Accessibility and Usability of Virtual Learning Environments

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Abstract

The paper commences with a discussion of some of the factors to be taken into account in making VLEs fully accessible and usable by all disabled and non-disabled students and staff. This discussion is followed by a report and commentary on the results of two short surveys of disabled and non-disabled users of VLEs and institutional practice in higher and further education respectively.

The results of the survey of individuals showed the need for text-to-speech conversion software in a range of languages and for mathematics, figures and tables and the lack of user knowledge of the accessibility features of VLEs. The survey of institutions indicated that VLE use is widespread and possibly universal in colleges and universities in the UK and that accessibility considerations have affected the choice of VLE in many institutions, but generally not been one of the main factors. In addition, many colleges and universities provide information on their websites and/or training on accessibility issues, but there is some concern about implementation of accessibility policies by teachers and lecturers.

1. Introduction

On-line learning is becoming increasingly popular and virtual learning environments (VLEs), content management (CMS) or learning management systems (LMS) are used to support and administer the process. Although the terms are sometimes used interchangeably, CMS were originally designed for academic environments, whereas LMS were intended for workplace learning environments. The different types of learning requiring support have led to LMS being oriented to registration and administration functions and CMS supporting longer term ongoing classroom courses, though more recent CMS also provide many administrative features [2]. There are at least a hundred different VLEs [7], of which more than 50 use only open source software [9].

1.1. Accessibility and usability

There has been a tendency to focus on the accessibility, rather than usability of technology for disabled people, though both are essential and complementary and should be considered part of good design practice. Accessibility relates to the environmental characteristics of the system input and output which enable particular (groups of) users to use the system, whereas usability is the ability of the system to carry out the intended function(s) or achieve specified goals effectively, efficiently and with satisfaction when used by particular (groups of) users in their particular context [5, 8].

There are disabled people in all parts of the world. Therefore, there is a need for accessible e-learning platforms with supporting documentation in multiple (including non-European) languages, which can be used in a wide range of different cultural contexts and which perform well with low bandwidth connectivity [1].

2. Accessibility of VLEs

Accessibility and usability of a VLE are multi-dimensional and should cover at least the following features for the full range of disabled learners and teachers, using a wide range of different assistive input and output devices:

- All student functions.
- All administrator and teacher functions, including editing and accessible content authoring, with prompts for features such as alternative text descriptions of figures.
- Navigation and links.
- The content and formatting of documents posted on the system.
- System modification in the case of open source software.

There is increasing awareness of the importance of making information accessible to blind and other disabled people and legislation in many countries which requires this. The use of VLEs potentially has the ability to make teaching content more accessible to disabled people and use of the World Wide Web Consortium (W3C) Web Content Accessibility Guidelines (WCAG1 and 2) [10, 11] could support this process. However, progress in practice has been relatively slow and accessibility and usability still do not feature high on the list of essential features for VLEs.

Accessibility does feature in the criteria used in the evaluation of learning management software [3] forming part of the New Zealand Open Source Virtual Learning Environment Project, but does not have a high profile. While accessibility is not discussed in detail, this discussion of evaluation criteria proposes the following 'accessibility hooks':

- Full support for text-only navigation, including link shortcuts, hidden links and descriptive link texts.
- Full support for alt text descriptions for graphics and rich media.
- Scalable fonts (text) and graphics.

Currently one of the most accessible VLEs is ATutor. The accessibility features it provides include keyboard access to all system components, adaptive navigation facilities which allow users to go directly to content bypassing non-essential elements and prompts for alternative text descriptions of figures [4].

2.1. Accessible content

Graphics frequently play an important role in teaching, particularly in the sciences and engineering, by providing important supplementary or complementary information to the main text. In some cases the graphical representation may even provide the main or sole presentation of a particular section of content. Graphical material is inaccessible to many blind and visually impaired people, amongst others. Electronic versions of the material have the potential to overcome this accessibility barrier, in particular through the provision of alternative text descriptions. VLEs can encourage this, for instance through prompting for such descriptions.

However, a recent study by the author [6] of PDF accessibility found that where alternative text descriptions of figures had been included, they generally only provided the figure caption and did not actually describe the figure. Such alternative descriptions meet the technical accessibility requirements, but do not provide any useful information about the figure to users of screenreaders.

