

ACCESSIBILITY AND MOBILE LEARNING

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Abstract: During the Digital Learning and MOBIlearn projects, the authors have acknowledged a new gap in defining accessibility in the context of mobile learning. This document describes this gap and seeks a broader definition of accessibility. Accessibility is discussed in terms of 1) usability, 2) a digital divide and 3) evaluation. First they describe how accessibility is traditionally understood in usability design and what issues mobility brings to accessibility. Secondly, equality issues are discussed in the context of a digital divide. Then the mobile learning evaluation framework is introduced and the implications of accessibility on evaluation are discussed. Finally, these perspectives are integrated and future research topics are proposed.

Keywords: mobile learning, equality issues, informal learning

1. INTRODUCTION

Accessibility has generally been defined as the ability of all people, regardless of the type or degree of disability, to have access to facilities and services. Another commonly used term is “Barrier Free”, implying that there should not exist any accessibility barriers for anyone. In order to find a reasonable way to use mobile tools in learning process the challenges in their accessibility must be recognised. Mobile learning process differs from a traditional e-learning process especially in an accessibility area. Learning, communication and observation tasks are now taking place outside classrooms and other training facilities, which reveal the vulnerability of accessibility concepts. Are we ready to be always accessible and available? Are current mobile learning services truly accessible in terms of learning and time management needs? Does the use of mobile learning services create

additional costs for the user? Should accessibility considerations also include the evaluation of required mental resources in mobile learning? These kinds of questions have been the daily concern in Digital Learning and MOBIlearn research projects. In order to respond to these questions, an evaluation framework has been developed in Digital Learning project.

2. THE RESEARCH PROJECTS

Digital Learning research project, funded by TEKES (the National Technology Agency in Finland), has been set up in order to investigate and develop new mobile and web-based learning and studying methods, tools, software programs and concepts (Digital Learning 2001). The pilots in Digital Learning have provided valuable input relating to accessibility. The following primary school example is used to describe the accessibility challenges of mobile devices. .

Nokia 9210 Communicators, which are originally designed for business-centric usage were used during the pilot. A teacher made an observation that the boys learned fast to use the interface of the mobile device. To them the device was a cool and entertaining gadget. On the other hand, the girls learned much slower, but their persistence paid off as they found faster the real meaning of using a mobile device in learning. This demonstrates that accessibility has many unpredictable aspects that have not yet been acknowledged properly. These aspects involve attitudes and orientations to new technical devices, which again affect motivation. Consequently, it is crucial to observe long-term use and whether or not a meaningful relationship to the media is formed.

MOBIlearn research project is a worldwide European-led research and development project funded by the EU IST-programme. The project explores new ways to use mobile environments to meet the needs of learners working independently or with others. A new m-learning architecture will support creation, brokerage, delivery and tracking of learning and information contents by using ambient intelligence, location-dependence, personalization, multimedia, instant messaging (text, video) and distributed databases. Field trials cover ‘blended learning’ (as a part of formal courses); ‘adventitious, location-dependent learning’ (during visits to museums); and ‘learning to interpret information sources and advice’ (acquiring medical information for everyday needs). (MOBIlearn 2003).

Our research team in MOBIlearn is responsible for usability and user interface research and design. In the pilot strands especially accessibility in relation to adaptation has proved to be interesting: for example, novice users hardly ever use the tools to adapt the interface. Consequently they are in an

unequal position in using the service compared to experienced users. Adaptability in learning systems should therefore be restricted to a couple of selections or definitions, like learning level (expertise) and instruction language.

3. USABILITY IN RELATION TO MOBILE ACCESSIBILITY

Usability can be seen as accessibility related in many different ways. Shackel (1991) points out that acceptance of an application by the end users can be seen as a primary goal of interactive systems design. In order to meet that goal the issues of utility, usability, likeability and costs should be discussed further.

Mobile devices are challenging from the usability point of view in several ways. First of all, a mobile device has a small display space. Therefore problems arising from the design of information presentation are essential. Secondly, input methods are limited in mobile devices. Thirdly, small devices have limited power. Also the context of a mobile system affects the input method. There are different situations in which people want to be connected to their learning resource. The WWW Consortium develops standards for mobile devices to support multiple interaction modes (<http://www.w3.org/2002/mmi/>). This multi-modularity gives us different interaction modes that can be implemented: speech, vision, pen, gestures and haptic interfaces. Interaction modes could enable communication between people with different devices anywhere and any time.

Usability issues can be approached as issues involving accessibility. In usability engineering the term accessibility is widely referred to as a web-centric phenomenon. The WWW Consortium has built series of accessibility guidelines published by the Web Accessibility Initiative (<http://www.w3.org/WAI/>) giving recommendation on how the Web should be accessible for everyone. The change from traditional e-learning solutions to mobile ones requires careful examination of existing accessibility related issues. In that change of the culture it would be reasonable to use these existing guidelines.

