's level of skill in using technologies –including assistive technologies –is a crucial determinant in how accessible a web resource is:

> Factors contributing to the success of a student with a disability in using the interface may include:
> - experience of the student in using complex adaptive technology such as a screen reader
> - familiarity of the student with use of the Internet
> - support available for training and orientation of student in use of [the VLE] in combination with adaptive technology.
>
> Testing of a VLE with screen reader users indicated that the single most significant factor in accessibility was the user's level of experience with screen reader software. Experienced users had no difficulty, while average users typically require coaching to navigate the complex layout and interface. (SNOW 2000b)

> It is a shame that enabling technologies do not come with an 'ability warning', as they generally require the user to have already acquired a certain level of skills, in a similar way that online courses require users to have a prior level of IT knowledge. (Draffan 2002)

The students in Evans and Sutherland's (2002) VLE accessibility testing study had a very high level of general IT skills and also skills in using assistive technology.

Rainger has looked at the issue of user skills and more broadly learner characteristics, noting five categories[27] the VLE learner requires:

- alternative user interface skills
- auditory skills
- visual spatial skills
- verbal linguistic skills
- physical skills

(Rainger 2003b)

Institutions may legitimately feel that it is not their remit to train users in all these skills. But it is notable that many FEIs and HEIs offer training - often run by ICT departments or library services – in, for example, common computing packages or effective use of the web in research. And some institutions, particularly those with high numbers of overseas students, will also offer language skills training.

Where assistive technologies are concerned, however, it would seem that basic knowledge within institutions is lacking, as a number of respondents suggested that FE and HE staff needed training in the use of assistive technologies in order to understand the principles of accessible web material.

There seems to be an assumption that disabled students will take responsibility for training themselves in general IT skills and assistive technology skills. This assumption may be encouraged by the fact that IT/AT skills can be paid for out of the Disabled Students Allowance, which the student manages themselves on an individual basis.

There appears to be a triple burden on disabled students where VLEs are concerned. They need high levels of IT and AT skills to use them at all, they are unlikely to be supported in attaining or improving these skills within FEIs/HEIs, and then, as Evans and Sutherland (2001) point out, the students needs approximately three times as long as their non-disabled peers to access the same amount of VLE material.

7.8 Suggested solutions

Question 20 asked respondents what resources might help address the urgent problem(s) they had outlined previously in the survey. Respondents had a wide variety of suggestions, shown in Figure 11.

7.8a. Training solutions

Almost half the suggestions made (41 of 89 – 46%) concerned training in one form or another. The most commonly suggested solution, made by 17% of respondents, was the provision of technical training in web design, including accessibility, for content authors.

There is certainly no lack of this kind of training available, and indeed many institutions have the capacity to provide it themselves, either from teaching staff who specialise in the field, or from ICT or ILT staff. What do seem to be lacking are the resources to make it available, and to free up time for content authors to actually do it.

[27] These categories will be used for the first time in the accessibility metadata in the JORUM+ (http://www.jorum.ac.uk) learning materials repository

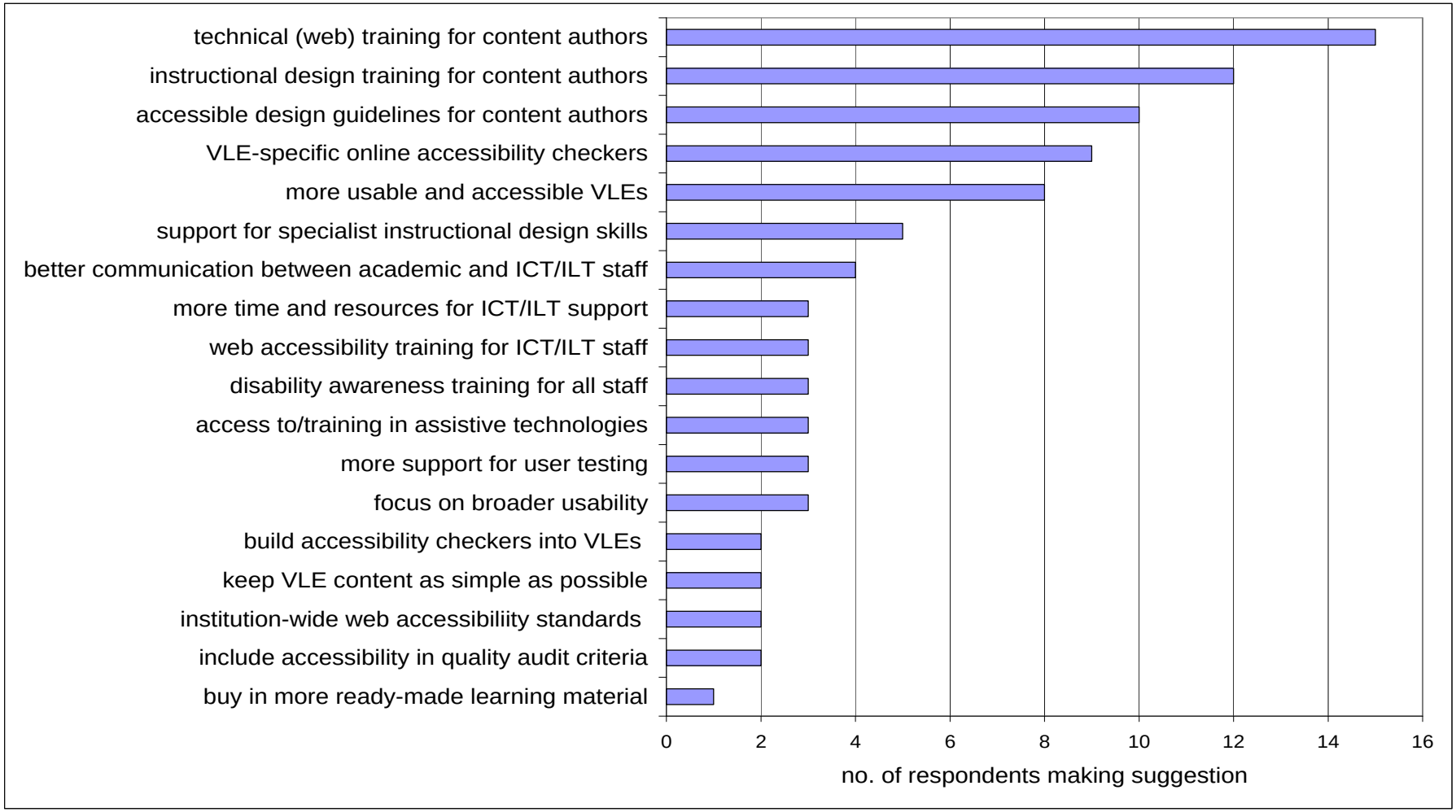

Figure 11. Suggestions for improving VLE course accessibility

Respondents pointed to some problems with training too:

> There is a danger with this idea that once you've done the training, that's that, you are trained, you can tick the box, end of story. But then you might not use the training until you come up against a particular problem, by which time you've forgotten. Then there's the time issue. If the training is half a day, fine. If it's more than that, then –sorry - I can't make it. (i03)

> Although training is always useful, it does not mean content authors will have the time to put what they learn into effect. (f15)

There is also the issue of the fast-changing nature of web design and technologies. Training given in basic issues such as valid HTML is likely to remain current for some time. But will non-technical content authors keep up with advances in accessibility in, for example, multimedia technologies?

Four per cent of respondents also pointed to the need for ILT and ICT staff to be trained in web accessibility. One made a point concerning the presentation of accessibility training as a standalone issue:

> Training will help, but only if built in to *all* relevant areas. Creating 'accessibility training' only ever reaches those already aware of the issues. Every course having anything to do with creating a website, using a VLE or any form of blended learning should have a short section raising the most pertinent accessibility issues - and usability issues as well, because they are related. (f19)

The second most common suggestion, made by a quarter of all respondents, was the provision of specific training in instructional design for content authors. A further 6% wanted more recognition of instructional design skills.

