Report:	**Design guidelines for effective e-learning materials**
Date:	**January 2004**
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Course:	**Design for Digital Media Master of Arts**

E-learning is a term that is used to describe the broad range of ways that information and communications technologies (ICTs) are used to support and facilitate learning.

Design, in its most general sense, is accepted as being a key factor in the success or failure of many commercial enterprises and the profile of design and designers has never been higher.

Today e-learning forms a major focus for investment and development within all sectors of education and, although it is difficult to obtain accurate statistics regarding e-learning deployment and activity, it is clearly evident that the use of e-learning is considered by many educators to be vital for the future of education.

This project will seek from teachers, designers, and developers involved in e-learning an overview of their awareness, opinions and experience relating to the following aspects of materials design:

Visual style
The visual appearance of the materials including the use of type and colour and the scale, consistency and composition of the elements on the screen.

Usability
The ease and speed with which targeted users can achieve the goals that the designer of the materials had intended, the level of intuitiveness and clarity to any interaction or interface that may be present.

Accessibility
The extent to which anyone, regardless of any disability, can effectively use a website via any web browsing technology including specialist assistive technologies (e.g. 'screen readers').

From these responses a set of design guidelines will be formulated which will aim to function as a resource for anyone involved in the production of e-learning materials.

It is important to note that the parameters of this project are limited to encompass only issues of 'materials design' (read 'content design') and the project does not attempt to address issues of course design / pedagogical intent. Furthermore the scope of this project is limited to the (UK) further and higher education sectors from which the data has been obtained.

Project website: http://www.surrey.ac.uk/cld/design

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Acknowledgments

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Many thanks to everyone who responded to the questionnaire.

Finally thanks to my family for coping without a dad during the final stages of the project.

Key to links

When using the PDF version of this document underlined text acts as a link.

Key to links:

References — click to link to references, click on reference entry to return to text

World-wide web link — click to launch webpage in browser

This report details the research project 'Design guidelines for effective e-learning materials' undertaken between September 2003 and January 2004 by Paul Burt. The project aims to investigate the perceived relevance of design criteria (specifically visual style, usability and accessibility) to the effectiveness of e-learning materials and establish a concise set of design guidelines for use by producers of materials.

Section 1 defines the scope of the project as stated in the pre-project proposal.

Section 2 puts the current focus on e-learning in the context of social, political, technical and pedagogical frameworks. Within this context the role of materials design and the challenge of production is discussed.

Section 3 provides an explanation of the concept and potential benefits of the 'Virtual Learning Environment' (VLE).

A major element of the 'Design guidelines for effective e-learning materials' research project is the design of a web-based questionnaire and its deployment among teachers, designers, and developers. The methodology of the questionnaire is explained in section 4.

A profile of the sample group who responded to the questionnaire is given in section 5.

Data derived from the questionnaire, analysed in sections 6–8, forms the statistical foundation for the final guidelines. Extensive use of qualitative data is made throughout this analysis to illustrate the respondents' recommendations (and noted pitfalls). Reflection upon the successes/failures of the question methodology is undertaken in the context of this analysis of responses.

The guidelines that form the culmination of the project can be found in section 9.

Below is the original project proposal written 7th August 2003.

The aim(s) of your research in the spheres of theory and practice:

- To research issues of visual style, usability and accessibility in relation to the design of e-learning materials. To present the research outcomes as an online knowledge base.
- To devise a range of guidelines, aimed at both non-designers and designers, that aid the design of effective e-learning materials. The guidelines will be presented as a web-based resource.

The objectives which you have identified as necessary to fulfil your stated aim(s):

- Undertake survey-based research on the comprehension and perceived importance of visual style, usability and accessibility issues in relation to the design and use of e-learning materials.
- Present the research outcomes and any supporting materials as a knowledge base on the world-wide-web to enable dissemination of specialist/scholarly information.
- Formulate from the research outcomes a number of guidelines for the design of effective e-learning materials.
- Present the guidelines as a web-based resource site, incorporating the research knowledge base, which can be promoted as a useful practical resource and starting point for future debate/development.

The proposed plan of research work:

The first stage of research will involve the creation and use of survey materials to obtain the design viewpoints and opinions of a sample group of post-secondary educators / e-learning specialists mainly comprised of academic colleagues and professional contacts. Specific emphasis will be placed upon visual style, usability and accessibility issues but considerations appropriate to learning theories and modes of e-learning implementation may be included. An online knowledge base will be built to disseminate the research.

The second stage will represent the practical element of the project and will take the form of a web-based resource site. In addition to the objectives identified above the following parameters will apply:

- The validity of the guidelines will be independent of institution/system specific situations.
- Although it is intended to formulate the guidelines upon the research outcomes, professional experience from the author's design background will be included.
- It is intended that the web-based resource site will be able to be developed subsequent to submission in order to enable continued critical dialogue.

E-learning is a term that is used to describe the broad range of ways that information and communications technologies (ICTs) are used to support and facilitate learning.

E-learning now forms a major focus for investment and development within all sectors of education and, although it is difficult to obtain accurate statistics regarding e-learning deployment and activity, it is clearly evident that the use of e-learning is considered by learners, educators and funding bodies to be central to the future of UK education.

To contextualise the current attention that e-learning attracts it is useful to present the social, political, technical and pedagogical frameworks within which this emphasis has arisen.

2.1   Social change

The UK economy has been undergoing a shift away from manufacturing, engineering and heavy industry towards high-tech, service-orientated industry. This shift results in the need for a workforce with a broader skills-base that can adapt to the continually changing requirements of working with technology:

"Society is changing. Our economy is becoming ever more knowledge-based – we are increasingly making our living through selling high-value services, rather than physical goods. These trends demand a more highly-skilled workforce." (DFES, 2003a:62)

The evolution of technology is a primary factor in generating the need for regular updating of skills but is also seen as a saviour in respect of the use of e-learning to make high-quality education available flexibly to remote learners in the workplace or through part-time distance study;

"We will also encourage other sorts of flexible provision, which meet the needs of an increasingly diverse student body, by improving more support for those doing part-time degrees, and supporting the development of flexible '2+'arrangements, credit transfer, and e-learning." (DFES, 2003a:60)

Today's students are increasingly ICT literate before they enter further or higher education which results in high expectancy levels for the appropriate use of ICT in their studies. Increasing emphasis is being placed upon enabling students to make informed decisions about where to study, now given sharper focus by the introduction of fees for

higher education. This will result in increasing numbers of future students carefully considering not only *what* they will study but also *where* (the choice of city/town has always been a factor but now the quality of the physical resources such as the lecture spaces and ICT provision will gain significance), and *how* (the size of tutorial groups, the relevant use of ICT and the availability of flexible modes of learning) before making their applications.

> "…the internet and use of new technologies are changing the total operation of HE. Learning and teaching are changing as we explore the possibilities presented by new technologies, for example in communications, and the creation and use of databases and digital resources. But these technologies are also bringing about new approaches in research, libraries and resources, and administration. Change therefore may come not just from explicit focus on technologies relating to learning and teaching, but from pervasive impacts and changes in other HE functions. In addition, students' expectations and experiences are changing because of their rising e-literacy. And finally employers are increasingly exploring e-based training in the workplace and particularly in e-commerce."
> (HEFCE, 2003:2)

2.2 Political motivations

Among the political motivations for the adoption and embedding of e-learning into educational practice are requirements placed upon both further and higher education institutions to teach more students on reduced funding. The government reports 'a drop of 36 per cent in funding per student between 1989 and 1997' (DFES, 2003a:23) and has set ambitious targets for 'expanding towards 50 per cent participation [in HE] for young people aged 18–30 years from all backgrounds' (DFES, 2003a:27). This has resulted in increased group (class) sizes;

> "here again there is a story of decline: staff-student ratios have fallen from just over 1:10 in 1983 to 1:18 in 2000 and this tends to mean that students write fewer assignments and have less face-to-face contact with staff." (DFES, 2003a:19)

One way in which institutions can attempt to maintain quality and financial viability whilst accepting these new demands is to reduce the teaching cost per student. E-learning technology has reached a level of evolution where many financial administrators are now particularly interested because of potential cost savings (e.g. theoretical student numbers are no longer limited by physical resources such as lecture spaces and book collections).

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Funding for higher education institutions (HEIs) is also now being tied to achieving targets for widening access to HE. This is primarily being achieved by allowing HEIs to charge higher tuition fees:

> "Those wishing to charge a higher tuition fee will wish to demonstrate to OFFA [Office for Fair Access] that they subscribe to these principles. As universities gain the freedom from September 2006 to vary the level of tuition fee, the Government is determined to ensure that access to higher education is broadened not narrowed. The measures outlined in the White Paper to improve on what is already one of the most generous student support systems in the world will help to ensure that this is the case." (DFES, 2003b:4)

The government has similar ambitions for the FE sector by aiming to:

> "raise the levels of achievement of all young people, reduce the gap in achievement between various socioeconomic and ethnic groups and increase participation in post-16 education and training..." (DFES, 2002a:4)

An effect of this participation-widening agenda is the need for more flexibility in the methods of teaching employed to ensure appropriate levels of differentiation to suit a wider range of students and learning styles. Again appropriate use of e-learning is often seen as a way of promoting student interaction and engagement with the subject and catering for a broader range of learner differences (see 2.4). Some commentators are able to foresee positive outcomes as a result of these pressures:

> "The push into mass higher education and widening participation, taken alongside an almost continuous reduction of funding for both HE and FE institutions, means that what was considered to be 'good practice' in the old traditional universities – lectures coupled with regular seminars and small tutorials plus good individual access to tutors – is becoming unsustainable for all but the wealthiest and most elite universities....
>
> ...The use of technology, particularly Internet-based technology, to support learning promises much. I'm excited by the potential it gives to us to provide our learners with an environment that allows them to distribute their studies in terms of place, time and pace. It seems to me that the potential is there for us to create learning environments that meet the needs of the modern, diverse learner and widen access to higher education still further. Importantly, they may give teaching staff more opportunity to actually communicate with students." (Stiles, 2002:5)

Recently the Department for Education and Skills has been engaging in debate with all UK education providers through the '*Towards a unified e-learning strategy*' consultation document. Responses from

the consultation period (which runs until 30 January 2004) are intended to be used to form an e-learning strategy document intended to unify the embedding of e-learning into all levels of the UK education system from primary schools to universities.

2.3 Technological developments

Although e-learning is not new, only recently has new technology made its adoption by mainstream education possible. The following technology related developments have now made e-learning a viable proposition:

- *Widescale access to fast internet connectivity*
  all UK further and higher education institutions have a minimum 2Mbps connection via the JANET network (Joint Academic Network managed by UKERNA for JISC) and students have increasing opportunities, although at cost, to obtain individual broadband connections at home.