In designing proper mobile learning devices all usability risks should be taken into consideration. Especially in the case of mobile devices and their interfaces all usability factors are crucial. When testing a www-page, the context and environment are of second interest and the traditional design principles presented by Nielsen (1995) apply. But, when testing the usability of a mobile solution, the context is the key element. Lindroth and Nilsson (2001) have argued that it is difficult to test mobile devices with traditional

usability test methods. Designers should be aware that the devices are for real mobile situations. One example of these real situations is a person walking in a rain with the mobile device in hand. On the EU level, accessibility issues have been approached under ‘Design for all’ and eAccessibility initiatives. Accessibility has been defined in terms of people with different needs or different types of disabilities. One of the main objectives is a social inclusion: especially the integration of older people and people with disabilities into the information society. The means to achieve this is to design mainstream products and services to be accessible by as broad a range of users as possible operating within the widest possible range of situations. The idea is to offer means and recommendations to design better usability and accessibility for environments, products and services, and to promote standardisation. Usability aims at easiness of use by emphasizing normal and typical, whereas accessibility considers different uses, which can even be characterized as atypical or abnormal. This means that there are potential conflicts, but usually usability and accessibility considerations largely lead to similar guidelines and solutions. (The Diffuse project 2002).

On the other hand, if the restrictions and barriers to special groups, e.g. the handicapped or the elderly, are taken as problems to be solved in design, the solutions can be useful to everyone. When considering the digital divide, advocating accessibility can also be seen as means to facilitate using the web or mobile services without skills needed for the typical PC use. Here different needs may cause conflicting requirements as well. In mobile learning situations learners may be on a different level, prefer different learning styles or orientations and may need different content and support. Also the contents and presentation of the services have to be adapted according to the device and network characteristics (Kaasinen 2000).

4. ACCESSIBILITY AS A MOBILE LEARNING EVALUATION COMPONENT

As mobile devices are a pervasive medium they can help to combine work, studying and leisure in a meaningful way (Ahonen, Joyce, Leino & Turunen 2003). Sharples (2000) has pointed out that mobile devices should be seen especially from the perspective of lifelong learning. Likewise, we consider mobile learning as a persistent activity, which requires a long-range use of mobile devices. In Digital Learning project researchers have developed a model for the evaluation of mobile learning. The following “m-learning components”-model especially takes notice on flexible (Collis & Moonen, 2001) and informal learning practices:

- Continuity and adaptability between learning contexts: How to support spontaneous learning?
- Learning as a personal process. Are the mobile learning products taken personally?
- Contextuality in learning: Is the context of learning better recognized in learning process?
- Accessibility: What is the adequate skill level for mobile learning?
- Support for time and learning management. How to support learner's self-monitoring and regulatory processes?
- Flexible interaction. How to enhance communication between peer-learners?

Later the components of m-learning will be operationalised into an on-line self-rating questionnaire adopted for two target groups representing the Finnish comprehensive school students (N=90) and adult learners (N=50) who have real m-learning experiences. The components will be utilized for developing evaluation methods for m-learning materials and environments. They also provide approaches for building m-learning learner profiles, applications and materials. The accessibility is seen here as the kind of competence a mobile learning solution expects from a learner: whether reasonably many can easily achieve meaningful learning with these expectancies. This has important consequences to the user-centered design. Failing to notice this leads to inequality. On the other hand noticing this means also realizing the cultural differences of the user groups.

5. UNITING PERSPECTIVES OF ACCESSIBILITY

We foresee that mobile accessibility issues should be inspected from a wider perspective than often referred in usability literature. The combination of a traditional special group and an equal accessibility point of views offer a new important way to see this matter. In this paper also other ways are suggested to enhance the scope of accessibility.

Research results arising from the CSCW (Computer Supported Co-operative Work) area have interestingly some models that integrate those earlier mentioned, new accessibility elements for mobile use. The following figure from Churchill & Wakeford (2002) indicates needs to consider the distance of information and levels of mobility.

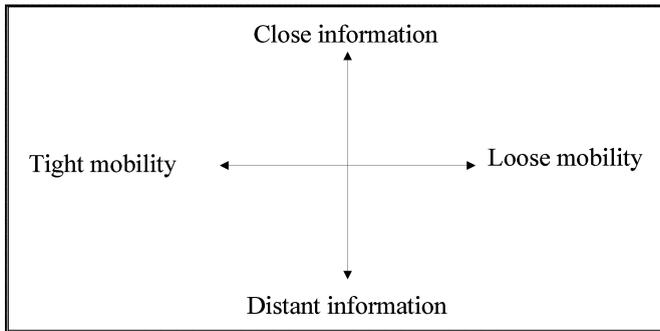


Figure 1. Design dimensions for mobile collaborations

Although mobility is usually associated with movement between geographically situated spaces, and is therefore linked to travel, it must also be thought in terms of time and not simply as expedient goal achievement. Mobile workers do not just need to connect while on the move (in airports, on trains, in cars and at remote locations). Their fundamental experience of mobility is embedded in an experience of temporality, which includes mutually negotiated rhythms of contact, availability and accessibility. (Churchill & Wakeford 2002, 173). The temporality and synchronicity of communication provide new noteworthy challenges for designing accessible mobile learning services.

