MOBILE DEVICES AND THE FUTURE OF FREE EDUCATION 2009

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Summary

Significant changes in technology are making free education possible. The most significant factor is the growth of the Web, which is now available globally to anyone who can access the Internet. And, access is becoming possible using low cost wireless devices that are becoming more and more available at lower and lower prices.

The Open Educational Resources movement with low cost course development and mass customization, along with new modes of elearning are revolutionizing education. A major technological trend is the growth in popularity of mobile devices, where the cellular phone is no longer just for speaking, but also for text messaging, photography, radio, even digital TV, web browsing etc. using mobile phones, personal digital assistants, handheld computers, ebooks and other untethered devices.

Another factor supporting the trend towards free education is the growth in economic importance of knowledge. Human capital has never been so important. The changes described in this paper point to significantly more open access to learning opportunities. Developing international standards for interoperability, open source and open access initiatives, the power of networks, along with the potential effects of exponential technological change, will make learning available globally to anyone who can access the Internet using mobile devices.

The costs of education can never be totally eliminated, but present trends point to the possibility of an asymptotic curve, where the education costs will continue to approach zero, without ever quite reaching it. These curves can be deceiving as the drop in costs increases exponentially. At present, we are near the top of this curve and so, the drop is only beginning to be noticeable. This curve is being driven by several factors.

Perhaps, the most significant factor is the growth of the World Wide Web, which is now available globally to anyone who can access the Internet. With the WWW, educators can reach an infinite audience. The growth of the WWW is contributing to the phenomenon of the "Death of Distance". With global telecommunications systems, satellites, wireless nodes and the ubiquity of the Internet, geographical distance is becoming irrelevant. Two significant trends in telecommunications and computers are also driving down costs. The first is Gilder's Law, where George Gilder has noted that the costs of telecommunications are dropping drastically with digitalization. The costs of high bandwidth Internet connections and long distance telephone calls are on a consistent downward trend, with no end in sight. Unfortunately, for some although the costs are going down for the Telcos, the prices are not. With growing competition from all sides, this downward trend in prices will prevail. The second trend is more well known --Moore's law notes the accelerating reduction in the cost of

computing power. The computer you bought last year will have half the power of today's computer at the same price point. More specifically, Moore's Law states the number of transistors on a chip doubles every 18 months. As a result, the cost-performance rises as the square of the number of transistors. While these and other trends are underlying this pricefall, two other trends are becoming more noticeable. The rising availability of open access learning materials and the ever increasing ubiquity of small powerful computers or mobile devices.

Open Educational Resources (OER)

OpenCourseware or Open Educational Resources (OER) are becoming important resources for both learners and instructors as the quantity and quality of the online content increases. The recycling and re-use of learning resources encapsulated as learning objects in standards-based repositories can significantly increase the cost effectiveness of both online and blended education. With a wise and considered implementation and integration of repositories and the removal of intellectual property barriers, we can reduce what is perhaps the largest barrier to participation in higher education, namely, the high, and growing individual and societal cost, while increasing quality and opening up mass participation in learning in a wide variety of ubiquitous computing environments.

In order to take full advantage of the OER materials that are available, instructors, developers and learners need to know more about OpenCourseware repositories and have some training in how to make optimal use of them. The best strategies for incorporating learning components into lessons and these into modules and courses have yet to be identified, yet there is growing evidence that these resources can be used effectively (Flexible Learning Advisory Group, 2003; Han, 2006). In this emergent stage, users need to learn what OER repositories are available and how to make use of them for learning and how to easily and quickly evaluate their efficacy in particular contexts. They are being used in 2008 and the number of learning resources being accessed is growing. The seamless interoperability of these resources housed in different repositories has yet to be achieved, as they have for the most part been developed independently with some notable attempts at rendering them interoperable. The ability to use learning objects seamlessly and consistently in different application environments, most recently on mobile devices, has been at least partially achieved (Liu, Abdulmotaleb, & Saddik, n. d.; eduSource, 2005; Sampson & Karampiperis, 2004; Osborne, 2005). Nevertheless, in maximizing the capabilities of the WWW, external LOs can be successfully integrated with course materials if not in a fully interoperable manner.

One necessary component of interoperability is the absence of digital rights management (DRM) software. DRM can be a significant impediment to interoperability. Learning resources must be usable without the necessity of entering into a special contractual arrangement with an offering party or parties. Licensing, subscriptions and other digital rights paraphernalia restrict the use of the content. The need for copyright clearances, contracts and licenses inhibit reuse. When access is hindered by these DRM devices, users just turn away. OER overcomes these difficulties facilitating access and the integration of learning materials into lessons and courses.