- *Improvements in the performance of personal computers*
  all recent personal computers now offer a level of performance that is more than sufficient to support e-learning use.

- *More efficient video and audio compression technologies*
  the evolution of compression algorithms such as MPEG now enables faster downloading and streaming of rich media.

- *Widespread digitisation of resources*
  increasingly books, periodicals and journals are available in digital formats and now extensive multimedia archives are becoming available to educators (e.g. the Education Image Gallery at http://edina.ac.uk/eig).

2.4 Pedagogical evolution

Since the 1960s there has been a shift in UK education away from a behaviourist model of learning, through cognitivist theory, towards a constructivist model.

A behaviourist model is not based upon gaining deep understanding and can be described as:

"A theory that equates learning with observable changes in learners' behaviour. In accordance with this theory skills should be learnt one at a time and each new skill should build on previously acquired ones." (Anagnostopoulo, 2002:3)

Cognitive learning theory is based around the work of John Dewey (1859–1952), Jerome Bruner (b.1915) and David Ausubel (b.1918). In contrast to behaviourist theory, these three psychologists believed that when we are involved in learning we are not passive receptors of stimuli. Instead they proposed that a complex process of understanding, assessing and contextualising information takes place and that our minds process the information we are given in such a way that it becomes understandable in the context of our individual way of ordering the world around us.

> "[According to] the work of Jerome S. Bruner in the 1960s to 1980s,... ...it is essential that the learner has a fundamental understanding of the underlying principles of a subject. Discovery learning, according to Bruner, is the most effective and authentic method of achieving real understanding of the principles of a subject and then applying those principles. Discovery learning involves confronting the learner with a problem and allowing them to explore the problem and try out solutions on the basis of inquiry and previous learning under the guidance of a teacher. The newly-acquired knowledge is then used to formulate a general principle which can then be applied to other situations." (Armitage, et.al., 2003:77)

The current strand of cognitivist theory is constructivism. In a constructivist model the key assumptions are:

- What the student currently believes, whether it is correct or incorrect, is important.
- Despite having the same learning experience, each individual will construct an individual meaning.
- Constructing understanding is a continual process.
- Learning is not a passive process, it requires activity and for students to take responsibility for their own learning. (based on Reece & Walker, 2002:115)

> "[Constructivist] theory asserts that learners construct their own knowledge and understanding, based on their personal interpretation of the subject. This will differ between learners as they all bring a unique set of experiences to the learning situation. Engaging students in meaningful activities forms the basis of their learning." (Anagnostopoulo, 2002:3)

E-learning is particularly suited to a constructivist pedagogy for the following reasons:

- It is well suited to supporting activity-based learning.
- Students can be organised to work in groups even if physical locations would normally prevent interaction.
- Students can manage their own learning with flexibility and freedom from time constraints.

- Activities can be constructed that involve authentic interaction with industry or professional partners.

This evolution is summed-up well by:

> "The shared theoretical assumptions are those of constructivism, and they result from two distinct shifts of emphasis. First, there has been a shift from a representational view of learning in which an acquisition metaphor guided design to a constructivist or constuctionist 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, 2001:17)

2.5   Materials design put into context

It is within the contexts explained in this section that this project and the following investigation of design criteria is situated. The pedagogical design of the programme of study, the way students are encouraged to interact with the activities and each other is not the focus of this project. Instructional design (pedagogy) is an area of intense research but is beyond the scope of this project.

A mistake that novice online lecturers often make is to feel pressure to 'fill' an online course with content with the assumption that more information (materials) is always positive:

> "...information is to knowledge as bricks are to buildings. It is as absurd to try and solve the problems of education by giving people access to information as it would be to solve the housing problem by giving people access to bricks." (Laurillard, 1996)

It is accepted within this report that factors of instructional design are of primary importance to the successful implementation of e-learning. However it is the intention of this project, after this proviso has been stated, to then explore the issues related to the graphic design of e-learning materials.

Within the scope of this project the design of e-learning materials is investigated with particular respect to their usage within a VLE. This context for use of e-learning materials is now the predominant mode within UK further and higher education.

3.1 Definition of VLE

The term VLE describes the use of information technology equipment generally, and specifically online technologies, for the purpose of learning. A VLE is a space in which a learner and a tutor can communicate and exchange information but equally it is a space in which a group of learners can collaborate and communicate. The 'Joint Information Systems Committee' (JISC) define a VLE as:

> "the components in which learners and tutors participate in online interactions of various kinds, including online learning." (JISC, 2002a: 1)

3.2 Usage of VLEs within the UK

Usage of VLEs within UK further and higher education is now widespread. Two surveys by the 'Universities and Colleges Information Systems Association' (UCISA) give accurate data as to the use of VLEs with UK higher education:

> "The first VLE survey in 2001 showed that VLE use was widespread with 81% of HEIs having a VLE. Two years on this percentage has risen to 86% of returns; this can be broken down into 84% of pre-91 universities; 97% of post 91 universities and 67% of HE colleges." (UCISA, 2003:10)

A recent survey commissioned by JISC revealed that 85% of a sample of 218 UK FE colleges currently use a VLE (JISC, 2003:85).

3.3 Features of a typical VLE

Most VLE systems offer the following features and information/resources to students on a course:

- Mapping of the curriculum into elements (or 'chunks') that can be assessed and recorded.

- Tracking of student activity and achievement against these elements.

- Support of online learning, including access to learning resources, assessment and guidance.

- Online tutor support.

- Peer group support.

- General communications, including email, group discussion and web access.

- Links to other systems, both in-house and externally. (JISC, 2002b:1)

3.4 Potential benefits of using a VLE

There can be many justifications to consider implementing a VLE – some of the more powerful ones are:

- Permits 24/7 access to course information and resources.

- Provides a secure environment for collaborative working and communication between students.

- Ensures accurate tracking of a student's progress, i.e. records assignment submission dates, logs student access to course documents.

- Can allow students to work at their own pace and would certainly assist any student who is required to 'catch-up' after a period of forced absence.

- Will appeal to students familiar with using information technologies and be appreciated as an efficient way of facilitating learning.

- Could enable contributions to a course by partners within industry when geographic or financial factors preclude attendance by these partners – for example contributions to a course by video conference link by professional practitioners.

3.5 Evolution into the 'Managed Learning Environment' (MLE)

Within most UK education institutions it is realised that the power and efficiency of deploying a VLE is greatly magnified when the VLE is able to communicate with other educational and management information systems. This communication and interconnection of systems forms an MLE. JISC have defined an MLE as:

> "the whole range of information systems and processes of a college (including its VLE if it has one) that contribute directly or indirectly to learning and the management of that learning." (JISC, 2002a:1)

Typically an MLE would share data both into and out from student records systems, provide seamless integration with library information systems and require less manual inputting of student course and module/unit enrolment data. However the technical challenges that

face institutions planning the implementation of an MLE should not be underestimated:

> "Add to... ...the role of the Virtual Learning Environment (VLE), all of the interoperability hooks that allow one or more VLEs to be linked with MIS systems, authentication servers, digital libraries and portals, and we have the vision of the Managed Learning Environment (MLE). When this is eventually achieved, both tutor and learner have a joined-up learning experience that combines effectively traditional and virtual learning and its management with access to local, national and international resources." (Stiles, 2002:5)

This project is divided into six consecutive stages:

- Project –
  definition of the project scope and intentions.

- Development –
  design of the questionnaire.

- Research –
  reviews of secondary research sources in applicable literature.

- Questionnaire –
  deployment and promotion.

- Report –
  account of the entire project including methodology, analysis of questionnaire data, relevant findings and definition of the guidelines.

- Guidelines –
  visual presentation of the set of design guidelines.

In addition to these there are two additional stages that are to meet requirements of the Masters course:

- Private area –
  this password protected area of the project contains a project weblog for the benefit of the course assessors.

- Formal presentation –
  a short, illustrated, presentation explaining the project and its outcomes.

The website that forms the centre of the project is divided into the same stages and can be accessed at:

    http://www.surrey.ac.uk/cld/design

4.1   Intention of questionnaire

The decision to utilise a web-based questionnaire was made early in the project. The aim of the project is to formulate a set of design guidelines that will be useful to e-learning practitioners and also be able to withstand expert scrutiny. To attempt to create the guidelines based upon an individual's experiences would not result in sufficiently robust recommendations and therefore it was decided to seek

the opinions and advice of e-learning practitioners as a vital component of the project.

4.2   Questionnaire development

A non-functional archive of the project questionnaire is available at:

http://www.surrey.ac.uk/cld/design/qu1.htm

There are significant challenges associated with developing a successful web-based questionnaire:

> "The web is obviously a viable mode of survey administration. Yet the lack of standardization among operating systems, servers, and browsers creates a challenging milieu in which the researcher must be technologically savvy as well as methodologically sound." (Smith, 1997)

Although the decision to utilise a web-based questionnaire was made early in the project; alternative technologies were considered for the questionnaire (see Table 1.).

Beyond issues of which technology to employ the following factors were considered during the development stage:

- The inherent challenge of seeking meaningful information about design because of its subjective nature.

- Aiming to make the questionnaire 'visual' in nature.

- Seeking to gain a respondents' relevance rating for a specific aspect of materials design (e.g. visual style) and then qualifying their response against their own design behaviour.

- Not wanting the experience of completing the questionnaire to feel like taking a test.

- Needing to generate data that could lead to formulation of the design guidelines without the use of 'leading' questions.

- Encouraging potential respondents to become respondents when they first inspect the questionnaire.

- Encouraging respondents to invest the time it takes to complete the questionnaire without any direct incentive.

The overall graphic design of the questionnaire was kept as visually 'neutral' as possible to avoid distracting from the content of the visual-based questions. To enable respondents to be able to gauge their progress the questionnaire was kept to a single, but with lengthy scrolling, HTML page. It was decided that the benefit of having an indicator of progress (the scroll-bar) outweighed design arguments against long scrolling pages.

technology	author's general experience level	merits for user	drawbacks for user	conclusion
paper-based	high	reliable, easy to use	requires active participation to be returned by post, cost	not appropriate for a survey about e-learning
HTML/javascript	low	easy to use, familiar to users	lack of control over visual design, not very 'printer-friendly', can only be completed online	the most appropriate but will require new skills development
PDF	high	accurate (and consistent) visual appearance, printer-friendly, can be completed off-line and then submitted electronically or returned by email	unfamiliar to most users, requires 'Adobe Reader' (formerly 'Acrobat Reader') to be installed	although technically possible to create interactive form there is little guidance available and is likely to discourage participation
custom produced (Flash or Shockwave)	medium	unusual, potential for inclusion of multimedia examples	unusual, requirements placed upon host system configuration, cross-platform issues	not foreseen that any of the questions will require the level of advanced interaction that would be this technology's USP

Table 1. Comparison of questionnaire technologies.