We have noted previously (section 5.1d) that instructional design is an undervalued skill in education. It is unclear from this study whether these skills should be part of the mix of skills teaching staff are expected to have, or whether they should be recognised as a specialism akin to, for example, graphic design or web development:

> Academics are not web designers and should not develop web based learning materials in their entirety. Instead they should concentrate on the educational content of the materials and pass on the coding to specialists who have better graphic, web and accessibility/usability design knowledge. (j07)

This is an area that would benefit from further investigation.

Six per cent of respondents suggested more general disability training was needed, and a further 6% wanted training in and/or access to assistive technologies (screen readers were mentioned specifically).

> [We need] higher input for staff training and disability awareness. (f18)

> The tutors need access to assistive technology to experience how content may appear to students using such technologies; an understanding of the complexity of navigation using only the keyboard - no access to mouse-clicks! (f21)

In Scotland, the BRITE initiative is attempting to raise awareness about assistive technologies. The initiative is funded in part by the Scottish Further Education Funding Council, and it enables staff from the Scottish FE sector to participate in training and to facilitate the distribution of, and support for, assistive technology workstations for FE Colleges in Scotland. The Initiative includes the BRITE Centre, which includes a staff development venue and a 'come-and-try' demonstration facility for enabling and assistive technologies.[28]

7.8b. Guidelines, standards and checkers
Just over a quarter of the suggested solutions concerned accessibility guidelines, accessibility standards and automated checkers.

Guidelines on accessible design aimed specifically at VLE content authors were the third most popular suggestion of all, mentioned by ten respondents. A number of respondents have already produced such guidelines (see Appendix 6). Some mechanism for sharing these resources would save duplication of work. There were caveats, however, about guidelines being used in isolation:

> Not just more guidelines – [we need] training for content authors and technical support staff needs to demonstrate the problems and the ways of solving them. (f29)

One respondent institution has developed an 'inclusion network':

> The inclusion network is trying to disseminate intuitive advice about accessibility. People are often open to the idea, but we need to make sure that all support staff and teaching staff are part of the work. We need to actively promote accessibility, not just put up another set of guidelines that are only ever accessed by those already in the know. We initially put the network resources on the VLE – but staff didn't like having to navigate through 3 separate steps to sign up! So now it is a link directly from the institution website. (i06)

Several respondents also noted that different students have different accessibility needs, and that there seemed to be a knowledge gap:

> I would like specific and detailed information – perhaps web-based – about improving VLEs and e-learning resources for different accessibility needs. (f25)

Next most popular was the development of a VLE specific accessibility checker. There are a number of testing programmes/validators already in existence for checking web-based materials, and it was unclear from this study exactly what a VLE specific tool might do differently. It is possible that it would need to enable checking of communication functions and multimedia materials as well as basic HTML resources, and to be an educationally orientated service sanctioned by a UK educational body. This is an area warranting further investigation.

Another suggestion regarding checkers was to incorporate them into the VLE. In this way, if an author develops a resource that is not accessible - say, as a simple example, there are no 'alt' tags – then the VLE would automatically prompt the

[28] BRITE initiative http://www.brite.ac.uk/about.htm

author to put them in. When a learning resource is completed, the VLE could automatically determine its compliance with chosen accessibility guidelines.

One respondent suggested that better policing of conformance with standards:

> Perhaps the vendors/creators of VLEs should be made to comply with accessibility standards before their products can be released to the market. (j02)

There have been suggestions for a UK e-learning conformance authority (eLCA) (CETIS 2002d).

7.8c. User-centred design

Seventeen per cent of respondents made suggestions that fall under the category of user-centred design. These included getting developers to produce more usable and accessible VLEs:

> We need to get developers (especially the commercial ones) to move beyond the 'we comply with SENDA/section 508' approach (grudging, minimal) and to seeing good accessibility as a positive selling point, and start competing with each other on accessibility improvements. (f19)

> VLE designers need to improve/develop products to be fully user - author and student - friendly and accessible –ASAP. (f27)

Respondents wanted to see more user-testing:

> The end-users must be involved in testing at all stages of VLE development. Only by including their experience and feedback will content authors and developers have any chance of making materials and VLEs accessible and usable. (f20)

> [VLE developers] need to spend more time researching and developing useful interfaces. At the moment they are product-driven and not end-user driven. (f31)

> All VLEs should be tested with a representative group of disabled students from the target audience. (j07)

Respondents also suggested that usability and accessibility testing is addressed by institutions for their own content:

> It would be useful to have a reasonably sized study of accessibility in different VLEs across several institutions doing a range of activities – from simple content distribution through to collaborative working. Only by publishing case studies that show success and failure can we move forward. (f08)

> Quality audits should include testing of accessibility of online materials. (f5)

> More user testing is needed to establish what accessibility problems exist. (f25)

> Access to testing [versions of accessibility] software would be good. For example, how do I know if my content is readable by a screen reader unless I test it with one? Products like Jaws are expensive; they do appear to have a free demo, but it is time-limited. (f32)

Several respondents suggested just keeping it simple, for example:

> Work to web standards, only use multimedia where it enhances the learning, use text for everything else (even if you style it prettily with CSS), work towards XML technologies (including SVG for graphics, perhaps). (c03)

> Acknowledge that some online tools may not be suitable for all. (f05)

It seems sometimes that the narrow focus on VLEs and their functionality can obscure the main issue – the student's learning experience. As Rainger points out: 'The students' learning experience is the most important thing – even if that means not using the web at all. Sometimes we have to appreciate that a hands-on alternative is much more appropriate.' (Rainger 2003b)

7.8d. Management/organisational issues

Suggestions respondents made in these areas can be summarised as 'better communication' and 'more strategic use of resources':

> Institutions must [raise] awareness of the problems and how they can be solved, and provide support for teaching staff and make sure they know it is available. (f09)

> [We need] more internal funding, more staff, more hours on each project. (f13)

> Accessibility will be improved only when the lecturing staff are allowed time to develop learning and assistive technologies. Resources need to be made available to allow them to do this. (f17)

> A clear VLE policy should be produced by senior management. (f23)

> We need communication between all users of the VLE. (f28)

> Support [is needed] from management to make people aware that electronic courses need to meet accessibility guidelines, just as much as the fabric of the building. (f32)

8. Conclusions

8.1 Sector-wide issues

This study was done just as a new tranche of SENDA provisions came into effect, and shortly after the Disability Rights Commission ran a national campaign about disability in education (DRC 2002). Nonetheless, a quarter of all correspondents reported a lack of awareness in the FE and HE sectors about disability issues in general, about accessible e-learning, and about the implications of SENDA.

Very few respondents suggested general 'disability awareness training' as a possible solution. The consensus was more that disability and accessibility issues should be incorporated as a matter of course in web development training, in instructional design training and e-pedagogy. Specialist 'accessibility courses' within these fields, it seems, run the risk of only reaching those who are already aware.

There is a not insignificant amount of activity in the area of e-learning accessibility, but it is generated by a relatively small number of knowledgeable researchers and practitioners. Disseminating this knowledge to the mainstream is a considerable challenge, but it is the only way that the experiences of the majority of disabled students will be improved.

Pring has pointed out that the expansion of participation in higher education seems to be taking place without much reference to how people learn, and the quality of the learning experience provided (Pring 2001). Disabled students have specific learning support needs, which need to be addressed if widening participation is to be followed through. However, policies for widening participation are also set against a background of declining funds per student (Pring 2001).

Respondents to this study drew attention to what they saw as insufficient resources, and consequently insufficient time, to address the learning needs of disabled students. Stiles points out that 'where institutions are committed to widening participation, the cost of supporting the widening participation of learners greatly exceeds additional available funding to support them, and "subsidy" is provided by (unpaid) staff time' (Stiles 2002).

Several respondents drew attention to the need to share skills and experience regarding accessible e-learning within FE and HE. Bodies such as JISC and Ferl do facilitate this, but it is interesting to note the evidence of duplication of work across the sector revealed even in this small study; a number of respondents to this study had produced their own guidelines to accessibility within VLEs – often the same VLE (See Appendix 6).

8.2 Staff development and training

The issue of staff skills and knowledge figures strongly in general discussions about e-learning implementation, and it is, if anything, more acute where accessibility is concerned.