We argue that the questions stemming from digital divide (Norris 2000) research practices should also be taken into account in designing accessibility for mobile learning. According to Sharples (2000), wider access to learning resources in the worldwide web from public places such as libraries has been seen as an answer for this. Less consideration has been given for providing technology to help people to learn when and wherever they choose and to support personal learning throughout a lifetime.

Drake (1999) mentions that learning must be a life-long process, but it also needs to be seen as a life-wide and life-deep as well in order to fully support the preparation for life. Therefore, to support lifelong learning, learning outcomes should be adaptable to the multitude of life situations. This means noticing people with different needs and different skill levels.

6. CONCLUSIONS

Accessibility should be seen as a more multifaceted area of usability and it should be implemented in designing products for mobile educational

purposes. Many old guidelines still apply but some important new ones are as well worth inspecting. This should also be taken into account in evaluation, especially in the case of mobile learning if the devices are seen from the lifelong and life-wide learning perspectives. Having potentially wide impact on everyday life and ways of action, this can in the worst case be a source of inequality and a new item of digital divide discussion.

Future research questions for accessibility in mobile learning could include online and offline synchronization studies in CSCW and CSCL contexts. Also better understanding on the time management is needed from users' personal perspectives. Mobile learning prototype development should advance towards recognizing more comprehensive definition of accessibility. This in turn means supporting all four areas of mobility mentioned by Churchill and Wakeford and better understanding of the personal resources people have to work with.

REFERENCES

- Ahonen, M., Joyce, B., Leino, M. & Turunen, H. (2003). Mobile Learning - a Different Viewpoint. In H. Kynäslähti & P. Seppälä, (Eds.) *Mobile Learning*. Helsinki: IT-Press.
- Churchill, E. & Wakeford, N. (2002) Framing mobile collaborations and mobile technologies. In B. Brown, N. Green, & R. Harper (Eds.) *Wireless World. Social and Interactional Aspects of the Mobile Age*. London: Springer.
- Collis, B. & Moonen, J. (2001). *Flexible learning in a digital world: experiences and expectations*. London: Kogan Page.
- Digital Learning. (2001). *Project web-pages*. (2001, 20.10.2001). Retrieved 14.02, 2003, from <http://dll.hamk.fi/dl/en/index.html>
- Drake, C. (1999) Values Education and Life-wide Learning. Paper presented at the 16th Annual Conference of the Hong Kong Educational Research Association. Retrieved 14.2.2003 from <http://www.livingvalues.net/pdf/lvlearning.pdf>.
- Kaasinen, E. (2000) *Mobile-transparent approach to adapt web services for WAP devices*. Available http://www9.org/w2-mobileweb/www9_workshop_kaasinen.html.
- Lindroth, T. & Nilsson, S. (2001). *Contextual Usability. Rigour meets relevance when usability goes mobile*. Retrieved 14.2.2003 from http://ecis2001.fov.uni-mb.si/doctoral/Students/ECIS-DC_LindrothNilsson.pdf.
- MOBilearn (2003). *Project pages*. Retrieved 14.2.2003 from <http://www.mobilearn.org.acce>.
- Nielsen, J. (1995) *Multimedia and hypertext. The internet and beyond*. Boston: AP Professional.
- Norris, P. (2000). *The Digital Divide*. Retrieved 14.2.2003 from <http://ksghome.harvard.edu/~pnorris.shorenstein.ksg/acrobat/digitalch1.pdf>.
- Shackel, B. (1991). Usability – context, framework, design and evaluation. In B. Shackel & S. Richardson (Eds.). *Human Factors for Informatics Usability*.(pp.21-38). Cambridge: Cambridge University Press,
- Sharples, M. (2000) The Design of Personal Mobile Technologies for Lifelong Learning. *Computers and Education*, 34, 177-193. Retrieved 14.2.2003 from <http://www.eee.bham.ac.uk/sharplem/papers/handler%20comped.pdf>.

- The Diffuse Project, (2001). *Guide to Web Accessibility and Design for All*. (2001, December 2002). Retrieved 14.2.2003 from <http://www.diffuse.org/accessibility.html>
- W3C. (2002). *Multimodal Interaction Activity*. Retrieved 14.2.2003 from [http://www.w3.org/2002/mmi/..](http://www.w3.org/2002/mmi/)
- W3C. (2002). *Web Accessibility Initiative (WAI)*. Retrieved 14.2.2003 from <http://www.w3.org/WAI/>.

BIOGRAPHY

Antti Syvänen has research interest in the human emotion, motivation and cognition related to using new communication technologies in learning. His recent research has focused on developing a theoretical model, evaluation methods and meaningful future scenarios for effective mobile learning.

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