The questionnaire was created using Macromedia Dreamweaver MX and conforms to the W3C HTML4.01 transitional standards (http://www.w3.org/TR/html401/). Minimal use of HTML tables was employed: presentation being achieved through use of 'Cascading Style Sheets' compliant with the level2 W3C specification (http://www.w3.org/TR/REC-CSS2/). Extensive attention was paid to ensuring that the questionnaire appeared visually consistent across browsers and platforms. Throughout development of the questionnaire, visual appearance was tested for consistency using:

- Microsoft Internet Explorer 5 on Windows NT4
- Microsoft Internet Explorer 6 on Windows 98
- Microsoft Internet Explorer 6 on Windows XP

- Netscape 7 on Windows XP
- Microsoft Internet Explorer 5.2 on Mac OS 10.2
- Netscape 7.1 on Mac OS 10.2
- Apple Safari 1 on Mac OS 10.2

Getting the questionnaire to function correctly required allocating each form field a unique identifier name and setting up configuration tags. When the 'Submit' button is clicked, the <FORM action=" "> tag references a 'FormMail' CGI script upon the University's web server. The script then parses the submitted data into an array of keyword-value pairs which is sent as an email to a specified address.

The questionnaire did not include a validation Javascript: although it is possible to have the form refuse to be accepted unless every question has been completed it was decided that this can be frustrating and it is better to encourage responses by stimulating question design.

The intention behind the design of each specific question is addressed within the context of the analysis of the responses received (Sections 4–9).

Structurally the questionnaire is in seven sections:
1. Visual style
2. Usability
3. Accessibility
4. Finding out the respondent's e-learning background
5. Finding out the respondent's teaching background
6. Finding out the respondent's design background
7. Asking for the respondent's contact details

In each of sections 1–3 the first question was in the following format:

"Which of the following statements about XXX do you agree with the most:
- 'XXX is irrelevant to the effectiveness of e-learning materials'
- 'XXX is one of the least relevant factors in relation to the effectiveness of e-learning materials'
- 'XXX is an important factor in relation to the effectiveness of e-learning materials'
- 'XXX is a critical factor in relation to the effectiveness of e-learning materials'

Where XXX equals either 'visual style', 'usability' or 'accessibility'.

When asking a question of this type an expectation is that many people may automatically respond 'critical' or 'important' with little regard to how they actually prioritise the factor in their practice. In anticipation of this possible discrepancy between behaviour and

belief it was decided to attempt to qualify a respondent's answer to the "How important?" question by measuring their sensitivity and reaction to visual examples. The design of the examples for each of these, visual-based, 'testing' questions was intended to maximise the variety of possible responses. Intentional mistakes were put into the 'bad' examples and the 'better' of the examples would always aim to be a clear but confident design. It is expected that the responses to the visual-based questions will be the most difficult to analyse but hopefully also provide interesting correlations to the more factual data.

There were various coding methods that could have been used to present the visual examples but it was decided that the overriding requirement was to ensure that there was absolute consistency in the visual appearance of each example for all respondents. It was because of this requirement that it was decided to convert all visual examples into images (GIF or JPEG as appropriate). One drawback of this method is that the size of the image is constrained by the minimum screen resolution that could be expected to be used to view the questionnaire. Assuming users to have a screen resolution of at least 800x600 pixels resulted in the type in some of the visual examples displaying uncomfortably small and this was noted by a few respondents. Alternative methods, such as the use of pop-up windows or frames, were considered but the dangers, such as font substitution, associated with these methods precluded their use.

At no stage was a definition given to the term 'effectiveness' (the phrase 'effectiveness of e-learning materials' was included in all possible response options for each importance-rating question). A decision was not to narrow down the meaning of 'effectiveness' to a set of measurable criteria of learning – the selection of which would have been troublesome due to the wide variety of possible criteria (e.g. exam results, browser hits, student feedback etc.). Intentionally leaving this term to interpretation did not, however, cause any respondents to challenge its use.

4.3   Questionnaire sampling strategy

The intended audience for the questionnaire was anyone who had an involvement with e-learning with the exclusion of students. Originally it was intended that the sample group should contain students as they are ideally situated to provide information about how a particular design style is received by the 'end-user' and to relay what they have perceived as effective e-learning materials design. However it was soon recognised that to design a single questionnaire which would probe in sufficient depth the opinions of e-learning professionals and still make sense to students was not feasible. Given this situation it was decided to exclude students from the sample for the purposes of this project. However it is recognised that a student-based survey comparing the effectiveness of different design styles for e-learning materials would form the basis of a valuable study.
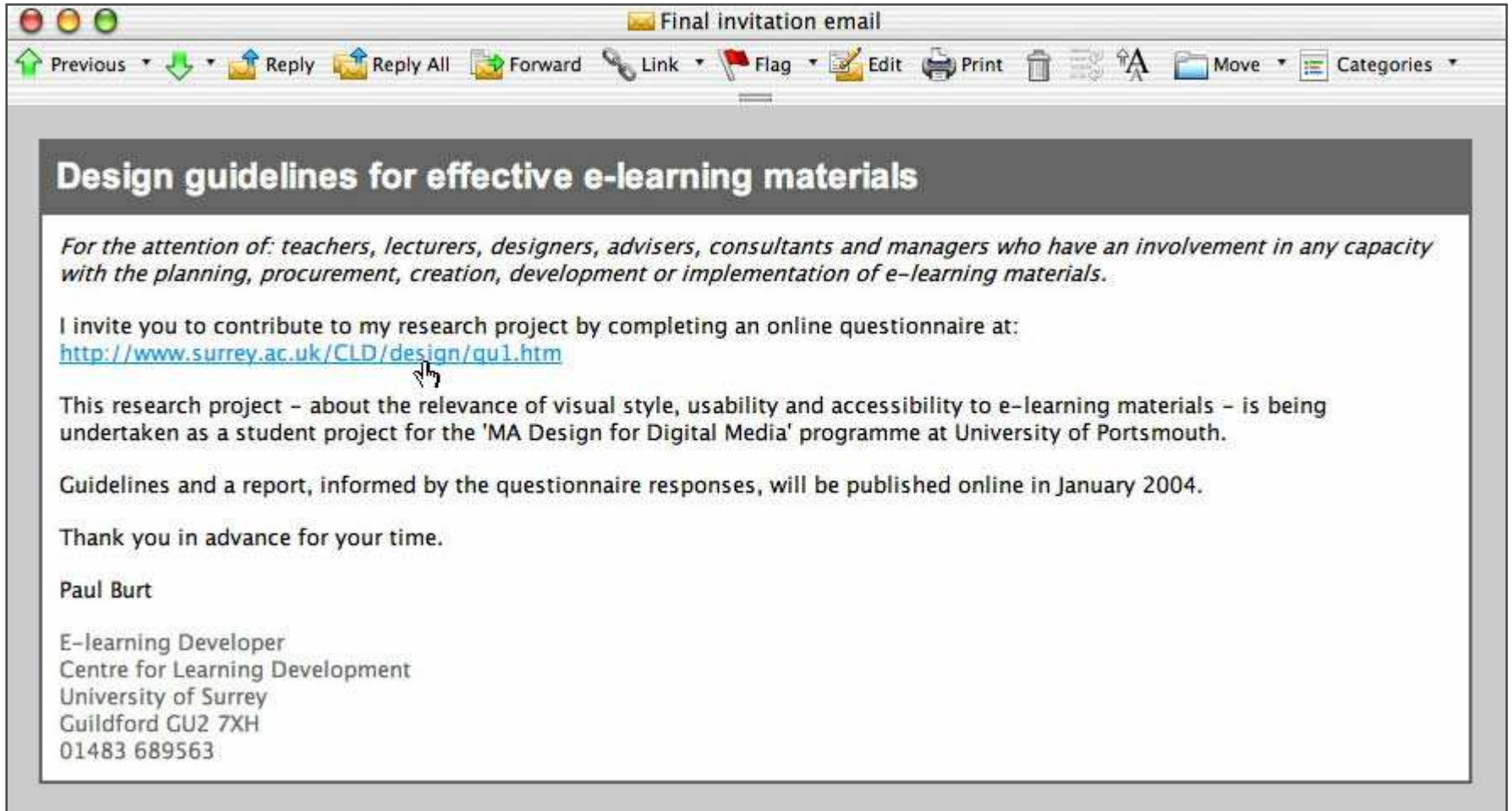
Figure 1. The email sent to invite questionnaire responses.

An invitation email (Figure 1.) was sent to selected JISCmail mailing lists. Invitations were also sent to selected individual contacts such as ex-colleagues.

Although the project is not directly backed or commissioned by University of Surrey (the employer of the project author) it was recognised that in order to obtain the maximum number of respondents (and to be permitted to use the JISCmail mailing lists) it would be essential to send the invitation emails using the author's Surrey academic domain address. An issue given consideration was the ability for potential respondents to identify the questionnaire as part of an academic based project as opposed to a commercial enterprise. Identity of both researchers and participants is an issue inherent in web-based research:

> "Even when researchers are attempting to be as authentic as possible in their presentation of self, they still face ethical decisions regarding the amount of information about themselves that they should make known to participants. For, just as researchers may not be sure of the precise identities of their participants, so may participants be unsure as to the identities of those conducting the research." (Mann & Stewart, 2000:59)

Seeking permission to use the university's email and web services for the project initially presented a minor barrier but was pursued until permission was granted.

In order to make the invitation email distinguishable from the day-to-day correspondences on the mailing lists it was decided to create a fully formatted email that had a style consistent with the questionnaire and supporting website. Compatibility of the email was tested with as many email client software applications as available and although some earlier versions of Microsoft Outlook were unable to display the HTML formatting the main text of the message remained intact.

4.4 Questionnaire deployment

The invitation email was sent to the following mailing lists on 14TH November 2003:

- blackboard-usergroup@jiscmail.ac.uk
- webct-uk@jiscmail.ac.uk
- elearning@jiscmail.ac.uk
- computer-assisted-learning@jiscmail.ac.uk

All of the list managers permitted the distribution of the invitation email to their list subscribers. The size of the distribution lists in each case varied but the average was approximately 200 subscribers per list (with an assumed number of cross-subscriptions).

After a two-week period, one week before the closing date for responses, a reminder version of the invitation email was sent to the same mailing lists.

The questionnaire was made available for a period of three weeks from 14TH November to 8TH December 2003. During this period a total of 127 completed sets of questionnaire responses were received.

