Usability, in relation to e-learning projects
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Summary
Experience has shown that it can be relatively simple to make online tools or learning resource accessible, but this alone can be quite useless if the resource is difficult to use or understand because of usability issues. The following report explores usability further by introducing ‘pedagogical usability’, reviews its importance to effective online learning and looks at ways in which usability testing can be carried out.

Defining usability
Usability is the extent to which a system can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use (Karat, 1997).

Cooper al at (2007) state that “usability, in an e-learning context, can thus be defined as the effectiveness, efficiency and satisfaction with which users can achieve specified learning (or learning related) goals in a particular environment or with a particular tool or learning resource” and that “Accessibility and usability are intrinsically linked. The lower the level of accessibility of a resource for an individual, the less usable it will be for them”. The same report also states that “accessibility and usability impact directly on the pedagogical effectiveness of elearning systems or resources for all learners, but particularly for disabled learners”.

Jeffels (2005) states that “if the basics of usable design are ignored all users can be disabled by the inappropriate use of technology”. He advocates that “technology should be an enabler not a barrier” and that “campaigning for usability should simplify life for everyone, not just those with specific accessibility requirements”.

Amongst the current list of usability experts, Melis et al (2003) claim the “eLearning system usable basically involves two aspects: technical usability and pedagogical usability”, that “technical usability involves methods for ensuring a trouble-free interaction with the system” while “pedagogical usability aims at supporting the learning process” and that “both aspects of usability are intertwined and tap the user’s cognitive resources”. Tervakari et al. (2002) [in Finnish] use the term “pedagogical usability” to denote whether the tools, content, interface and the tasks of the web-based learning environments support various learners to learn in various learning contexts according to selected pedagogical objectives.

Silius et al (2003) state that “The evaluation of pedagogical usability should moreover always be undertaken in relation to selected pedagogical objectives and the value added anticipated”.

Usability – the key to successful e-learning
Melis et al (2003) claim that “Many eLearning systems seem to fail because they aim at replacing proven methods of learning instead of improving the learning experience, where there is room for improvement”.
Abedour and Smith (2006) concur that “The cost of poor usability is high. It includes unsatisfied, ineffective learners and ineffective e-learning initiatives, Learners who find an e-learning program hard to use might:

- Carry out their task reluctantly
- Be confused about the learning exercise
- Fail to engage with the e-learning, possibly abandon the e-learning completely, fail to learn or retain knowledge.

Ardito et al (2006) note that “we often find that an e-learning application is a mere electronic transposition of traditional material, presented through rigid interaction schemes and awkward interfaces”.

Wong et al (2003) state that “If an e-learning system is not usable enough, it obstructs student's learning: the learners would not spend more time learning how to use the software rather than learning the contents”.

Abedour and Smith (2006) conclude that “E-learning has to work much harder than traditional learning to engage and retain the learner. In the classroom, content is ‘hidden’ behind the teacher who mediates the learning, whereas e-learning content is fully visible and has nowhere to hide; all its flaws are exposed, making it an easy target for detractors.”

Quintana (1996) found that “while students gain the advantage of flexibility in time, pace, and distance with web-based instruction, many of them feel isolated, suffer from a lack of motivation, or lack of support, and find that the feedback provided is too limited, and consequently drop out of their courses”.

Mitchell et al (2005) found that “users performed better with a system design matching their preferences” and that “students with low levels of web enjoyment need additional help those who enjoy the web were less likely to struggle with non-linear navigation”. It was suggested that “instructors can create an email list that includes all the email addresses of the students taking the same module, so the students can discuss their problems and share their experience with their classmates. This may also provide a way to gain encouragement from each other, which may increase their enjoyment. The purpose of these approaches is to incorporate a number of different teaching strategies to ensure that there is at least one effective strategy for each learner”.

Mclean (2004) gives a summary of how e-learning can be targeted to suite those with different learning styles as identified by Kolb (1984).

**Implementing and testing for e-learning usability**

Shin et al. (1994) suggest providing “recommendations on the sequence to follow through the material” for less confident users.

Aberdour and Smith (2006) refer to both Nielson and Gagné, stating that “the end result of successfully applying Gagné’s *nine steps of instruction* will always be a highly usable piece of e-learning content”.