To produce genuinely accessible VLE courses, institutions need staff with web skills, instructional design skills and e-pedagogy skills. All the skills do not need to be contributed by the same individual, but they do all need to applied at some stage in the production of all e-learning products the institutions create, as is

shown in Figure 12's idealised critical path for accessible e-learning materials at the end of this section.

This situation is currently a long way off. This is perhaps due in part to the current evolutionary stage of the e-learning industry. Since the web took off as a mass medium, it has taken five 'e-generations' (about 10 years) for web developers to tear themselves away from 'bleeding edge' technology-for-its-own-sake, and recognise the importance of well-edited content, sound information architecture and good usability on the web (Wroblewski 2002). Somehow, 'old-fashioned' editorial and communication skills got lost in the early years of the web.

Similarly, many e-learning enthusiasts have been overly focused on complex functionality and technical issues such as interoperability at the expense of simple, basic, learner-focused approaches to producing learning content. The lessons about web usability, good instructional design techniques and good pedagogy (e-based or not) are not new – they have just got left behind in the scramble to get on the e-learning express.

The respondents to this survey and other studies referenced in the literature review are agreed on the problems of skills shortages, but there is less consensus about how to address them. Some respondents to this survey felt that teaching staff, as the primary producers of VLE content, needed to get 'up to speed' with all the issues involved in creating usable and accessible content. Others felt that these skills were specialist ones that required considerable training and regular updating, and so deserved recognition as disciplines in their own right.

The idealised critical path in Figure 12 below splits these skills up, suggesting perhaps that teaching staff are supported in gaining skills in e-pedagogy (those outlined by Salmon (2000) for example), and that specialist ICT and ILT staff are supported in developing web and instructional design skills. Needless to say, the concept of inclusive learning needs to be at the heart of all these skills-based development programmes – as a founding principle, not a bolt-on extra.

Initiatives such as the SEDA (Staff and Educational Development Association) Embedding Learning Technologies Award[29] are beginning to address some of these problems, but unless they are supported by management (see section 8.4 below) they will at best encourage isolated pockets of good practice.

8.3 Standards, specifications and guidelines

A host of standards and guidelines come into play in e-learning. This study has focused on those of specific relevance to accessibility, as outlined in the critical path in Figure 12 below:

- W3C guidelines for accessible web content (WCAG – for both developers and content authors) and accessible authoring tools (ATAG – for developers only)
- Section 508 standards (generic ICT standards necessary for the US market)
- IMS accessibility guidelines (e-learning specific)
- IMS ACCLIP specification (technical learner profile specification, as yet untried in UK).

However, there are two fundamental issues with all guidelines in e-learning: they are at once overemphasised and under-policed. They are overemphasised because

[29] This award grew from the results of the EFFECTS research programme at Plymouth University. See http://www.seda.ac.uk/pdf/embedding_learning_technologies.htm

all stakeholders assume being 'compliant' or 'conformant' means, *ipso facto*, accessible. This is not the case, as we have seen in this and other studies, because the guidelines:

- can be flawed (e.g. not working with all user agents)
- are open to varied interpretation by developers/authors
- cannot ensure usability, a precondition of accessibility.

In addition, no one is currently checking that standards are complied with, or enforcing any sanctions if they are not. There is therefore no way for institutions to tell whether a VLE complies with the guidelines it claims to without extensive testing. In reality, the technical complexity of the guidelines themselves and their implementation mean that institutions have little choice but to trust and hope.

It is tempting for all parties to reduce e-learning accessibility to a tick-box, a technical standard 'to be complied with'. But unfortunately it is more complex and irreducible than that, involving a complete incorporation of principles of learner-centred design and inclusive learning and teaching. Rainger (2003b) points out that 'Standards compliant material does not mean accessible material – and even more than that, it certainly does not mean a good learning experience.'

One respondent in this survey wanted developers to move beyond the grudging language of 'compliance' towards seeing accessibility more broadly as a positive selling point. However, the developers take their cue from their customers. And until educational institutions begin to understand the full implications of inclusive e-learning, developers have no reason to change.

8.4 Institutional issues

There are many reasons why institutions have not yet grasped the implications of inclusive e-learning. Traditional organisational structures do not support e-learning implementation, because e-learning cuts across many boundaries. A lack of 'joined-up-ness' between disability services, ICT support, ILT support and teaching staff has been noted by several past studies and was again reflected in this one, with lack of internal communication being pinpointed as a problem.

Added to this, in higher education particularly, a tradition of being 'faculty-driven' rather than 'enterprise-driven' hinders the cohesive implementation of e-learning across the institution. Accessibility standards will be an inevitable casualty of this kind of uncoordinated approach.

More specifically, and as several respondents to this study noted, accessibility is not yet incorporated into institutional quality assessment procedures. While this process will not necessarily ensure that accessible materials are produced, it could at least alert institutions to problems and kick-start the awareness-raising process that many in this study say is needed.

A number of cultural factors within institutions are also seen as perpetuating the 'skills gap' noted in section 8.2: lack of recognition of good teaching skills in FE and HE generally; a suspicion that e-learning is *de facto* less effective than face-to-face teaching, and that it is a competitor rather than a companion to it; and a generally poor history in professional development within academia, summed up by Elton and Johnson thus:

> Until management gives adequate time and resources for all academic teachers to engage in the kind of training and continuing professional

> development which the latter consider essential for every profession except their own – and academics are prepared to engage in it – little of significance will change. (Quoted in Stiles 2002)

8.5 User-centred design

The end-users – the students – seem to be some way down the priority list for both commercial VLE developers and institutions. Some commentators may argue that this is because VLE adoption is driven by politico-economic pressures rather than a desire to improve students' learning experiences. In one sense, however, the underlying motives are not that important; because, by improving the learner's experience, user-centred design will ultimately give institutions competitive advantage anyway.

In the first instance, of course, the VLE developers need to adopt a user-centred approach to product development. But commercial developers will always focus on the demands of the paying customer. Until the institutions make the quality of student experience a criterion of equal importance as, say, ease of use for teaching staff and compatibility with management information systems, then developers will not address it.

And indeed why should they, when institutions themselves do not include user-testing by students in their own content development processes? Implementing a user-focused approach requires forward planning, internal co-ordination, and resources - a rare trinity in institutional approaches to e-learning. A number of people in this study pointed out that insufficient allowances are made for the additional development time involved in addressing the technical guidelines of the W3C WAI. Even more time is required to test content with students.

However, it is only by focusing on user testing that accessibility problems, and their solutions, can be understood. Further research into how testing might be resourced and supported with FE and HE would be valuable.

Several respondents in this study noted that some accessibility problems were hard-coded into commercial VLEs. A minority of institutions have adopted either open source approaches to VLEs – either developing their own or using existing open source products. For larger and well-resourced institutions, particularly those with very specific structural requirements (for example in terms of student demographics or institutional structure) this is a viable option, allowing them complete control over the whole VLE system and (hopefully) to build in a user-focus along the whole development process.

8.6 Pedagogically focused e-learning

E-learning does have the potential to meet the needs of diverse learners, including disabled students. But the initial hype surrounding it has not yet materialised into evidence of large-scale effectiveness. One of the reasons for this seems to be a lack of pedagogical focus.

Most learning development and learning technology specialists emphasise the need for the adoption of learner-centred paradigms based on constructivist learning principles (see section 5.1c) But support for self-directed learning should not mean leaving students alone. As Stiles (2002) and others point out, there is a tendency in e-learning to focus on curriculum and content design and delivery mechanisms,

rather than the overall design of the learning experience itself. This is important for accessibility specifically, because it focuses on narrow, technical compliance issues at the expense of a more holistic understanding of learning support.

Rather than looking at the accessibility of individual learning materials, the focus needs to be on the accessibility of the overall learning experience. Ultimately, the aim is for disabled students to get the same value out of a learning experience as their non-disabled peers. The means by which they achieve this may very likely be diverse. A genuine learner-centred approach, by acknowledging learner diversity not just on the basis of disabilities, but on personal learning styles as well, will ultimately benefit all students.