5.1   Profile of respondents

The questionnaire requested each respondent to give the name of the institution that they are associated with and their email address. Considering contemporary issues with unsolicited email (spam) it was not surprising that some respondents opted to omit personal contact details. Analysis of the sectors represented by the survey sample is shown in Table 2.

Sector	Count	%
Higher Education	95	74.8%
Other (e.g. Museums)	12	9.4%
Overseas Higher Education	6	4.7%
Further Education (often with HE provision)	5	3.9%
Not supplied	9	7.1%
Total	127	100.0%

Table 2. Sectors represented in survey sample.

Within the survey group there was a fairly even distribution between the different category options to indicate e-learning role, Table 3.

E-learning involvement	Count	%
E-learning adviser	29	22.8%
E-learning developer	28	22.0%
Lecturer and producer of e-learning materials	24	18.9%
Manager of e-learning within your institution	11	8.7%
Lecturer (using materials prepared by others)	2	1.6%
Other	33	26.0%
Total	127	100.0%

Table 3. E-learning involvement represented in survey sample.

Respondents who selected 'other' generally indicated in the text field next to the option button that their role was a hybrid of the other options.

The following sections contain analysis of the responses given in each of the three main sub-sections of the questionnaire: visual style; usability; and accessibility. Quantitative analysis was undertaken using Microsoft Excel and SPSS.

6.1   Intention and definition

The intentions of the 'visual style' section of the questionnaire were:

- To ask how important the respondents considered 'visual style' to be in relation to the effectiveness of e-learning materials.

- Seek opinions about the use of different styles of composition, use of colour and use of type.

- Find out how 'typographically aware' the respondents were and how easily they could make stylistic associations to different examples of type.

A definition of the term 'visual style' was given as:

"The visual appearance of the materials including the use of type, colour and scale, and the consistency and composition of elements on the screen."

This definition was created solely for the purposes of the questionnaire and is not directly attributable to any external source.

6.2   Relevance of visual style

Question 1 asked respondents to select which statement they identified with the most from a choice of four. The statements formed a scale of relevance ratings for the relationship of visual style to the effectiveness of e-learning materials. The results produced are shown in Table 4.

Relevance of visual style	Count	%
Critical	40	31.5%
Important	83	65.4%
Least relevant	3	2.4%
No answer	1	0.8%
Total	127	100.0%

Table 4. Relevance of visual style to effectiveness of e-learning materials.

A space to provide a comment was available and 74% of respondents took the opportunity to elaborate upon their selection. Comments provided were generally lengthy and the content of most enabled the comment to be coded into one of the five categories of themes listed in Table 5. Where a respondent's comment contained themes that spanned more than one category a judgement had to be made to identify the dominant theme.

Coded visual style comment	Count	%
Design relates to motivation	27	21.3%
Accessibility/usability related comment	24	18.9%
Poor design hinders learning	19	15.0%
Inseparable from function	14	11.0%
Less than pedagogy and/or content	4	3.1%
Not coded	6	4.7%
No answer	33	26.0%
Total	127	100.0%

Table 5. Coding frames used with responses to visual relevance question.

Of particular relevance within the responses to this question was the emphasis of the impact of visual style upon student motivation. This perceived impact may be related to a web designer's general concern to attract 'return hits' (usually by ensuring regularly updated content) but in the case of e-learning is likely to be a more subtle issue. Examples of comments that have been classified within the coding frame of 'Design relates to motivation' are:

"Visual style is important when thinking about e-learning – it has to be visually appealing, in that it 'leads' the students through the learning material. If it is not visually appealing then people may find it easier to 'switch off' from the learning also the screen should not be too busy – depending upon the target audience of course." (Respondent 40)

"Critical for e-learning is engagement. You need to use visual style to augment the learning experience, to make it more appealing, less boring, less samey. At the same time you need to avoid focusing on visual style to the exclusion of all else; an overemphasis on style detracts from usability, informativeness, credibility." (Respondent 21)

Many respondents, understandably, made direct connections between visual style and accessibility/usability:

"Architecture and style make it easy for a user to subconsciously use materials. It's not about the flashy, it's about making something effortless to use. That's the tough part!" (Respondent 57)

"Well it depends if you can see or not! The effect level also depends whether you are a visual learner." (Respondent 111)

The following comment was noted because of the validity of the notion of visual style, usability and accessibility forming a design triad:

"I've selected 'important' – as colour, font, emphasis and scale are cues to information location, but usability and accessibility complete the triumvirate." (Respondent 117)

< > print

Clear amongst the responses given was a general awareness of some of the considerations of design for screen.

"Design and layout of any learning materials are critical – there must be ease of reading – particularly on screen, which requires a whole different set of considerations as people are staring at a screen and not at the printed page." (Respondent 66)

Research studies exist about the way people use computer-based information which reinforce the comment above:

"We have derived three main content-oriented conclusions from our four years' of web usability studies:
- users do not read on the web; instead they scan the pages, trying to pick out a few sentences or even parts of sentences to get the information they want
- users do not like long, scrolling pages: they prefer the text to be short and to the point
- users detest anything that seems like marketing fluff or overly hyped language ('marketese') and prefer factual information." (Morkes & Nielsen 1997)

The following two comments advise restraint when designing e-learning materials:

"If it is designed well people may not actually notice the design, they will just use it." (Respondent 10)

"For the avoidance of distractions as much as visual enhancement; for consistency as much as creativity." (Respondent 126)

An interesting point made by one respondent alludes to a danger which applies to the design of most e-learning materials – it is lecturers, many of whom do not have any background in design, who are required to produce the materials:

"Poor visual style can make e-learning materials look amateurish. If users start to question the design capabilities of the staff creating materials, this may also lead then to question the academic value of the materials." (Respondent 79)

This issue highlights one of the reasons for the formation of teams within academic institutions to advise on and/or help with the production of materials:

"Until now designing courses has predominately been the role of the academic or lecturer. In the past few years teachers with an interest in using computer and information technology (early adopters) have been innovative in developing online courses and materials. This shift in practice has meant that other teachers, with little or no technical experience, also want to develop online courses. Further impetus is evident in the expectation of students themselves who have reportedly requested staff to use online teaching methods when they

have had positive experiences of learning this way on other parts of their programmes. In response to this demand, non-academic staff with an interest in learning technology have migrated from very diverse backgrounds and with different levels of technical skills into a support role for teachers: the learning technologist has evolved to meet this need. With institutions and individual teachers having different priorities and practices, learning technologists have developed varied roles and skills to support the development of online learning and teaching." (Struthers, 2002:3)

6.3   Visual style examples

The second question in this section attempted to seek respondents' impressions about the visual style of three examples provided. A multi-part question was used to ask respondents what they felt about the specific aspects of composition, use of colour and use of type in each of the three examples.

Each example provided was a variation on a simple piece of content (the actual content was two disparate quotes from an e-learning publication: the selection of content to put in the examples should ideally have been given more consideration to represent realistic educational content). The examples provided are shown in Figures 2, 3, 4.

Responses to each of the three examples are shown as percentages in Figure 5. It is clear from the bar graphs that overall most respondents preferred the visual style of Example 3 and only the use of colour in Example 2 particularly offended people's taste.

The opportunity to elaborate on choices made was provided and below are a selection of the comments submitted that represented the majority views:

"Blue text and underlined text are always confusing, they can be interpreted as links. Blocks of text in italics are similarly hard to read. It is difficult to assess size in a reduced screenshot such as these. The navigation bar at the side looks OK." (Respondent 12)

"Example 1 is basic and functional. However, the design gives the impression of being 'old-fashioned' (underlined headings, serif font used for content intended to be read online etc.). It looks like the kind of content a circa-1995 website would have used. Example 2 looks awful and very unprofessional. The designer has selected inappropriate colours, and has over used different fonts types... ...Example 3 looks the most professional of the three. There is plenty of white space, good use of colour and fonts, which makes it the most visually attractive." (Respondent 55)