Resolving this problem will require the development of recommendations and guidelines as to what constitutes good alternative text descriptions, as well as examples of good and bad practice with explanations as to why they are good or bad practice. It may also require investigation of different types of graphics and the associated learning aims to enable suggestions to be made of the different types of text description that are appropriate in each case. A related issue is the representation of mathematics.

Another important issue is the relation between type of content format, nature of the content and explanatory power. In particular, this should include the extent to which descriptions of figures provide the same type of information and are able to support learning in the same way as the figures themselves. This also raises issues of how different groups of people, particularly blind and visually impaired people, conceptualise and process information with a view to understanding and learning. Investigation of these issues will require both the development of theory and models and empirical investigations. There may also be a need for educational content authors to examine the role of graphics in their teaching material to ensure that learners have full access to this learning content, whether through the provision of alternative text descriptions or in some other way. This may also require the development of new pedagogies for the provision of accessible electronic learning materials.

3. Survey of Accessibility of VLEs

In order to investigate the accessibility of existing VLEs two surveys were carried out:

- Of universities and colleges in the UK with the aims of investigating the extent to which their VLEs were accessible and their knowledge about accessibility issues relating to VLEs.
- Of the experiences of disabled and non-disabled users of VLEs.

Both surveys were sent out by email and respondents were given the opportunity to respond by email or post. A remainder was sent out by email to all non-respondents a few days before the deadline.

3.1. Survey of disabled and non-disabled students and staff

Due to time constraints, the survey was restricted to contacts of the author working in the area of assistive technology, including both disabled and non-disabled students and staff, and it was not possible to define control groups of non-disabled staff and students. This would have involved sending the survey to the same

numbers of disabled and non-disabled students and staff at each institution with the groups of disabled and non-disabled people matched on factors such as gender, race and seniority, amongst others.

Thus, the present survey can be considered as a pilot survey, which will identify issues for further investigation and may lead to modification of the questionnaire before it is used in a large scale controlled survey, as described above.

The questionnaire commenced with a few personal questions, including on the respondent's impairments and their use of assistive technology, for statistical analysis and correlation purposes. The questions in the main part of the questionnaire covered the following topics:

- Whether their programme of study, department or school uses a VLE and, if so, which one.
- How easy this VLE is to use.
- Whether this VLE has any features to make it easier for disabled students and staff to use and, if so, which ones and whether the respondent personally finds these features useful.
- How accessible they personally find this VLE.

Respondents were given the opportunity to provide comments after each multiple choice question as well as to provide general comments and further information at the end of the questionnaire.

3.2. Survey of universities and colleges

The survey was sent to the 129 members of Universities UK, which includes a few further education colleges as well as universities, and to 120 different colleges, chosen at random from a web-based list of all the UK colleges. Where appropriate addresses could be found, the questionnaire was sent to a named person in the IT or Computer Services Department. Otherwise it was sent to the help desk or webmaster. Where these addresses could not be obtained, the questionnaire was sent to the Student Disability Service. Since it was rarely possible to find contact emails for specific named people or people in particular departments on college web sites, most of the college questionnaires were sent to the webmaster and/or the general enquiries address.

Colleges and universities were asked the following questions:

- Whether the institution uses a particular VLE and, if so, which one.
- What were the main reasons for the choice of this VLE and whether accessibility to disabled students and staff influenced the decision.

- Whether the VLE provides any particular accessibility features and brief details of these features, if any.
- Whether the institution provides guidelines and recommendations and/or training on making documents accessible (and usable) and brief details (or provision of materials) of any guidelines, recommendations or training.
- Whether the institution provides guidelines and recommendations and/or training on making documents provided on the VLE accessible and brief details (or provision of materials) of any guidelines, recommendations or training.

Thus, this very brief questionnaire asked for a mixture for quantitative and qualitative data and provided considerable opportunities for institutions to comment and supplement their answers.

4. Results

4.1. Disabled and non-disabled staff and students

Replies were received from five women and four men, of whom three were members of staff and three students in higher education institutions (HEI), one a member of staff in a further education institution, one in industry with a secondary career as a member of staff in an HEI and one a member of staff in a secondary school. One HEI member of staff and one student had secondary careers as an HEI student and member of staff respectively. One of the respondents was blind and used assistive technology (AT) and the other eight were non-disabled and did not use AT.