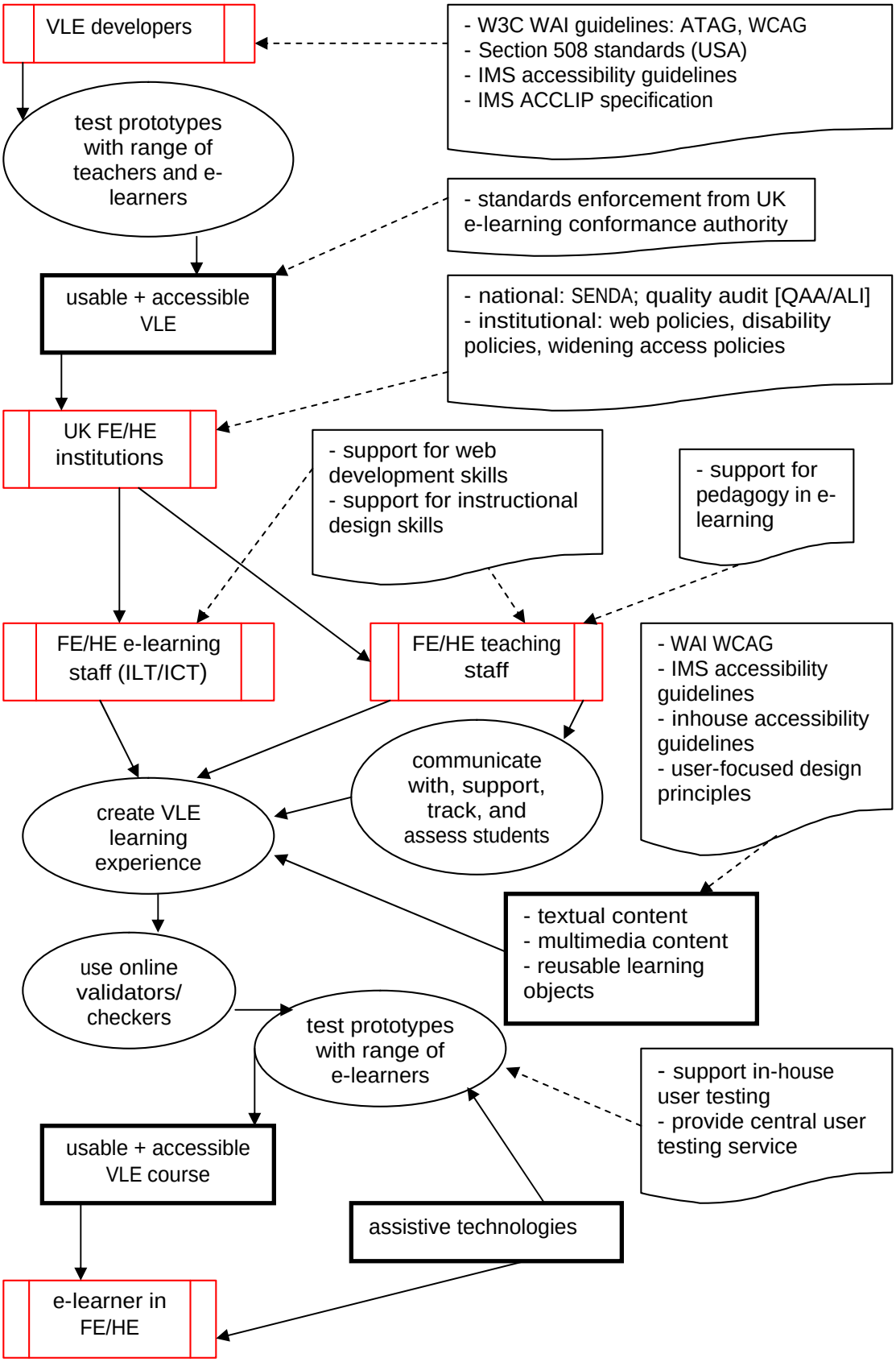

Figure 12. The accessible ideal: e-learning from developer to student

9. Recommendations

Implementing accessibility in VLEs is a complex and collaborative enterprise involving numerous stakeholders, including:

- VLE developers
- technical bodies
- national educational bodies
- individual FE and HE institutions
- teaching staff
- ILT/ICT staff
- students.

The idealised critical path in Figure 12 above indicates where these groups come in the 'life cycle' of a VLE course, from the original software developer to the student's computer. While the following recommendations address these stakeholders as separate groups, many of them have implications for many or all of the groups, as Figure 12 indicates.

9.1 VLE developers

- Adopt user-centred development processes, incorporating testing for usability and accessibility with all groups of end users – ICT systems support, content authors, teaching staff and – crucially – students

- Actively consider alternatives to the frames-based structures currently favoured, and consider simplifying interfaces and functions, rather than adding more complexity with each new version

- Give as much control as possible over display preferences to the end user

- Acknowledge that compliance with standards does not guarantee accessibility, and encourage educational institutions to understand this

- Acknowledge in particular the problems that synchronous communication tools continue to pose for a range of disabled students, and draw the attention of institutions to these issues

- Understand and be explicit about the pedagogical assumptions made during product design, and acknowledge one VLE cannot suit all pedagogical requirements

- Investigate more diverse models for VLEs, including systems more suited to active learning as opposed to a content-delivery approach

- Consider incorporating automated accessibility checking within the authoring tools incorporated into the VLE.

9.2 Technical bodies

- Adopt a more pragmatic and user-centred approach to producing standards, specifications and guidelines, taking into account the constraints under

which developers and authors operate, and the conditions under which the majority of users access the web

- Clearly differentiate between standards and specifications aimed at technical experts, and general guidelines for non-technical content authors

- Focus as much on usability issues as on interoperability

- Make clear the limits of accessibility standards/specifications/guidelines, so that compliance is not assumed *ipso facto* to equal accessibility.

9.3 National educational bodies

- Consider developing joint initiatives with bodies such as the Disability Rights Commission to target awareness about disability law and accessibility good practice in further and higher education institutions

- Further consider the creation of some form of e-learning conformance authority to monitor and enforce adherence to technical standards, including accessibility standards, in UK e-learning products

- Continue to take steps to delineate and address the skills gaps in e-learning; specifically, consider actively supporting the creation of a recognised qualification in instructional design, and ensure e-learning usability and accessibility are given due prominence

- Continue to support initiatives such as Skills for Access (2003) that aim to address some of the technical skills gaps in accessible e-learning, including training and support regarding the specialist needs of learners with various disabilities

- Consider providing support for a central usability and accessibility testing service for e-learning material used in FE and HE

- Consider establishing a central repository for accessibility guidelines for non-technical authors of VLE content resources, ideally in a downloadable format that can be quickly customised to the needs of individual institutions

- Consider providing support for institutions undertaking institution-wide accessibility audits that include e-learning

- Consider support for FE and HE staff wishing to learn more about assistive technologies (see for example the BRITE initiative (BRITE 2003))

- Consider supporting institutions in buying-in assistive technologies such as screen readers, to enable in-house testing and increase staff awareness about the practicalities of disabled web access.

9.4 Individual FE and HE institutions

- Recognise the range of skills needed to develop quality e-learning, in particular:
    - consider creating learning development specialist units, responsible for the overall planning and management of e-learning in close collaboration with academic groups

    - support the development of instructional designers within these units
- Conduct an institution-wide accessibility audit, including of e-learning provision, to highlight problems and enable efficient targeting of resources (see for example the IDEAS project (University of Aberdeen 2001))

- Develop an institution-wide web accessibility policy, which incorporates or is linked to an institution-wide VLE accessibility policy; set up mechanisms to implement and monitor these policies

- Ensure that strategies for ICT, learning and teaching, and widening participation, are joined up and consistent

- Ensure co-ordination between disability services, ICT support, learning support and teaching staff when addressing VLE accessibility

- Recognise the additional time needed to needed to comply with technical accessibility guidelines when developing VLE content

- Include accessibility in quality assurance (QA) processes, and ensure QA takes account of the pedagogic impact of online learning, and the impact on any inclusive learning objectives in learning and teaching strategies

- Ensure that inclusive learning and teaching, which will include accessibility issues, is incorporated into staff training and development programmes

- Consider acquiring the most common assistive technologies such as speaking browsers, and develop the capacity of ICT and ILT specialists to support users of these technologies

- Ensure that all training for staff in the use of VLEs includes accessibility and usability

- Ensure there is adequate support for students, including disabled students, using VLEs.