Figures 2, 3, 4. The examples of visual style that were rated by respondents.
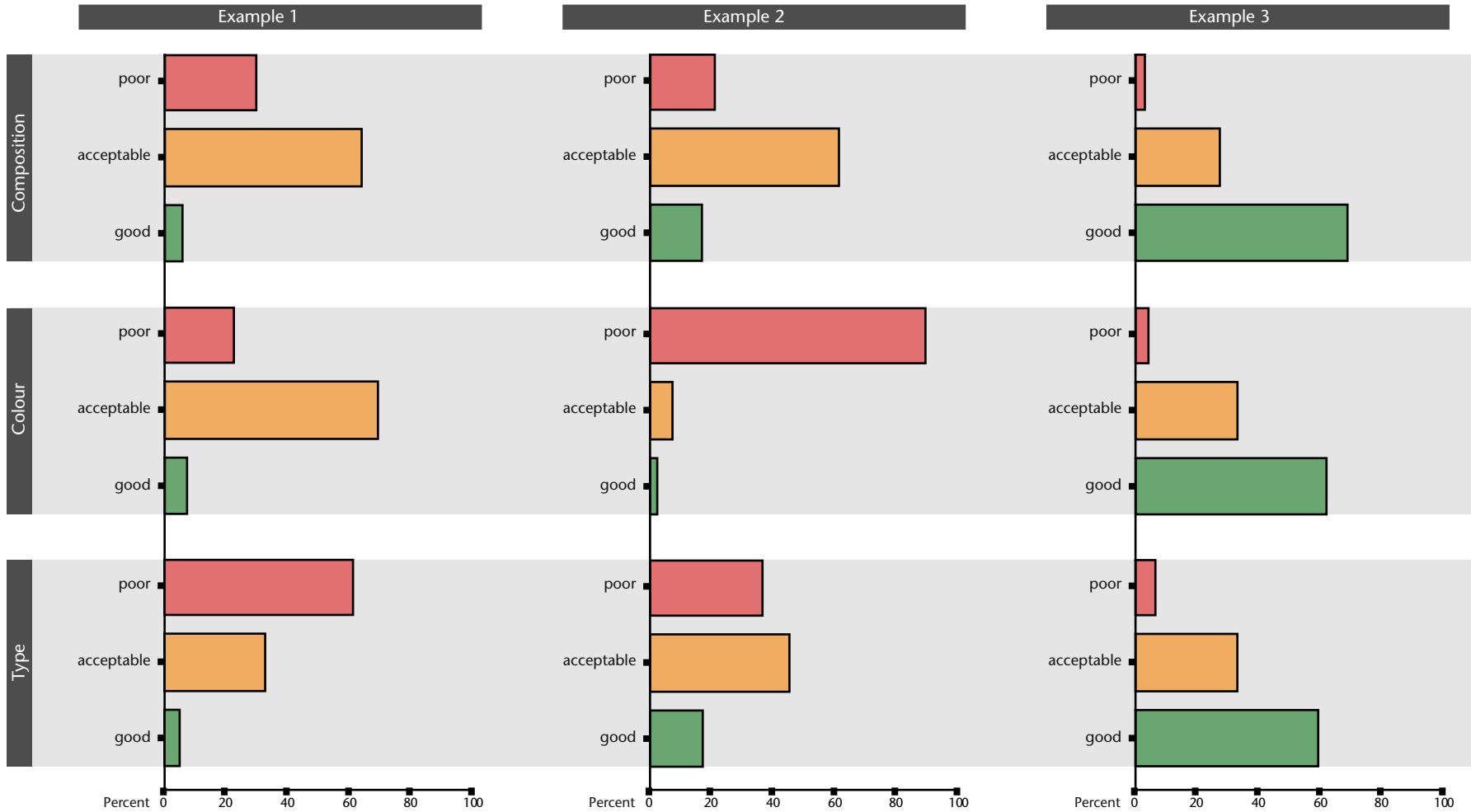From top to bottom: Example 1, Example 2 and Example 3.
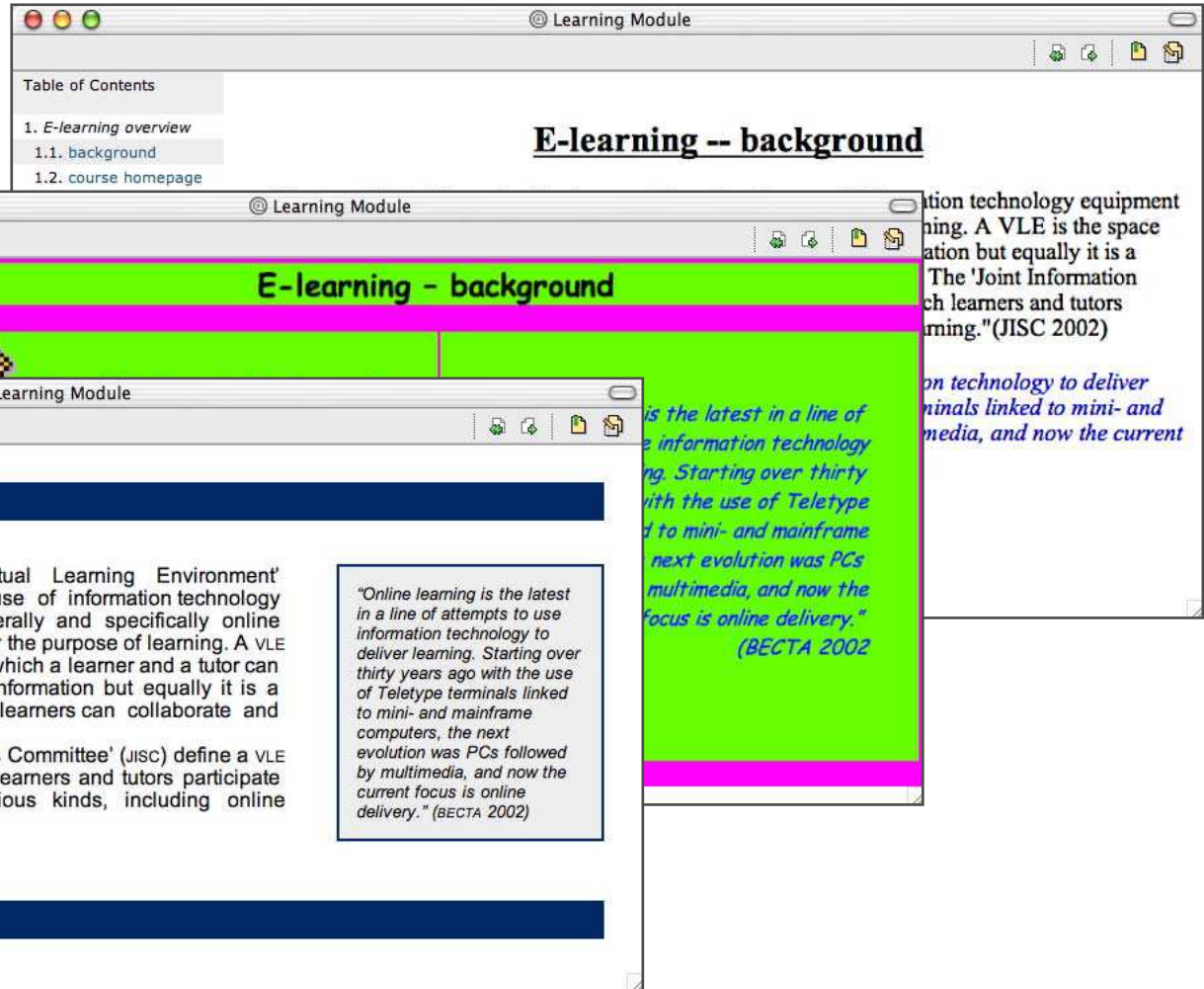
Figure 5. Percentage ratings for visual style of the three example learning modules.

"1. text based word orientated example of something thrown together with no concept of e-learning or pedagogical issues taken into account.

2. Its got it all approach – enthusiastic attempt at creating a piece of eLearning content with the creater[sic] having no concept of design in any way what so ever. An attempt at change and something completely different and being totally unacceptable to most people… unless your favourite colours happen to be bright green and purple… Hmmmm

3. An excellent attempt and most acceptable piece of standard elearning material. Well presented using nice type and application of basic style, colour and design skills. Pleasant to view and easy to read with extras added to complement the page."
(Respondent 119)

One respondent rated the use of type in Example 2 as the best of the three and commented:

"The composition and font used in example 2 is my favourite - it looks inviting (despite the clashing colours!) and friendly. Comic Sans is a good font for people with dyslexia, although italics are not always easy to read - but in example 2 they are easier to read than in example 3." (Respondent 81)

This comment was notable for its recommendation to use Comic Sans, a font of child-like appearance whose widespread use is widely abhorred by professional designers (e.g. see http://www.bancomicsans.com). However,

in the light of this respondent's comment, further research reveals that there are proponents for Comic Sans' use on the grounds of legibility (e.g. http://www.dyslexic.com/database/articles/fonts.html) but mostly its 'unprofessional' appearance precludes it recommendation (see http://www.techdis.ac.uk/seven/papers/dyslexia3.html).

Overall the results from the visual style example-based question were as would be expected but the comments submitted contain many suggestions that will inform the creation of the guidelines. The question also had value in confirming, in the broadest sense, one appropriate visual style for e-learning materials.

6.4   Type: 'the chair question'

Of all the questions in this survey, it was 'the chair question' that sparked the most debate and polarised the opinions of people – uniquely in this instance the debate was about the design of the question and not the subject being asked.

The question presented four pictures of different chairs and asked respondents to select from four samples of type the most stylistically similar pairs.

Behind this question was the intention to gauge each person's appreciation of the subtle stylistic cues and associations present in type. Inspiration for the question was taken from an exercise in the book

"Stop stealing sheep & find out how type works" (Spiekermann & Ginger, 1993). In the book a typographic puzzle is set which asks the reader to select which typeface best fits with each of a selection of different styles of shoe. However in the book the point of the exercise is to state that there are no right or wrong answers when choosing a typeface but also that there are appropriate and inappropriate uses for particular fonts.

Results from the chair question are shown in Figure 6. It can be seen that the majority of respondents made associations for each of the chairs to the same typeface (or sometimes a particular pair of typefaces). Seeking to identify correlations between the typeface people associated with each chair and any of the other sets of data (e.g. how did they rate the importance of visual style) was one intention behind the question but the final results revealed no such correlations. One explanation for the lack of such relationships is that the sample group of the survey probably have all roughly the same level of 'visual literacy'. The question may have returned different results if it was used to compare, for example, a group of professional designers against a non-design related group.

When designing the question it was not an intention to 'show-up' respondents' inappropriate choices but to gauge to what extent people involved in e-learning are attuned to stylistic clues:

"It is a bit like having been to a concert, thoroughly enjoying it, then reading in the paper the next morning the conductor had been incompetent, the orchestra out of tune, and that the whole piece of music not worth performing in the first place. While you had a great night out, some experts were unhappy with the performance because their standards and expectations were different than yours.
The same thing happens when you have a glass of wine. While you might be perfectly happy with whatever you're drinking, someone at the table will make a face and go on at length why this particular bottle is too warm, how that year was a lousy one anyway, and that he just happens to have a case full of some amazing stuff at home that the uncle of a friend imports directly from France.
Does that make you a fool or does it simply say that there are varying levels of quality and satisfaction in everything we do?" (Spiekermann & Ginger, 1993:17)

Although the question did not reveal any interesting correlations it did, it is supposed, add a degree of fun into the questionnaire and ensured that respondents were in an alert, and interested, mental state for the rest of the questionnaire. Interest aroused by this question may help to account for the impressive response-rate to an individual's (student-originated) questionnaire.
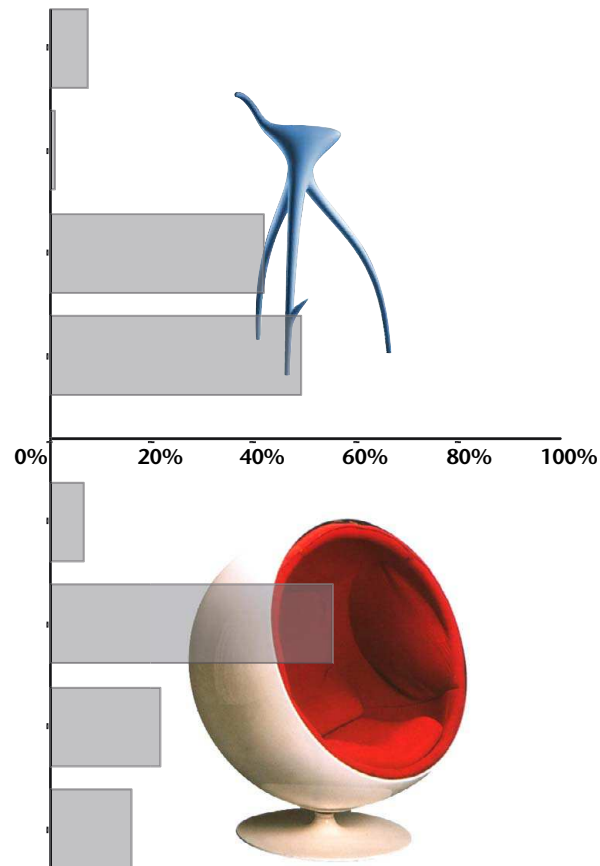
Figure 6. Association percentages produced by 'the chair question'.