**Gagné’s Nine Steps of Instruction**

- Gain attention - Stimuli activate receptors
- Inform learners of objectives - Creates level of expectation for learning
- Stimulate recall of prior learning - Retrieval and activation of short-term memory
- Present the content - Selective perception of content
Provide ‘learning guidance’ - Semantic encoding for storage in long-term memory
Elicit performance (practice) - Response to questions to enhance encoding and verification
Provide feedback - Reinforcement and assessment of correct performance
Assess performance - Retrieval and reinforcement of content as final evaluation
Enhance retention and transfer to the job - Retrieval and generalisation of learned skill to new situation

Ardito at al (2006) consider that the following must be evaluated:
- Analysis of learning needs
- Definition of learning goals
- Didactic content organization - is the organization of didactic resources consistent with the organization of defined learning goals?
- Selection of the teaching methodologies
- Learning assessment - are the assessment methods and tools suited for the courseware?

There is a need for a formative usability evaluation methodology that evaluates both the traditional usability and the pedagogical aspect of e-learning systems. The list of the usability factors investigated by Nguyen and Chang (2006) includes:
- Interface issues - factors such as attractiveness, consistency, customisability, error reduction/recovery, help and documentation, internationalisation, learner control, recall and recognition improvement, navigation support, and interactivity
- Pedagogical issues - these include learner control, learner activity, applicability, added value for learning, motivation, valuation of previous knowledge, and flexibility
- Information architecture issues - these include information organisation, sequencing of information, and search facility
- Accessibility/delivery issues - these include accessibility, download speed, adherence to conventions, and standards
- Multimedia issues - these include coherence of multimedia presentation, suitability of the multimedia used and synchronicity of multimedia presentation.

Lanzilotti et al (2006) define e-learning systems quality as “the extent with which technology, interaction, content and offered services comply with expectations of learners and teachers by allowing them to learn/teach with satisfaction” and go on to define “TICS” (Technology, Interaction, Content, Services) as follows:
- Technology - refers to the technological problems that can obstruct or make difficult the use of the e-learning system and to the hypermedia characteristics of e-learning systems
- Interaction - if an e-learning system interface is not usable, learners spend more time learning how to use the software rather than learning the content, which is their main goal.
- Content - this also refers to the way that the material is taught and to the capability of the e-learning system to propose study activities to the learner, who should also be free to autonomously choose his/her learning path.
- Services - it is necessary to provide users with communication tools, auto-evaluation tools, help services, search engines, references, scaffolding, and so on. Ease of learn and ease of use of such tools permit users to concentrate their efforts on the learning paths without being required to spend too much time trying to understand the way the e-learning system works.

Using TICS the authors have developed an evaluation methodology, called “eLSE” (e-Learning Systematic Evaluation), which prescribes a structured flow of activities. The main idea of eLSE is that the most
reliable evaluation results can be achieved by systematically combining inspection with “user-based evaluation”. The activities in the evaluation process are organised into a preparatory phase and an execution phase. In the preparatory phase, a number of decisions must be taken and the definition of a specific set of Abstract Tasks (ATs) created. ATs guide the evaluator’s activities by describing which elements of the application to look for, and which actions the evaluators must perform in order to analyse such elements. ATs indicate how to define the Concrete Tasks (CTs for short), i.e. the actual tasks that users are required to perform during the test.
Conclusions

For e-learning to be successful it must be engaging, relevant to the pedagogical aims of the course, accommodate students with a range of learning styles and contain help and hints for those who are less confident in using computer based materials. If the materials are usable for all students, including those with a range of disabilities, the user satisfaction will be higher and a greater proportion of the students’ time will be spent on useful tasks rather than with struggling and feeling alienated by the technology.

It is far more cost effective to consider usability at the design stage and it would therefore make sense for a portion of the budget and development time to be apportioned to this task, probably using a system similar to Lanzilotti et al (2006) with the designer’s developing and performing “Abstract Tasks” and recruiting some prospective users to test the system using “Concrete Tasks”. When creating “Abstract Tasks” it must be remembered that a variety of disabled users (e.g. dyslexic, blind, partially sighted, deaf etc.) will also need to complete these and thus some of the testing should involve using appropriate assistive technology. The various learning styles that students could adopt should also be taken into account.

Although it is best to consider usability during the development phase, any e-learning site could benefit from an in depth usability study designed by the course leader in conjunction with an e-learning usability expert.
References