9.5 Teaching staff

- Understand the pedagogical underpinning of VLE courses, and define carefully the goals and outcomes of learning experiences that incorporate VLEs

- Recognise that e-learning is neither a 'total solution' nor a 'total problem', but a tool that, properly used, can contribute greatly to the aim of inclusive learning

- Recognise the promotion and support of accessible learning as the responsibility of all teaching staff, not just the specialist disability services

- Understand that a basic level of ICT skills is a prerequisite for teaching, and in particular take steps to understand the key issues in web accessibility

- Understand that 'quick and easy' approaches to creating web content will not produce usable and accessible material. Allow adequate time in

curriculum development processes to create quality online materials, and provide appropriate alternatives to any inaccessible aspects of the material or experience

- Know where to find specialist advice on both instructional design and web accessibility, and incorporate this advice into authored content

- Adopt a student-centred approach to creating VLE content by encouraging structured feedback on VLE materials from students, making changes accordingly, testing new courses with a range of students, including if possible students with disabilities.

9.6 ILT/ICT staff

- Take steps to understand the fundamentals of user-centred design, as well as the technical aspects of web accessibility, and to try to support their implementation across the creation of all VLE content

- Develop an understanding of pedagogical theory and inclusive learning objectives, and aim to ensure that these underpin the design of all VLE courses, and work with teaching staff to develop this

- Consider setting up a formal user-testing programme for all VLE courses in an institution

- In institutions where web accessibility policies do not exist, push for their development and for the incorporation of VLEs into these policies

- Try to ensure that the perspectives of specialist instructional design and web development staff are adequately represented at the early stages of curriculum design, and that communication between teaching staff and ILT/ICT specialists is open and constructive.

9.7 Students

- Understand the implications of disability legislation and institutional policies with regard to ICT provision and inclusive learning and teaching

- Work constructively with institutions to improve the accessibility of VLE material, including taking part in user testing

- Make use of any training offered in ICT skills.

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11. Glossary of terms and acronyms

Accessible design
Ensuring content and presentation of an educational product/experience enables participation by every student, regardless of browser settings or assistive technology. Also known as Design for All or Universal Design.

Accessibility
The degree to which a product or services is barrier-free for all users.

ACCLIP
A specification recently produced by IMS (*q.v.*), which introduces accessibility elements in its Learner Information Package (LIP)

Action on Access
http://www.actiononaccess.org/
Action on Access is the national co-ordination team appointed by HEFCE (*q.v.*) and LSC (*q.v.*) to support their Widening Participation strategies for England.

ADL
Advanced Distributed Learning
http://www.adlnet.org/
US Federal Government initiative, overseen by the US Department of Defense; produces SCORM (shareable courseware object reference model - *q.v.*) standards.

AICC
Aviation Industry CBT (computer-based training) Committee
http://www.aicc.org/index.html
International association which is developing guidelines for the aviation industry in CBT and related training technologies. Like ADL's SCORM, the scope of the specifications has moved beyond its originating sector, and AICC works with IEEE (*q.v.*), IMS (*q.v.*) and ADL (*q.v.*) to produce guidelines and recommendations.

ALI
Adult Learning Inspectorate
http://www.ali.gov.uk/
Reports on the quality of education and training received by adult learners and young people in England; responsible for inspecting all publicly funded work-based training for people over 16 and learning for post-19s.

ALT
Association for Learning Technology
http://www.alt.ac.uk/index.html
Professional and scholarly association which seeks to bring together all those with an interest in the use of learning technology to promote good practice in the use of learning technologies in education and industry and facilitate collaboration between practitioners, researchers, and policy makers.

Assistive technology
Devices, tools, hardware or software that enable people with disabilities to use a computer. Examples include screen readers (also known as speaking browsers), screen magnifiers, alternative keyboards or input devices, voice recognition software.

BECTa
British Educational Communications and Technology Agency
http://www.becta.org.uk
UK government lead agency for ICT in education.

BRITE initiative
http://www.brite.ac.uk
Supported by Scottish Executive and Scottish Further Education Funding Council; offers regional training facilities at the Scottish ACCESS Centres to support staff from the FE sector to facilitate the distribution of (and support for) assistive technology workstations for FE Colleges in Scotland.

CAI
Computer aided instruction

C&IT
Communication and information technologies

CBT
Computer based training. Refers to any form of training involving interaction between user and computer; may be web-based, or offline with CD-Rom, for example.

CEN/ISSS
CEN – Centre for European Normalisation – is the European Union committee which promotes voluntary technical harmonization in Europe in conjunction with its European partners as well as worldwide bodies. ISSS - Information Society Standardisation System – works in e-learning interoperability in Europe, looking in particular at issues of internationalisation, localisation and copyright issues.

CETIS
http://www.cetis.ac.uk
Centre for Educational Technology Interoperability Standards; represents UK higher and further education institutions on international learning technology standards initiatives.

CHEST
http://www.chest.ac.uk/
Educational shop window for purchases of software, data, information, training materials and other IT related products. CHEST negotiates license agreements for use by the educational community. It also produces a VLE comparison grid at http://www.chest.ac.uk/datasets/vle/ for Blackboard, FD learning environment, Granada LearnWise (Granada Learning) Teknical Virtual Campus, WebCT and Wizlearn.

CMC
Computer mediated communication

Compliance
Operating in a way defined by a standard

Conformance
Operating in a way defined by a specification

CSS
A cascading style sheet is a web page derived from multiple sources with a defined order of precedence where the definitions of any style element conflict. CSS gives more control over the appearance of a Web page to the page creator than to the browser designer or the viewer. In general, the web page creator's style sheet takes precedence, but it's recommended that browsers provide ways for the viewer to override the style attributes in some respects.

DCMI
Dublin Core Metadata Initiative
http://dublincore.org
Dublin Core is an open forum developing web-based metadata standards for a wide range of purposes. The DCMI metadata element set, based on extensive international consensus, is intended to facilitate the discovery of web-based resources. Most of the 15 elements have commonly understood semantics akin to a library catalogue card.

DEMOS
http://jarmin.com/demos/
HEFCE funded project that ran from 2000 to March 2003. Developed an online learning package aimed specifically at academic staff and examined the issues faced by disabled students in higher education. The project was a collaboration between the Universities of Salford, Manchester, Manchester Metropolitan and UMIST.

DDA
Disability Discrimination Act

DfES
UK Department for Education and Skills, the government body with ultimate responsibility for all sectors of education.

DfES E-learning Strategy Unit
http://www.dfes.gov.uk/elearningstrategy/
The UK Department for Education and Skills has an E-learning strategy covering pre-school right through to adult learning.

DRC
Disability Rights Commission
http://www.drc-gb.org/
Non-departmental public body with general remit to promote equal opportunities for disabled people; oversees implementation of the DDA (*q.v.*) and SENDA (*q.v.*).

DTD
Document type definition
Specification that accompanies XML (*q.v.*) documents and defines the mark-up that identifies topic headings and hierarchies and how each is to be processed. By mailing a DTD with a document, any location that has a DTD ‘reader’ will be able to process the document and display or print it as intended. For XML to accessible, the DTD must incorporate accessibility options.

Dyslexia, dyspraxia
There are a number of specific forms of learning disability that affect people's ability to read and/or write. Guidelines on developing web material for individuals with these kinds of learning disabilities are at
http://www.techdis.ac.uk/seven/papers/

EDeAN
European Design for All e-Accessibility Network
http://www.e-accessibility.org/
Raises the profile of Design for All/Universal Design across the European Union and emphasizes its importance in achieving greater e-accessibility. Formed as a result of the *eEurope 2002 Action Plan,* one of EDeAN's tasks is to establish links with appropriate education channels to embed Design for All best practices in new curricula.

elearningeuropa.info
http://www.elearningeuropa.info
European Union portal gathering information on the use of multimedia technologies and the internet for education, training and lifelong learning in Europe. Part of the *EU eLearning Action Plan*, managed by the Multimedia Unit of the EU Directorate of General Education and Culture.

e-GIF
e-government interoperability framework, which sets out the standards web developers need to implement to ensure all the public sector information systems can work together.