An opportunity to comment on the question was provided and below are a selection of the positive and negative responses received:

"This is an unusual, but very interesting idea for a question." (Respondent 96)

"Interesting question - matching chairs to fonts - kinda fun too!" (Respondent 80)

"Hmm it is interesting, not quite sure what I am doing but is quite amusing and does make you think about design." (Respondent 33)

"A very interesting perspective and demonstrates that one does make associations of meaning with a style of font." (Respondent 69)

"The activity prioritises appearance over all other elements. In terms of website design, this is probably not a good idea unless it's an activity aimed at graphic designers." (Respondent 92)

"I feel this is a rather artificial set-up, in making associations of images and fonts this way. You would really need to ask people how old they are, how visually literate they are....." (Respondent 70)

The last two comments could be interpreted as saying that visual style is only of interest to designers, a concerning view because a designer involved in e-learning is probably the person who spends the least time *having* to look at the materials and also has the most control to change any visual aspect they do not like. Conversely learners may have to spend extended periods using materials and can exert little control over the visual style they have to view.

Last words on 'the chair question' given by a respondent:

"No choice. Chairs are chairs and typeface is typeface." (Respondent 11)

7.1   Intention and definition

The intentions of the 'usability' section of the questionnaire were:

- To ask how important the respondents considered 'usability' to be in relation to the effectiveness of e-learning materials.

- Seek respondents' opinions about the use of different methods of placing a hyperlink within text.

- Seek respondents' opinions about the benefits and drawbacks of duplicating VLE navigation within material.

A definition of the term 'usability' was given as:

> "The ease and speed with which targeted users can achieve the goals that the designer of the materials had intended, the level of intuitiveness and clarity to any interaction or interface that may be present."

This definition was created solely for the purposes of the questionnaire and is not directly attributable to any external source.

7.2   Relevance of usability

Question one asked respondents to select which statement they identified with the most from a choice of four. The statements about the relationship of usability to the effectiveness of e-learning materials formed a scale of relevance ratings. The results produced are shown in Table 6.

Relevance of usability	Count	%
Critical	109	85.8%
Important	18	14.2%
Least relevant	0	0.0%
No answer	0	0.0%
Total	127	100.0%

Table 6. Relevance of usability to effectiveness of e-learning materials.

When asking this question it was expected that respondents would automatically answer 'critical' and typical comments provided confirm the importance associated to usability:

> "Not many people have the discipline required to persevere with e-learning materials that are not designed for ease-of-use. Low usability materials will fail to engage learners." (Respondent 24)

"Usability is extremely important as e-learning should be as intuitive as possible – they are after all there to learn from the learning material and it should be easy to find and navigate around the site." (Respondent 40)

"Having just done my first on-line course, several of the students could not participate to their fullest extent because they did not understand how to navigate properly and consequently missed bits of the course." (Respondent 83)

"Usability is everything." (Respondent 124)

7.3 Method of hyperlinking

The second question in the usability section asked respondents to indicate which of three displayed methods of placing a hyperlink they considered acceptable. Below are the examples used:
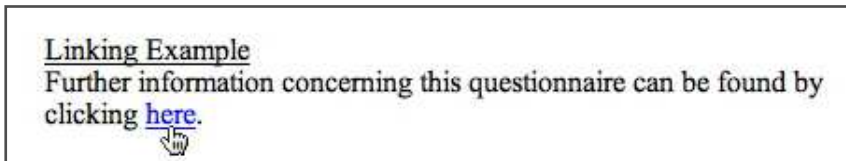

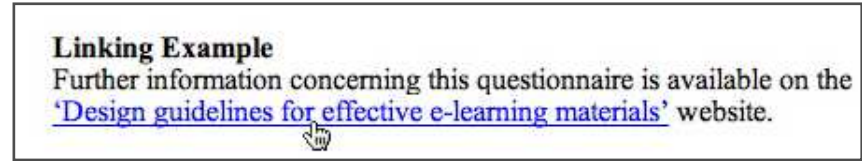Figure 7. The first method of hyperlinking shown.

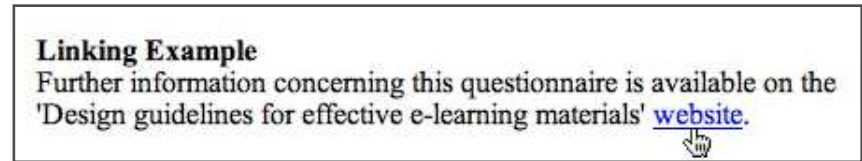Figure 8. The second method of hyperlinking shown.

Figure 9. The third method of hyperlinking shown.

Expert advice exists (Degener, 1998) that describes the acceptable method of hyperlinking. Of the examples used in this question it is only the second method shown that is acceptable. It could be argued that the word 'website' in this example is a reference to the mechanics of the web, advised against by the originator of HTML (Berners-Lee, 1998), but its use here was considered to be acceptable in the context of the sentence.

Respondents do not appear to be aware of this guidance as less than 50% identify that only one acceptable method was shown. Results from this question are shown in Table 7. An assumption is that the widespread use of the word 'here' as a link, specifically advised against by the World Wide Web Consortium (W3C, 2001), has negatively influenced respondents.

Linking methods acceptable	Count	%
Only one acceptable	60	47.2%
Two are acceptable	46	36.2%
All three are acceptable	21	16.5%
Total	127	100.0%

Table 7. Method of acceptable hyperlink placement within text.

A noted flaw in the design of this question is that a respondent could have selected the response that only one of the displayed methods was correct but be incorrect in identifying which one. This occurrence can be confirmed in at least one case because of the comment given:

> "Version 3 identifies the link as a link to a website (not PDF, email link etc)" (Respondent 59)

7.4 Navigation within materials

The third question in the usability section was about the benefits and drawbacks of producing, for use within a VLE, e-learning materials that contain their own navigation. Although commonplace, it is apparent that it is not good practice to duplicate the navigation interface within materials for the following reasons:

- Duplicating the navigation can only increase the complexity of the potential choices presented to the student and will add to any existing confusion.

- Even if the navigation interface created by the producer of the materials is well designed it will be inconsistent with the interface produced by designers of other materials that the student is likely to use in their studies and will therefore add complexity.

- Encouraging students to use any interface located within the materials will delay them becoming confident in the use of the VLE's interface. Given that many students will, increasingly, be encouraged to make use of an institution's VLE throughout their programme this could have a negative effect.

- The likelihood of a broken or incorrect link occurring within hand-produced materials is higher than when using the VLE's in-built navigation.

- Using navigation within materials is likely to defeat the accuracy of any tracking performed within the VLE.

- Many VLE's present a trail of 'breadcrumbs' to the user to show their current location in relation to how they have navigated there. Putting navigation within materials will defeat this helpful feature.

- Putting links in materials limits opportunities for re-use of content.

The question was worded:

"In further and higher education most e-learning activity takes place within a virtual learning environment (VLE) e.g. Blackboard, WebCT. In this context which of the following approaches to navigation leads to the best usability:

- put as many links between materials as possible into content files so that students can always find a new way to navigate
- don't duplicate the VLE's navigation within the material files
- make long scrolling materials so that the students do not need to understand the navigation"

Results are shown in Table 8.

Navigation within materials	Count	%
Do not duplicate VLE navigation	72	56.7%
Put in as many links as possible	38	29.9%
Create long scrolling materials	2	1.6%
No answer	15	11.8%
Total	127	100.0%

Table 8. Options for additional navigation within materials.

A correlation exists between those respondents who identified the correct way to place a hyperlink within text and advising not to duplicate navigation within the design of materials. This correlation is
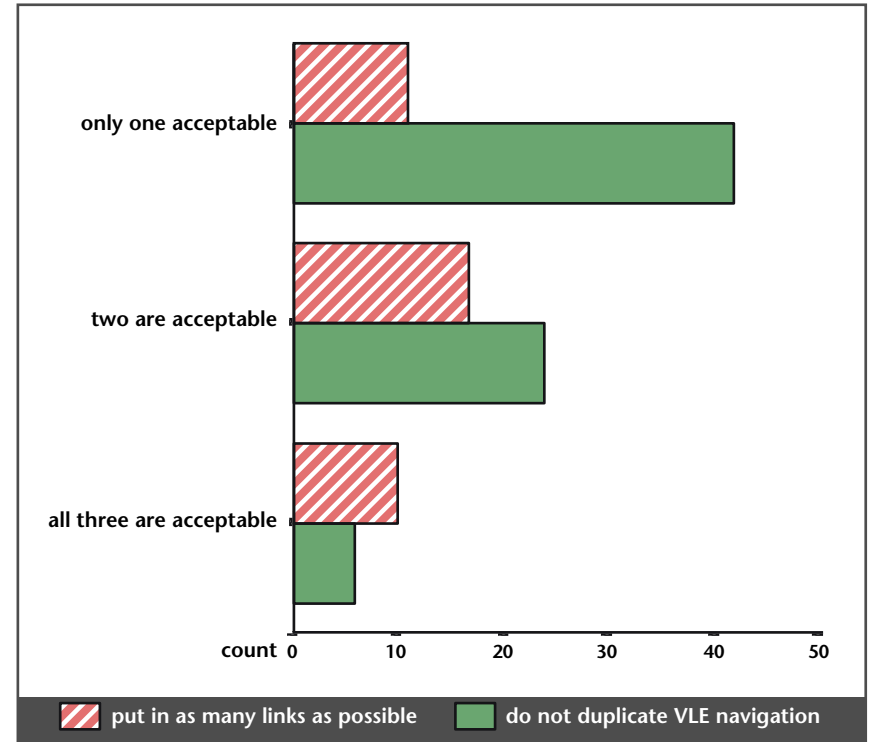

Figure 10. Correlation between hyperlink and VLE navigation responses.

shown in Figure 10. An interpretation of this correlation could be that those who were technically correct, as defined by experts, about the placement of the hyperlink were also the strongest proponents of not duplicating VLE navigation which adds further weight to the case against putting navigation within VLE materials.

8.1   Intention and definition

The intentions of the 'accessibility' section of the questionnaire were:

- To ask how important the respondents considered 'accessibility' to be in relation to the effectiveness of e-learning materials.

- To gauge respondents' understanding of current legislation that is applicable to e-learning accessibility.

- Seek respondents' opinions about the potential accessibility issues within two visual examples presented.

A definition of the term 'accessibility' was given as:

"The extent to which anyone, regardless of any disability, can effectively use a website via any web browsing technology including specialist assistive technologies (e.g. 'screen readers')."

This definition was created solely for the purposes of the questionnaire and is not directly attributable to any external source.