The programmes of study, departments or schools of six respondents used VLEs, one did not, and one respondent was unsure. The VLEs used included AVOIR, Moodle and Scenaria. One respondent found the VLE very easy and one easy to use and two neither easy nor difficult. Three were unsure. One of the respondents had used an early version, which they found cumbersome and seems to have been discouraged from trying later versions for this reason. Another respondent commented that their VLE was easy to use, but difficult to code, as it was missing important functions such as user management, which would, however, be included in a later version.

One respondent thought the VLE had features to make it easier to use by disabled students and staff, one thought it did not and four were unsure. The only feature mentioned was learning materials written in very large characters for visually impaired people. It is not clear whether this refers to the facility to personalise the font size or particular documents. A

respondent commented that the current version had little support for blind users, though there were promises to provide it. One respondent found the VLE accessible as a whole and one partially accessible, whereas five were unsure. One respondent 'hated' the user management system and found that expanding the system with new features or developing new modules was not 'very clean'. Another was able to use Moodle in learning, but had problems in creating virtual simulations and three dimensional virtual environments. A respondent suggested that VLEs had a lot of potential benefits in education for disabled students, but even non-disabled students did not know a lot about them. Another had found the HTML pages generated by Moodle a few years ago partly accessible, but had not tried it recently. A third respondent would like more text-to-speech conversion software in Romanian, as well as text-to-speech conversion software for texts including figures, tables and formulae.

4.2. Universities and colleges

Replies were received from 18 universities and eight colleges, all of which used a VLE. In most cases there was an institutional standard VLE which was generally used. Most institutions used either Moodle or Blackboard, with the colleges having a strong preference for Moodle (six colleges), whereas the universities had a strong preference for Blackboard (12 universities, with three using Moodle and one about to adopt it). One of the universities had adopted a VLE before Moodle was available. Two universities, but no colleges are using other systems. One of them is using Student Portal and 'Emily' and the other currently has a home made virtual learning portal and is in the process of deploying Desire2Learn. One of the institutions using Moodle is in the process of transferring to Sakai.

Five of the universities using Blackboard specified which version of the Campus Suite they are using (between 4 and 7) and one of those using Moodle specified that they use version 1.6. None of the colleges specified which version they use.

One of the respondents noted that 60% of further education colleges use Moodle, indicating that the preference found in this survey holds more generally across further education, though it is not quite as strong as obtained here. The main reasons for colleges' choice of Moodle were costs, the fact that it is Open Source, ease of use, functionality, including integration with existing systems, and the availability of support. The main considerations for universities were ease of use, functionality, pedagogical issues, including not constraining users to a particular pedagogical approach

and support for sophisticated course design, and the availability of support. Cost considerations seemed to have been less important than for colleges, with only two universities mentioning costs. Only one of the universities using Moodle mentioned the importance of Open Source. Therefore many of the main reasons for choice of a particular VLE are common to both colleges and universities, but costs played in greater role in the college choices and pedagogical issues in the university choices. One college mentioned ease of use with screenreaders and two university mentioned accessibility as being important factors.

When asked specifically whether considerations of accessibility to disabled staff and students had influenced the choice of VLE, 11 universities and five colleges stated that it had, though in the case of one university this was limited to concern that the VLE provided some basic accessibility features. One university and two colleges had not been influenced by accessibility considerations and six universities and one college were unsure. In combination with the previous responses this indicates that about two thirds of the institutions had considered accessibility when making decisions about which VLE to adopt, but that it had been a major consideration for only a small number of them.

Three colleges and 12 universities thought that the VLE they used provided particular accessibility features, four colleges and five universities were unsure and one university believed that it did not. There is obviously a need for this latter university to either change its VLE or upgrade to a later version which does provide accessibility features. The accessibility features university respondents were aware of included compliance with accessibility standards such as those of the World Wide Web Consortium Web Content Accessibility Guidelines and legal requirements such as those of the UK Disability Discrimination Act (DDA) 1995 and Section 508 of the US legislation, though one university noted that they are not aware of any VLE that fully conforms to the DDA. Other features included the ability to customise the system with regards to layout, colour and text size, compatibility with screenreaders, the availability of high contrast colour schemes and keyboard accessibility features. One university respondent drew attention to the problems caused by teachers putting up inaccessible materials even if the VLE is itself accessible.