FAQs
Frequently asked questions

Ferl
Further Education Resources for Learning
http://www.ferl.org.uk
Information service for UK Post Compulsory Education sector. Aims to support individuals and organisations in making effective use of ILT (Information Learning Technologies). Ferl is funded by the Learning and Skills Council and managed by BECTa.

Further education
All education after the age of 16 that is not higher education (*q.v.*). Courses are provided in a range of general and specialist institutions –FEIs - and are mostly technical, professional and vocational.

HEFCE
Higher Education Funding Council for England
http://www.hefce.ac.uk/
Promotes and funds teaching and research in universities and colleges of higher education in England.

HESA
Higher Education Statistics Agency
http://www.hesa.ac.uk/

Higher education
Academic education above A-level and its Scottish equivalent, as provided by universities and colleges of higher education - HEIs

HTML
Hypertext mark-up language
The fundamental language of the web; HTML mark-up symbols or codes are inserted in a file intended for display on a web browser page. The mark-up tells the web browser how to display a web page's words and images for the user. Each individual mark-up code is referred to as an element (but many people also refer to it as a tag). Most elements come in pairs that indicate when some display effect is to begin and when it is to end.

ICT
Information and communication technologies.

IDEAS
http://www.ideas-project.org/pack/index.hti
A University of Aberdeen project 1999-2001 'to develop a systematic method of integrating disability issues within the mainstream of institutional practices for the direct benefit of the total learning environment of students with disabilities'; has produced online resource pack for educators and administrators.

IEEE
Institute of Electrical and Electronics Engineers
http://www.ieee.org/portal/index.jsp
One of the principal global accredited standards bodies. Its Learning Technology Standards Committee (LTSC) (*q.v.*) oversees e-learning standards.

ILT (1)
Information and learning tehcnology.

ILT (2)
Insitute for Learning and Teaching
http://www.ilt.ac.uk/
Professional body for all who teach and support learning in higher education in the UK.

IMS (1)
Instructional Management System
http://www.imsproject.org/
IMS Global Learning Consortium is a non-profit organisation comprised of educational, commercial and government members in the United States, launched in 1997 by Educom (now Educause). Develops and promotes open specifications for online learning such as locating and using learning content, tracking learner progress, reporting learner performance, exchanging student records. Also has a set of guidelines concerning accessibility.
http://www.imsproject.org/accessibility/index.cfm

IMS (2)
Information management systems

Inclusion/inclusive learning
Design of educational environments and experiences that takes account of the needs of all learners.

Interoperability
The ability of systems and data to work together seamlessly.

ISO
International Standards Organisation
http://www.iso.ch
Network of national standards institutes from 140 countries. ISO/IEC JTC1 SC36 (http://jtc1sc36.0rg) develops international standards in e-learning, focusing on existing specifications.

JANET
Joint academic network
http://www.ja.net/
The UK's education and research network, managed for JISC (q.v.) by UKERNA

Javascript
A programming language used in web site development to do such things as: automatically change a formatted date on a web page; cause a linked-to page to appear in a popup window; or cause text or a graphic image to change during a mouse rollover. Also used in communication tools such as chat rooms.

JISC
Joint Information Systems Committee
http://www.jisc.ac.uk/
Supports further and higher education by providing strategic guidance, advice and opportunities to use Information and Communications Technology to support teaching, learning, research and administration.

LEAP
Learning environments and pedagogy
A project of LTSN (*q.v.*).

Learndirect
UK national e-learning service that offers, through partners, internet access to over 680 online course and runs 1900 access centres across the UK.

LSC
Learning and Skills Council
http://www.lsc.gov.uk
The government agency responsible for funding and planning education and training for over 16-year-olds in England.

Lifelong learning
Term used to indicate that acquiring new knowledge is a continuous process which does not stop with the end of school or university.

LTSC
Learning Technology Standards Committee
http://ltsc.ieee.org/
Committee of the IEEE (*q.v.)* that oversees e-learning standards.

LTSN
Learning and Teaching Support Network
http://www.ltsn.ac.uk/genericcentre/index.asp
The LTSN Generic Centre promotes good practices in learning and teaching across all disciplines in UK higher education and provides a one-stop shop of learning and teaching resources and information for the HE community.

MLE
Managed learning environment.

NDT
National Disability Team
Contracted by HEFCE (*q.v.*) to undertake the servicing of a national team to improve provision for disabled students in higher education. Together with Action on Access (*q.v.*) they provide the inclusion in the higher education website at http://www.inclusion.ac.uk/index.html

NLN
National Learning Network
http://www.nln.ac.uk
UK-wide initiative to provide robust network infrastructure, support and information, as well as learning materials to encourage further and higher education institutions to make best use of technology, ILT materials and resources.

PDF
Portable document format
A file format that has captured all the elements of a printed document as an electronic image that the user can view, navigate, print, or forward to someone else. PDF files are created using Adobe Acrobat, Acrobat Capture, or similar products. PDF files are not accessible in the same way as HTML files, though newer versions are becoming more accessible.

QAA
Quality Assurance Agency for Higher Education
http://www.qaa.ac.uk/
Independent public body overseeing standards of UK higher education qualifications and encouraging improvement in the management of the quality of higher education; section 3 of the QAA Code of Practice for the Assurance of Quality and Standards in Higher Education covers students with disabilities.

RNCB
Royal National College for the Blind

SCORM
Shareable Courseware Object Reference Model
http://www.adlnet.org/index.cfm?fuseaction=scormabt
Suite of technical standards that allow web-based learning systems to find, import, share, re-use and export learning content in a standardised way. Developed by Advanced Distributed Learning (ADL) (q.v.) under the auspices of the US Department of Defense

Section 508
http://www.access-board.gov/
A shorthand reference to section 508 of the US Rehabilitation Act, which mandates that all technology acquired by the US Federal Government is accessible. A set of standards for software and web-based information and applications is overseen by the Federal Access Board

SENDA
Special Educational Needs and Disabilities Act 2001
UK legislation aimed at ensuring disabled students get the same access to and quality of education as non-disabled students.

Skill
National Bureau for Students with Disabilities
http://www.skill.org.uk
Independent body working with FE and HE institutions to promote opportunities for disabled people.

Skills for Access
http://www.shef.ac.uk/sfa/
Joint initiative by the Learning Media Unit at the University of Sheffield and the Digital Media Access Group at the University of Dundee to develop a generic resource to the Higher Education community that will help develop understanding and production of multimedia resources that conform to best practice with regards to accessibility.

SVG
Scalable vector graphics
Scalable Vector Graphics (SVG) is the description of an image as an application of XML (*q.v.*); the SVG format enables the viewing of an image on a computer display of any size and resolution, whether a tiny screen in a cell phone or a large display in a workstation; also allows text within images to be recognized as such, so that the text can be located by a search engine and easily translated into other languages

TechDis
Technology for disabilities information service
http://www.techdis.ac.uk
JISC (*q.v.*) funded service aimed at enhancing access for those with learning difficulties and/or disabilities, to learning and teaching.

Tertiary education
Tertiary education is a slightly confusing term, used in the UK mainly as a synonym for higher education. In other countries it is coterminous with all post-16 education.

UKeU
UK e-university
http://www.ukeu.com
A company established in 2000 by HEFCE with £62m funding, charged with delivering online and worldwide degrees and degree-level learning from UK universities.

UKOLN
http://www.ukoln.ac.uk/
A centre of expertise in digital information management, providing advice and services to the library, information, education and cultural heritage communities

Universal design
Also known as design for all

VLE
Virtual learning environment

W3C WAI
Web Accessibility Initiative of the World Wide Web Consortium; W3C provides interoperable technologies aiming to 'lead the web to its full potential'. The W3C Web Accessibility Initiative provides accessibility guidelines for web content (WCAG), as well as for authoring tools (ATAG) and user agents (UAAG).

XML
Extensible mark-up language
Provides a standard 'meta-language' for defining data structures; it is text-based, structured and transformable (via XSLT *q.v.*). All major computer platforms support XML, so it solves a lot of interoperability problems, including those with assistive technologies. XML separates content from presentation, meaning that a specific stylesheet for an individual user or a particular platform can separately operate on the 'raw' data provided in the XML document. XML does not guarantee accessibility however, unless developers follow guidelines such as the W3C XML accessibility guidelines as well and include accessibility elements in DTDs and schema.