8.2   Relevance of accessibility

Question one asked respondents to select which statement they identified with the most from a choice of four. The statements about the relationship of accessibility to the effectiveness of e-learning materials formed a scale of relevance ratings. The results produced are shown in Table 9.

Relevance of accessibility	Count	%
Critical	82	64.6%
Important	40	31.5%
Least relevant	3	2.4%
Irrelevant	1	0.8%
No answer	1	0.8%
Total	127	100.0%

Table 9. Relevance of accessibility to effectiveness of e-learning materials.

It can clearly be seen that to the majority of respondents, accessibility is a critical factor. It is important to appreciate when interpreting this result that accessibility is currently an issue at the forefront of every institution's agenda in light of only relatively recent legal changes.

8.3   Accessibility legislation

Since 1995 the 'Disability Discrimination Act' (DDA) has prohibited discrimination against disabled people by employers and service providers. The original act however did not originally include similar requirements for the provision of education. However new duties for education providers came into effect in September 2002 under Part IV of the DDA as amended by the 'Special Educational Needs and Disability Act 2001' (SENDA).

SENDA applies to all schools, colleges, universities, providers of adult education and youth services (private providers of post-16 education are covered under Part III of the main act). In addition to requiring providers not to discriminate against disabled people SENDA requires responsible bodies to provide certain types of reasonable adjustments to provision where disabled students or other disabled people might otherwise be substantially disadvantaged.

As with all acts, SENDA does not make specific reference to the requirements applicable to e-learning, but does refer in Section 36 to the Disability Rights Commission (DRC) codes of practice. Codes of practice are not legally enforceable documents but compliance with a code of practice should demonstrate to a court or tribunal compliance with the law. The DRC's *Code of practice for providers of post 16 education and related services - DDA 1995: Part 4* does give a specific example about e-learning:

"*Example 5.2F* A tutor in Zoology delivers one of his modules through a computer-based learning environment and awards marks for students' participation in online discussion. The system does not work with a visually impaired student's software. The student is likely to be placed at a substantial disadvantage." (DRC, 2003:68)

An important aspect of the SENDA legislation is the requirement to act in anticipation:

"5.5 A responsible body's duty to make reasonable adjustments is an anticipatory duty owed to disabled people and students at large. [s 28T] It is not simply a duty to individuals." (DRC, 2003:69)

This requirement brings into question a number of comments made by respondents in respect to the relevance of accessibility:

"Accessibility is going to be important whether we like it or not. However, a VLE means that we know who is accessing our material, and we can provide appropriate accessibility." (Respondent 11)

"I'm not sure how much attempting to give a level playing field for everyone compromises / homogenises the whole to an extent that it becomes bland – I think the ability to use discre-

tion and target particular known audiences with less 'basic' formats should be available." (Respondent 41)

The following statement proposes a logical approach, but would fall foul of the anticipatory requirement because each year's cohort of students will differ:

"It is a very important factor, but so is the tenet of knowing your audience – if you know it is a course that will have a higher level of disability of a certain type, cater to that. Likewise, if it's a course that will be virtually free of a particular disability, it is less important to build accommodation for that into the design." (Respondent 108)

Question 8 asked what level of legislation awareness each respondent possessed by requesting that they opted for one from the following statements:

"I have no knowledge of the accessibility legislation that applies to e-learning."

"I know that there is accessibility legislation that applies to e-learning but would not be able to specify it's name."

"I can name the accessibility legislation that applies to e-learning but would not be able to explain any of its main principles."

"I can name the accessibility legislation that applies to e-learning and can explain some of its main principles."

Results from this question are shown in Table 10.

Knowledge of SENDA	Count	%
No knowledge of accessibility legislation	12	9.4%
Aware legislation exists but could not name it	27	21.3%
I know legislation name but not its contents	13	10.2%
I know legislation name and main principles	75	59.1%
Total	127	100.0%

Table 10. Awareness of accessibility legislation applicable to e-learning.

Considering the possible legal implications it is surprising to note that over 40% of respondents to a specialist questionnaire about e-learning appear to have an insufficient knowledge of SENDA and its requirements.

8.4   Availability of accessibility advice

Question 9 asked which sources of specialist accessibility advice respondents had available to them. Respondents were asked to select all the statements that were applicable to their institution. (Note: a coding error in the questionnaire prevented the majority of respondents from deselecting a statement once clicked upon. This error was

evident for approximately two weeks before being rectified. However the impact of the error is not considered sufficiently severe so as to effect the validity of the statistics.)

Results to question 9 are shown in Table 11.

Specialist accessibility advice/guidance	Count	%(of 127)
Institution e-learning accessibility guidelines	69	54.3%
Accessibility advice from an e-learning specialist	76	59.8%
Other	52	40.9%
None the respondent is aware of	14	11.0%

Table 11. Sources of e-learning accessibility advice available to respondents.

Respondents indicating availability of an 'other' source of advice/guidance were asked to specify and below are a selection of the responses:

"Websites, documents and e-learning specialists." (Respondent 80)

"Online tools and institutional tool (LIFT)" (Respondent 89)

"Sector guidance produced by JISC/ALT, links on the web, paper-based information, research." (Respondent 124)

8.5   Visual-based accessibility question

In order to gauge the extent to which respondents could demonstrate their practical understanding of e-learning accessibility issues question10 presented two visual examples (Figure 11. and Figure 12.) and asked the following questions about each:

"What impact on **accessibility** might the **visual style**, e.g. background and use of type, in this example have?"

"Would the **illustrations** in this material improve **accessibility** for learners with cognitive disabilities?"

The phrase 'cognitive disabilities' was used as a broad term to describe the full range of disabilities that can affect a persons ability to comprehend, remember and apply information. In the *Web content accessibility guidelines* the W3C makes regular use of the phrase (W3C, 1999). Disabilities covered by the term include 'Specific Learning Difficulties' (SLD) such as Dyslexia and Asperger's Syndrome which, "after dyslexia, it is probably the cognitive disability we are most likely to encounter at University level." (Dix, 2001)
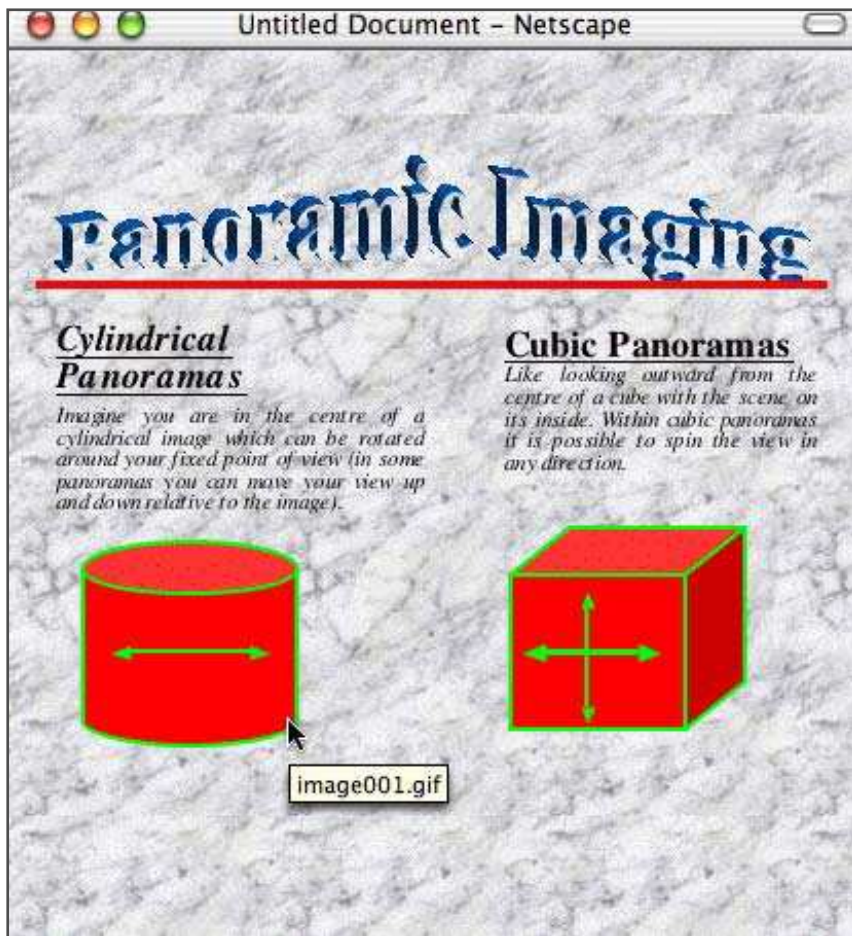
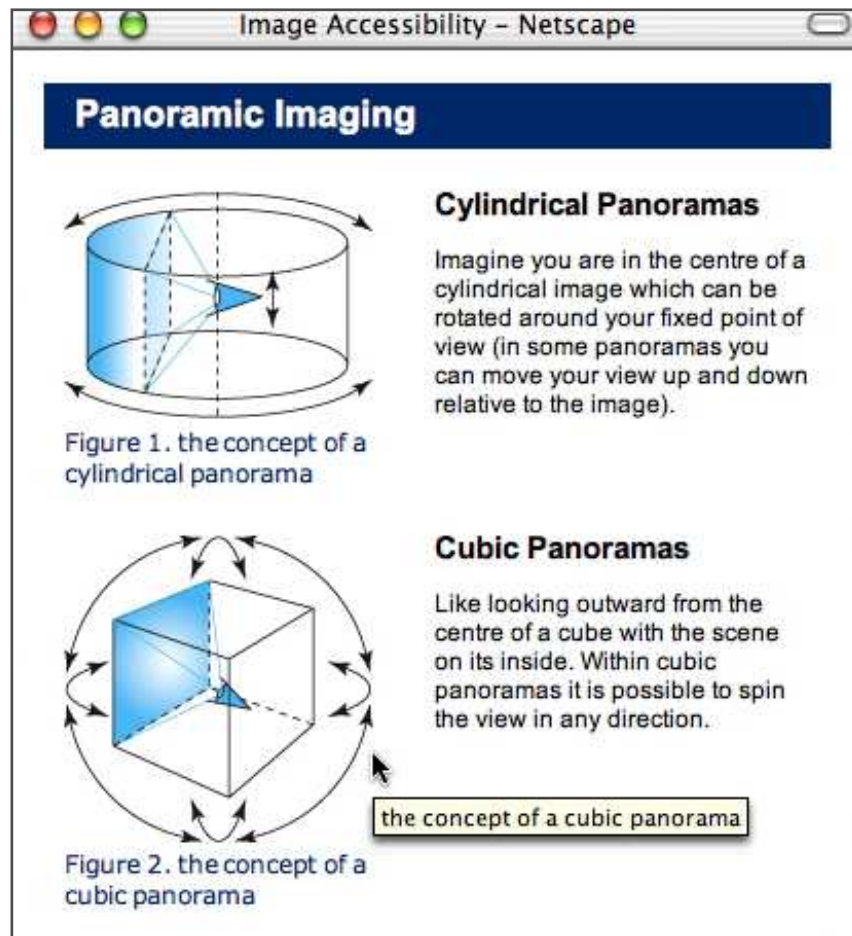Figure 11. Example 1 of the visual-based accessibility question.