15 universities provide recommendations and guidelines on document accessibility and 13 of them also provide training, whereas six colleges provide recommendations, guidelines and training. Two university respondents were unsure whether their institution provides guidelines and recommendations

and three were unsure whether it provided training. One college was unsure whether it provided guidelines and recommendations. One university and two colleges do not provide training and one college does not provide guidelines and recommendations. Four colleges provide recommendations and guidelines and three training on making documents on the VLE accessible and 11 universities provide recommendations and guidelines and ten training.

One university respondent noted that their guidelines were not very prominent or widely known. It is clearly insufficient to have policies, guidelines or recommendations on accessibility unless they are made known to all members of staff and measures are taken to ensure that they are generally implemented. The issue of accessibility guidelines not being widely known is in line with anecdotal evidence that universities have quite good policies on a range of equality issues, but are less good at ensuring they are implemented and that the implementation is monitored. This is borne out by the comment from one of the universities that it is difficult to monitor whether the guidelines are followed and that their experience indicates that take-up of specific training on accessibility is generally low. One college and three universities are unsure whether they provide guidelines and recommendations. One college and two universities are unsure whether they provide training. Three college and three universities do not provide guidelines and recommendations. Four colleges and five universities do not provide training.

A number of universities and colleges provided additional information about their training. Both the approaches of integrating accessibility issues into general e-learning training and separate courses on accessibility were represented. For instance, one institution had made an explicit decision to include accessibility as part of all their e-learning training rather than to run separate accessibility training events. At least one institution combines both approaches. This has the advantage of 'mainstreaming' accessibility by integrating accessibility training with general training, while providing more in-depth or detailed training on specific accessibility topics through separate courses.

Examples of the different types of training provided include the following:
1. A brief overview of accessibility and assistive technology followed by a 50 minute hands-on session creating accessible HTML learning modules.
2. A self-paced specialist online course module on creating accessible learning material which lasts one to four hours depending on prior knowledge.

3. One-to-one sessions with the webmaster for people responsible for creating content. However, a high proportion of staff are now involved in some content creation and resource limitations will generally make it difficult to provide individual sessions for all these staff.
4. Inclusion of accessibility considerations in all training courses related to web site design.
5. Encouraging staff to access resources about accessibility and to attend a session on the use of WIMA Course Genie (now called Create) which is considered to be fully SENDA (Special Educational Needs and Disability Act 2001) compliant.

Several institutions provide information on their web sites on accessibility topics. One university provides a good practice guide to accessible curriculum design, which covers a number of topics, including assistive technology, making web pages and online coursework accessible and making online modules accessible. Another institution provides a link to the JISC TechDis documents, which cover authoring accessible documents, producing accessible PDFs and producing accessible presentations. Several universities provide information on accessible website design.

One institution had included targets for improving accessibility of all their web pages and online teaching materials in their Disability Action Plan. This plan is a requirement on all public bodies as a result of recent legislation in the UK. This institution's Disability Advisory Group advises on auditing information services materials and policies. Another institution has a communications policy for text and layout.

In general the college respondents provided less detailed information than the university respondents. Training and guidelines include the following:
1. Regularly updated Moodle training for all staff.
2. Following the guidance of JISC TechDis (the UK educational advisory service on accessibility and inclusion).
3. Training (on document accessibility), which takes place in the staff development area, initially in small groups and then on a one-to-one basis.
4. Frequent training events, which are available to all staff.
5. Regular staff training for teachers on issues relating to the DDA, though the college finds it more effective to personalise documents and materials due to the size of the institution.

However, none of the colleges provided specific information about the accessibility components of their training.

As already noted, both colleges and universities were slightly less likely to provide guidelines and recommendations or training on making VLE documents than on general document accessibility and

usability. They also provided less detailed information about their provision in this case and what information was provided was generally similar to that provided in the general case.

5. Conclusions

This paper commenced with a discussion of some of the issues to be taken into account in making VLEs accessible and usable by disabled students and staff and noted that new pedagogical approaches may be required.