Appendices

A1. Full survey text

An archive version of this document is available at
http://www.synergy-communications.co.uk/vle-questionnaire/

[intro]

Virtual learning environments and accessibility for disabled students

Thank you very much for taking the time to fill in this questionnaire, which should not take more than 15 minutes.

Your submitted questionnaire will automatically enter you for a prize draw for a £50 Amazon voucher.

This survey is part of a research project on accessibility in e-learning for the EU VISUAL program under the direction of Prof. Helen Petrie at City University Centre for HCI Design.

The purpose of the research is to gain an overview of levels of awareness in the UK Post-Compulsory Education sector regarding accessibility and virtual learning environments. I am hoping to develop recommendations for improving the accessibility of VLEs.

This questionnaire is aimed at people who are involved with the implementation of VLEs in FE/HE institutions. But if you are an expert not directly involved with an institution with a VLE, your views would still be very valuable. Please just mark N/A any questions that are not applicable.

All information supplied:

- is confidential
- is solely for the purposes of this research project
- will not be shared with any third party
- will be completely anonymised in the final report
- if we want to attribute quotes to individuals or institutions in the final report, we will contact you separately to seek permission.

Notification of the publication of the report will be posted on the FerI-VLE, CETIS-Accessibility and Jisc-MLE Jiscmail lists later this year.

The closing date for completed questionnaires is Tuesday 2 September.With many thanks

Centre for HCI Design
City University
Northampton Square
London EC1V 0HB
http://www-hcid.soi.city.ac.uk

[new page]

If any questions do no apply to you, or you are unable to complete them, please:
check the ‘Not applicable’ (N/A) or ‘Don’t Know’ (D/K) button, or
type ‘D/K’ or ‘N/A’ in the free-text box

in order for the form to validate.

1. Do you work for an educational institution?
(Your institution will not be identified in the report without your permission)

☐ yes

Name of institution:

☐ no

2. The following information will only be used to contact you for express permission to quote your answers in the research report, and to enter you in the prize draw.

a. Your name

b. Your email address

3. What is your job title?

4. How many students are there at your institution?

☐ less than 1,000

☐ 1,000-5,000

☐ 5,000-10,000

☐ 10,000-15,000

☐ more than 15,000

☐ N/A

5. What proportion of students has declared a disability?

6. Does your institution have a disability statement/policy?

☐ yes

URL (if available)

☐ no

☐ D/K

☐ N/A

7. Does your institution have disability services for students?

☐ yes

URL (if available)

☐ no

☐ D/K

☐ N/A

8. Roughly how long has e-learning been used at your institution?

a. offline computer resources (e.g. CD rom)

☐ less than 1 year

☐ 1-2 years

☐ 2-3 years

- 3-5 years
- more than 5 years
- D/K
- N/A

b. web-based learning (e.g. web-based research resources)

- less than 1 year
- 1-2 years
- 2-3 years
- 3-5 years
- more than 5 years
- D/K
- N/A

c. virtual learning environment (VLE)

- less than 1 year
- 1-2 years
- 2-3 years
- 3-5 years
- more than 5 years
- D/K
- N/A

d. other e-learning technology - e.g. teleconferencing (please specify)

- less than 1 year
- 1-2 years
- 2-3 years
- 3-5 years
- more than 5 years
- D/K
- N/A

9. Does your institution have a web accessibility policy?

- yes

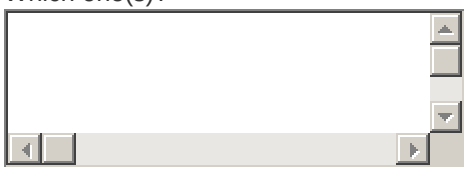
URL (if available)

- no
- N/A

10. Does your institution use, or is it about to use, a VLE(s)?

- yes

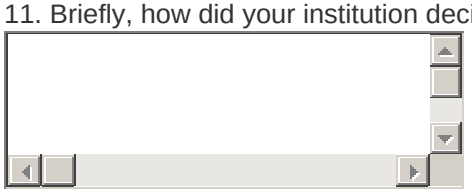
Which one(s)?



no

N/A

11. Briefly, how did your institution decide which VLE to use?



12. As a criterion for your choice of VLE, was accessibility for disabled users (staff and students):

not important

considered, but not primary

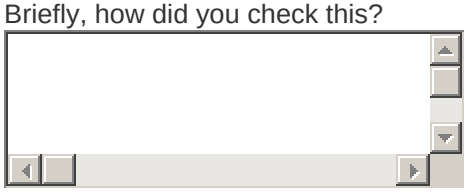
of primary importance

a necessary pre-condition since the introduction of the Special Educational Needs and Disability Act

13. Has the VLE itself proved to be accessible?

yes

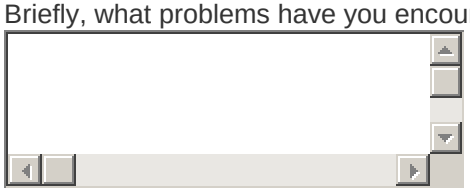
Briefly, how did you check this?



partially

no

Briefly, what problems have you encountered?



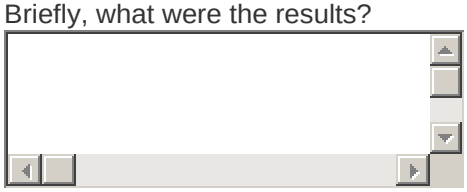
D/K

N/A

14. Has any of the content put into the VLE been evaluated for accessibility? (e.g by expert review or by usability testing)

yes

Briefly, what were the results?



no

D/K

☐ N/A

15. Approximately what percentage of courses at your institution use the VLE as their prime mode of delivery for some or all modules?

☐ less than 5%

☐ less than10%

☐ 10-25%

☐ 25-50%

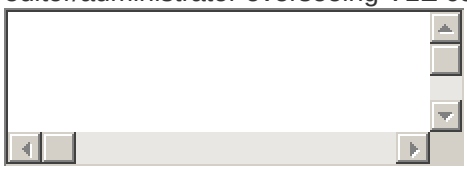
☐ 50-75%

☐ more than 75%

☐ D/K

☐ N/A

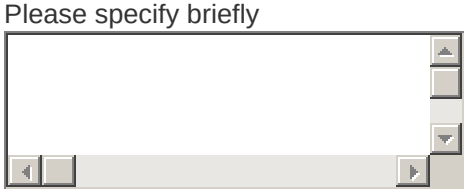
16. Briefly, what is the mechanism for getting course content onto the VLE? (e.g. do teaching staff themselves put content onto the VLE, or is there a central content editor/administrator overseeing VLE content?)



17. Is there any advice on accessibility for content authors (other than that supplied by vendors as part of the VLE)?

☐ yes

Please specify briefly



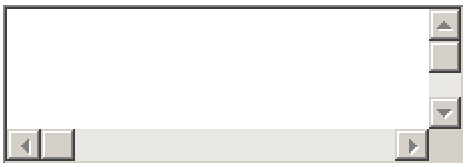
☐ no

☐ D/K

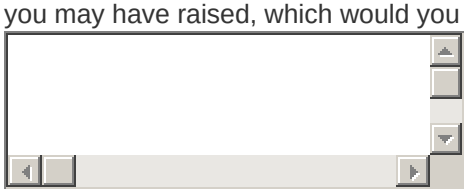
☐ N/A

18. On a scale of 1 to 5 (where 1=strongly disagree, 5=strongly agree), please rate the following possible reasons for a lack of accessibility in courses delivered by VLEs:

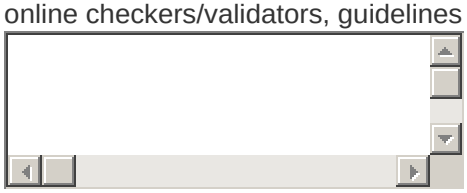
1	2	3	4	5	
☐	☐	☐	☐	☐	a. The VLE itself is not always accessible
☐	☐	☐	☐	☐	b. The content put onto the VLE is not always accessible
☐	☐	☐	☐	☐	c. Content authors do not always have the technical knowledge/awareness to ensure accessibility
☐	☐	☐	☐	☐	d. There is insufficient technical support for authors to help them make content accessible
☐	☐	☐	☐	☐	e. There is insufficient technical support for the students using the VLEs
☐	☐	☐	☐	☐	f. Insufficient user testing is done on courses, so accessibility cannot be verified
☐	☐	☐	☐	☐	g. The course content is not sufficiently adapted for the VLE
☐	☐	☐	☐	☐	h. Other - please specify



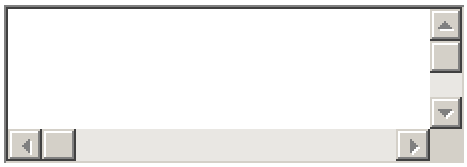
19. Of the problems outlined in the previous question (18), including any additional ones you may have raised, which would you say needs most urgently addressing, and why?