Figure 12. Example 2 of the visual-based accessibility question.

The production and use of this question presented two main challenges:

- Creating visual examples that gave sufficient visual clues for respondents to be able to identify problems of accessibility when the actual accessibility of each example could not be tested (because they are represented as images and therefore appearance cannot be adjusted). Suitable material was adapted from the project author's own teaching resources. The examples were made into opposite examples of accessibility extremes but the information conveyed is the same in both.

- To ensure that the responses received would be valid it was important to attempt to create a non-leading question. Therefore the use of a 'radio-button' type was inappropriate and the use of text-fields was necessary. Free-text responses are inherently more time-consuming to analyse and less precise at providing data because interpretation of responses into coding frames has to be undertaken to facilitate statistical analysis.

In order to quantify the responses given to Example 1 a list of the main accessibility issues evident within the example was created:

- Distracting background pattern/texture applied that serves no purpose and would greatly reduce the legibility of text seen on top of it.

- Use of italic font for no valid reason greatly reduces the legibility of the text. Font used is a typeface with serifs which is less readable on-screen (the opposite is true in respect of printed media).

- Other identifiable problems with the type and layout include: the distortion of the title (Microsoft call this 'WordArt'!); the use of underlined text (when not a hyperlink) and use of justified text alignment (which slightly reduces readability but can be justifiable [sic] on layout/composition grounds – see any professionally produced newspaper, magazine or book).

- Inappropriate <ALT> tag used. (It should be noted that the small pop-up appearing when the cursor is positioned over an image is a browser specific behaviour. In some browsers the cursor pop-up displays the <TITLE> tag rather than the <ALT> tag.)

- Poor use of colour within the illustrations. The most common form of colour blindness is red/green vision deficiency and therefore the colours used are particularly inappropriate.

- Unhelpful illustrations – learners would only find the illustrations helpful if they reinforced the message contained in the text. The lack of sophistication in the illustrations in the example means they convey no more information than the shape of a cylinder and a cube.

Using this list as a base, the comments given by respondents were coded to result in the data shown in Table 12.

Accessibility issues identified for Example 1.	Count	%(of 127)
Distracting background texture	75	59.1%
Inappropriate use of type	67	52.8%
Other issue (e.g. WordArt, underlines)	32	25.2%
Inappropriate <ALT> tag	41	32.3%
Poor use of colour in illustrations	52	40.9%
Lack of information conveyed by illustrations	34	26.8%
No comments provided	9	7.1%

Table 12. Accessibility issues in Example 1 identified by respondents.

It can be seen many respondents identified multiple accessibility issues within the visual example but the poor quality of the illustrations, which conveyed in visual terms very little information, was missed by most respondents.

When shown Example 2. almost all respondents commented on the improvements:

"Good contrast between text and background. Text well layed out, and much easier to read. Meaningful text used as ALT text." (Respondent 54)

"Excellent example. The images illustrate the concepts very well. The white background provides enough contrast to see the diagram and read the text. The font chosen is sans serif which is easier to read for all students. The diagrams will help all students to visualise the concepts and will be particularly helpful to those with dyslexia." (Respondent 101)

A number of respondents indicated that although a more meaningful <ALT> tag was used it was still not sufficiently descriptive:

"Text much easier to read than before (still can't tell if they can increase size / alter colour combination if black on white too strong a contrast. Alt text still not ideal, as it's repeating what's in the label. 'D' link would be better." (Respondent 57)

"Although the images have been tagged it would be far better to have long descriptors so as to explain the image more thoroughly and what it is depicting rather than just a glorified title." (Respondent 119)

Regarding the illustrations, although the majority commented on the improvement over Example 1, others provided suggestions to improve their usefulness further:

"Again, diagrams would require that the user had good spatial awareness, for some people visualising spatial movement is very difficult. – could they be made more interactive, so that they

could be made to spin etc. However, they are far clearer to someone who has difficulty with text (e.g. dyslexia) than the previous examples were. (To start with, I know now what they both are, I didn't from the first really!)" (Respondent 58)

"Much clearer, 3D illustration much better. presume that online you could move this around?" (Respondent 30)

"The illustrations are more helpful I think, and taken along with the text could help a user with cognitive difficulties as well as e.g. dyslexic users." (Respondent 71)

"These diagrams really help. However, I would suggest a short key – what are the arrows for? What does the eye in the middle mean? Why is one face of the shape coloured in? Again, a longer text explanation could be useful." (Respondent 81)

The use of animation is certainly valid if explaining a concept of movement within an instructional diagram but it would be of interest to know how many additional accessibility issues would have been identified had the diagrams been animated/interactive.

Overall the use of illustrations should generally be encouraged:

"Content that is only text will be viewed as being poor instructional design even if it meets the instructional objectives. Participants in internet-based learning expect to see and use features of the internet environment. To not use internet features in internet-based learning would suggest that the wrong delivery vehicle has been chosen. However, the features the instructor chooses to use should enhance the content. For example, graphics should add to the information being presented by the text. Graphics should not be added to spice up the text or add visual interest unless the graphics are related to and help explain the text." (Harris, D. 1999:155)

Design guidelines for effective e-learning materials

The nine guidelines that follow have been formulated to help produc-
ers of e-learning materials make effective design decisions. Expert
opinion obtained through a national survey has, in conjunction with
existing guidance and expertise, helped inform this new set of guide-
lines. Each guideline promotes a general principle – further details
and specific information on these principles is contained within the
main body of the project report.

**Visual style guideline 1: use colour judiciously**

Colour can enhance the design of materials which, in turn, can help with student motivation. Use colour to
distinguish different sections or to reinforce a consistency within a design. Never rely on colour alone to
convey information and ensure that your design can function when viewed without colour (run a test on a
monochrome laser printer).

Visual style guideline 2: take care with type

The way you use type – your choice of typeface, font style and weight, along with the type composition and alignment – will influence both the visual appearance and effectiveness of your design. Use no more than two typefaces within a single design. Avoid extended use of italic or bold attributes and never set type in all capitals. Double spaces between sentences are not needed in the digital age and result in visual 'rivers' of white space within blocks of text which reduces legibility.
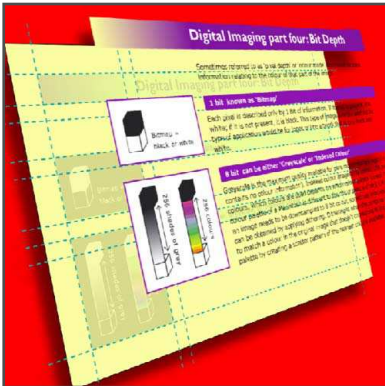
Visual style guideline 3: don't be inconsistent (or overly consistent)

Don't create a new design for every screen or page – this will only lead to confusion. Aim to keep the visual style of materials consistent throughout a module or unit of study. Consistency will ensure students are able to focus on the information relevant to learning rather than being distracted by design styles. Once consistency has been achieved, aim to break repetition by introducing variable elements (visual markers) to help distinguish between content areas or sections. Students returning to locate information will be aided by those distinctive, memorable, elements.

Usability guideline 1: think before you link

Web usability is based upon a common understanding of navigation and interface. Users expect underlined text to be a link. Don't break this common understanding by creating your own interface 'language' – we learn new interfaces through 'evolution' not 'revolution'. In the context of e-learning materials the use of links within text should be questioned: students are more likely to understand text they can read in its entirety without the interruption of non-essential information. Collect useful links together to create a resources area. Make link wording descriptive of the information to be gained rather than the mechanics of getting there.

Usability guideline 2: design with context in mind

Consider the impact on your design of the context in which it will be used. A virtual learning environment exists to save you creating interfaces and structure. Do not duplicate the function of navigational interfaces within your materials – students will only become familiar with a VLE's interface through using it. The VLE forms a visual frame which limits the screen area remaining for your materials. Ensure your materials work in the context of the area that would remain on the smallest monitor likely to be used by your students. Check that materials do not appear too visually cramped: giving visual space around materials is recommended.
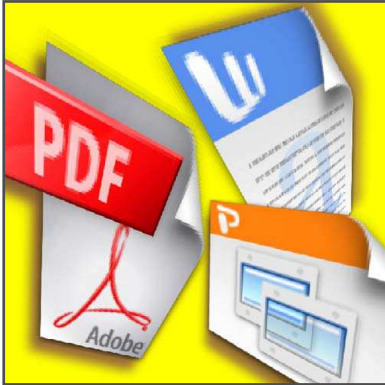
Usability guideline 3: use web-friendly formats

Think about your end users when deciding to provide information in any format other than a HTML. Microsoft Office documents often have large file sizes ill-suited to web transmission and can display inconsistently across different computers. Long documents are ideally suited to Portable Document Format (PDF). If using video, offer a variety of qualities and indicate download sizes to users in advance.

Accessibility guideline 1: use valid code

Understanding the basic principles of HTML and how to work with cascading style sheets (CSS) can greatly speed up the creation of efficient (i.e. quicker download), consistent and effective materials. Use appropriate tools for appropriate tasks: a word processor is rarely suited to materials design. The innate accessibility of the web is defeated by incorrect coding. Check your coding using a validator (available online or as a function of many web design applications). If possible use a specialist accessibility validator to check your designs.

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Accessibility guideline 2: provide text descriptions for visual content

Visual content such as diagrams, illustrations, photographs and video will be inaccessible to people with visual impairments unless you provide a text description or transcription. Visually impaired students are able to use assistive technologies such as 'screen reading' software to access web-based information. When inserting still images ensure you provide a text description that conveys the same function or purpose as the image. For all images enter a brief description as an ALT attribute within the <IMG> tag. If the image function or purpose necessitates further explanation use the LONGDESC attribute. A transcript or description for video can be located within the <OBJECT></OBJECT> tags or on a separate page that is linked to the clip.

Accessibility guideline 3: don't only use text

No student will benefit from all information on a module or unit of study being presented only as text. Use of supplemental illustrations, diagrams, flow-charts and photographs can greatly enhance the accessibility of materials for some students (e.g. dyslexia). Processes are often learnt more efficiently from illustrations or photographs than from text. If appropriate consider the use of video, but always remember accessibility guideline 2 and provide a transcription.

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