The paper also reported the results of two surveys. The first survey was a small scale pilot survey of disabled and non-disabled users of VLEs. It will be followed up by a large scale controlled survey of disabled and non-disabled staff and students approximately matched by characteristics in each institution surveyed. The results of the survey highlighted the need for text-to-speech conversion software for a much greater range of different languages, as well as text-to-speech conversion software specifically designed for mathematics, figures and tables. Nearly half the respondents were unsure whether their institution's VLE had features to make it easier to use by disabled staff and students (with a third not replying to this question), indicating a lack of knowledge of accessibility issues relating to VLEs. This is worrying, particularly since the respondents were working in the area of assistive technology and therefore likely, if anything, to be better informed on accessibility features than average VLE users.

The low response rate and the nature of the survey makes it not unlikely that the results of the survey of colleges and universities exhibited respondent bias toward the better practices in the sector rather than being typical. This possible lack of representativeness with the results probably illustrating the better practice end of the spectrum does not mean that the results are not useful, but needs to be taken into account in their interpretation of them.

All the respondents used a VLE, mainly Moodle and Blackboard, with colleges having a strong preference for Moodle and universities for Blackboard and two universities using other VLEs. Both colleges and universities were mainly influenced by functionality, ease of use and availability of support in their choices, with universities also concerned about pedagogical issues and colleges about costs and the system being Open Source. The interest of colleges, but not universities in Open Source seems counter-intuitive, but it is possible that universities in general obtained VLEs earlier than colleges, when the main Open Source VLE, Moodle, was not yet available,

although this was only indicated by one university. The institutions of the individual respondents used several other VLEs as well as Moodle. Since this was an international sample, it may indicate that the popularity of Blackboard and Moodle in the UK is not worldwide, though the sample is too small to confirm this. Two universities and one college mentioned accessibility or associated issues as being major factors in their choices and just under two thirds of the universities and colleges had taken accessibility into account in their choices. None of the universities or colleges used ATutor, which is considered to one of the most accessible VLEs [4].

The version of the VLE used is often important as a greater range of accessibility features are available with later versions. Unfortunately, even when there are not upfront financial costs associated with upgrading, there may be significant costs in terms of staff time. In addition, some learning will be required for new features or features which are implemented differently.

Nearly 40% of the colleges and two thirds of the universities thought that the VLE they used had accessibility features, with the majority of the reminder being unsure and one university thinking their VLE did not. The accessibility features respondents believed to be available included system customisation, compatibility with screenreaders and compatibility with different legislative accessibility requirements, although one respondent thought that no VLE was fully compliant with the UK Disability Discrimination Act. Comparison of respondents' knowledge or perceptions of available accessibility features with information from the manufacturers would be a useful topic for further research.

Three quarters of the colleges provide recommendations, guidelines and training on document accessibility and nearly 85% of the universities provide guidelines and recommendations and 72% training. Slightly smaller percentages provide guidelines and recommendations and training on the accessibility of PDF documents. In general the universities provided more detailed information about their recommendations, guidelines and training than the colleges. Universities used both the approaches of integration of accessibility issues into other courses and separate courses on accessibility. Other than the case of one university, which stated that the integration approach was the result of a policy decision, it is difficult to know whether the choice to use a particular approach was the result of a policy decision or other factors. While several colleges provided information about training, including on issues relating to the DDA, they provided no specific information on training on document or VLE accessibility.

Despite the results presented here probably representing the better practices within the sector, respondents from some of these institutions were uncertain about their practices with regards to accessibility. There is also the issue of the take-up of training and the way teaching using VLEs is implemented by teachers, lecturers and tutors. The comments about accessibility guidelines not being prominent or well known and teachers displaying inaccessible materials (on accessible web sites) are very telling. A number of institutions probably need to put considerable additional effort into publicising their guidelines and recommendations, improving take-up of training and encouraging members of staff to use this knowledge in their teaching. However, the extent to which these comments are typical of the actual situation would require further investigation, as would the relationship between good practice at different levels in an institution. This includes both how lecturers concerned about accessibility can have an impact on their institutions and how good practice at the institutional level filters down to individual lecturers.

Accessibility of VLEs to disabled staff and students has two main aspects:

- The design of the VLE and the accessibility features available.
- The way in which the VLE is used by individual teachers and lecturers, including whether or not documents and other materials made available through the VLE are in an accessible format.

Taking account of the first factor will require improvements in the design of VLEs, particularly with regards to their accessibility features, whereas the second will require a change of culture so that accessibility becomes an integral part of standard (good) practice in higher and further education rather than an add-on or optional extra. This cultural change will, of course, still need to be supplemented by widely available information and training.

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