20. What resources might help address this problem? (e.g. training, information resources, online checkers/validators, guidelines for content authors)



21. Finally, do you have any other comments regarding how to improve accessibility and VLEs?



A2. VLEs in use in the UK

This is not an exhaustive list, but includes all those cited in the survey research, plus some other academically developed systems. A VLE comparison grid is available at http://www.chest.ac.uk/datasets/vle/

Blackboard
http://www.blackboard.com/
Commercial developer founded in 1997 by the merger of an academic team from Cornell University with independent consultants. Blackboard has 32% of the combined UK FE and HE VLE market, and is particularly prominent in post-1992 universities. (JISC/UCISA 2003)

Bodington Common
http://www.fldu.leeds.ac.uk/bodingtoncommon.html
Developed at University of Leeds, and used by other academic institutions. Is an open source project: http://bodington.org/index.html

Colloquia
http://www.colloquia.net
Developed at University of Wales Bangor, a distributed learning management tool which provides context-based group and individual discussion spaces, supported by learning resources.

CoMentor
http://comentor.hud.ac.uk/
University of Huddersfield web-based VLE which enables sharing of documents and provides synchronous discussion space for learning; particularly aimed at arts, humanities and social science courses.

COSE (Creation of Study Environments) [pron. 'cosy']
http://www.staffs.ac.uk/cose
Web-based system developed by Staffordshire University with funding from JISC to support development and delivery of active learning content to learners working individually or collaborating in groups. The licence is free and there are plans to make it open source.

FirstClass
http://www.softarc.com/
Predominantly conferencing package from softarc.com used to support both staff and students with e-mail, computer based conferencing, real-time chat. The most common users of FirstCLass are pre-1992 universities (JISC/UCISA 2003). Through CHEST, FirstClass is available to academic organizations to create their own customised online learning environments:
http://www.chest.ac.uk/software/firstclass/index.html

FD Learning (formerly Fretwell Downing)
http://www.fdlearning.com/
FD Learning works in UK FE, HE and public sectors offering a range of software applications and services, specialising in the post-16 education and training market. The *le* ® virtual learning environment is used in 8% of further education institutions. (JIISC/UCISA 2003)

LearnWise (Granada)
http://www.learnwise.com/products/server.jhtml

Used in 18% (JISC/UCISA 2003) of combined FE/HE sector, Learnwise is from UK company Granada. Provides delivery of web based content, online assessment tools, collaboration tools, tracking and reporting.

Virtual Campus (TekniCal)
http://www.teknical.com
TekniCal's Virtual Campus provides web based delivery, tracking and management. Various GUIs are available to accommodate the user's IT competency, age and learning needs. Used in 10% of combined FE/HE sector, mainly in FE colleges.

WebCT
http://www.webct.com/
VLE originated from an academic team at University of British Columbia and WebCT is now a large corporate provider of e-learning. WebCT is used by 20% of the combined FE/HE sector.

A3. W3C WAI web content accessibility guidelines

The W3C provides interoperable technologies aiming to ‘lead the web to its full potential’. The W3C Web Accessibility Initiative (WAI) provides accessibility guidelines for web content (WCAG), as well as for authoring tools (ATAG) and user agents (UAAG).

There are 14 principles in the WCAG guidelines:

1. Provide equivalent alternatives to auditory and visual content.
2. Don't rely on colour alone.
3. Use mark-up and style sheets and do so properly.
4. Clarify natural language usage.
5. Create tables that transform gracefully.
6. Ensure that pages featuring new technologies transform gracefully.
7. Ensure user control of time-sensitive content changes.
8. Ensure direct accessibility of embedded user interfaces.
9. Design for device-independence.
10. Use interim solutions.
11. Use W3C technologies and guidelines.
12. Provide context and orientation information.
13. Provide clear navigation mechanisms.
14. Ensure that documents are clear and simple.

(W3C WAI 1999)

The WAI WCAG has a hierarchical structure with three levels:

- priority 1 is a minimum level of accessibility that removes the fundamental barriers to accessing web materials, but may still exclude many disabled users
- priority 2 removes more of the barriers, though will still not be accessible to some users
- priority 3 ensures that web based material is accessible to the great majority of disabled users.

(W3C WAI 1999).

The WAI is in the process of drafting a new version of the WCAG (W3C WAI 2003a).

A4. Section 508/WAI WCAG differences

Section 508 of the US Rehabilitation Act requires federal agencies to ensure that their electronic and information technology is accessible to disabled people. A set of standards applies to software and web-based applications. Witt and McDermott note the following additional standards a developer must address if they wish to be section 508 as well as WAI WCAG priority 1 accessible:

- any information displayed using scripts must also be displayed with functional text that can be read with assistive technology
- any page that requires an applet or plug-in for use must provide a link to that applet or plug-in
- electronic forms must be accessible with assistive technology, including all field elements, functionality, directions and cues
- users must be able to skip navigation links (to avoid repetition)
- users must be alerted when a timed response is required and given the opportunity to indicate more time is needed.

(Witt and McDermott 2002)

Developers who have addressed Section 508 standards but wish also to adhere to the WAI WCAG priority 1 as well have four additional checkpoints:

- provide an audio equivalent of visual information
- identify changes in the text's language
- ensure equivalents for dynamic content are updated
- user clear and simple language wherever possible.

(Witt and McDermott 2002)

A5: Disability statistics in UK further and higher education

1. Further education

	Students in FE 2000/1 (%)
learning difficulty (LD) • dyslexia • moderate LD • severe LD • multiple LDs	 0.43 0.63 0.19 0.15
visual impairment	0.18
hearing impairment	0.24
disability affecting mobility	0.24
other physical disability	0.19
other medical condition	0.49
emotional/behavioural difficulties	0.06
mental ill health	0.15
temporary disability	0.02
profound/complex disabilities	0.03
multiple disabilities	0.16
others	0.72

(figures from LSC 2003)

2. Higher education

	Students in HE 2000/1 (%)
dyslexia	1.7
blind/partially sighted	0.15
deaf/hard of hearing	0.3
wheelchair user/mobility difficulties	0.23
personal care support required	0.01
mental health difficulties	0.19
unseen disability (e.g. diabetes, epilepsy, asthma)	1.15
two or more of the above disabilities/special needs	0.32
other disability/special need	0.58

(figures from UCAS 2003)

A6. Links to accessibility guidelines for VLE authors

University of Aberdeen
Accessibility of online learning materials
http://www.abdn.ac.uk/diss/ltu/accessibility/webct.htm

University of Greenwich
Guidelines for Developers of Online Course Materials and Web-based Content
Shirley Ambrose, 2002
http://www.gre.ac.uk/~as13/webct/guidelines.doc

University of New South Wales
Guidelines for accessible online courses
Elaine Pearson and Tony Koppi, 2001
http://www.edtec.unsw.edu.au/inter/dload/accessibilty/default.html

University of Wales Institute, Cardiff
Making your module accessible
Carol Doyle, 2001
http://www.uwic.ac.uk/ltsu/5min_guide_module_accessible.htm

University of the West of England
Tips on creating accessible web pages
http://info.uwe.ac.uk/online/blackboard/accesstips.asp