Mobile Learning

Combine this with the growing ubiquity of mobile devices and the possibility of free education becomes possible for the first time. M-learning is an emerging area of distance education. Elearning, which has only recently come into its own, is now being transformed by the Internet and by the power of wireless technologies into M-learning. Globally, there are more than one billion Web-enabled mobile phones, netbook computers, and other mobile devices. Combined, these devices now outsell PCs by a wide margin. Certain occupations such as

health professionals, technicians, police, sales people etc. are well-suited to open up the possibilities of M-learning, which is positioned to transform training to take place at and when it is used, in the workplace, home, and other learning environments. M-learning is well positioned to at first complement, then transform our traditional learning environments.

PCs became ubiquitous in the developed world when their cost dropped below $US3000 or the average monthly salary of workers in those countries. The cost of cell phones and other simple mobile devices has now dropped to less than US$70, which is below the average monthly salary of workers in the under-developed world. India has just produced a protype for a $10 computer. This global ubiquity of mobile devices will drive M-learning as an important means of delivering education and training, especially in the workplace (Rheingold, 2003).

M-learning is an exciting new field. To date, elearning has been focusing on PCs and delivery of online courses to the home or workstation. M-learning is novel in that it w allows for the delivery of learning to anyone, anywhere, at any time using ubiquitous mobile devices. The lessons learned in this new environment will impact significantly not only on elearning, but also on traditional learning. In the near future, mobile learning will become a normal part of everyone's education.

According to Keegan (2002), M-learning is the first stage in the creation of a global provision of training on the wireless internet. It sets in place the first building block for the next generation of learning which is the movement from distance learning (DLearning) and electronic learning (ELearning) to mobile learning (M-learning). Recent data to support the case for mobile learning indicate that (1) There are presently more than 1 billion wireless internet subscribers worldwide. (2) Multi-purpose handheld devices now outsell laptop/desktop computers combined.

M-learning happens in context in which it is needed and relevant and is situated within the active cognitive processes of individual and groups of learners. Thus, it gains in authenticity, immediacy and relevance (Herrington & Oliver, 1999). As long ago as 1989 Brown, Collins and Duguid argued that education that is situated in a meaningful context, such as that experienced in apprenticeship is not only more relevant but actually more effective. Twenty years later we see the emergence of technologies that accompany the learner in their authentic workplace. These technologies exploit the affordances of the Net – they provide access to vast amounts of searchable information, they support communications in multiple formats among humans and they support the processing and computational power of autonomous agents continuously sorting, sifting and processing this information. (Anderson, 2003) argues that these three affordances can be selectively used to substitute teacher, student and content interactions for each other creating customized forms of educational programming – some of which are ideally suited for mobile, anytime delivery.

The US army is promoting M-learning because of its ability to significantly increase the speed of access to learning and the speed of the learning process itself. This is combined with the known efficacy of learning just in time (Mobile Computing Online, 2002).

The need for good pedagogy for M-learning is supported by Harris (2001), who predicts the principal advances in mobile learning will shift from infrastructure-related areas to content. He claimed that the biggest challenge is how to chunk content in a granular way and develop the content so it can be deployed in different forms. Designing content for mobile learning devices requires a whole new perspective and little work has been done in this area. AU has done some ground work on learning objects, which must be considered when developing learning materials for mobile learning devices. Other variables that should be looked at when conducting research on mobile learning include design for mobility and how to provide timely training; how individuals behave in a wireless Internet environment; simplicity of the

interface; and the storage, display, and speed capacity of the mobile device (Baek, el al., 2002).

Ring (2001) reported on a study where students took a course using wireless phone technology. Data from the study indicated that 93% of students having wireless access reported that the technology made the course more convenient. Some specific comments from students include: they could work from anywhere, was able to access the course while traveling in a taxi or waiting for a bus, the wireless technology gave freedom, and they were able to use the technology to get an overall feel for the content in the course. Research is needed to determine how to develop the technology and courses for mobile learning to meet the needs of students with different styles and characteristics.

At the same time, M-learning research is high risk because many institutions have only just made concessions to support elearning generally and M-learning represents a quantum leap forward (or sideways) not just in the computer applications and hardware used, but also in the pedagogy. Many institutions would feel more comfortable settling in with the elearning changes they have implemented rather than exploring further in the uncharted territory of M-learning.

M-learning is a new area of research, but it builds on distance educators' expertise in elearning and particularly for AU in the development of learning objects. AU ha been a leader in the support of interoperable learning object repositories across Canada and internationally (eduSource, 2003). AU has been the lead player in the development of the CanCore metadata profile for the IEEE Learning Object Metadata, that enables search, retrieval and interoperability of educational resources (CanCore, 2003). These are crucial infrastructures needed for the practical implementation of M-learning. So, as M-learning emerges, AU exploit its early success in the pedagogical application of telecommunications technologies.

AU has taken the first steps in leading an educational transformation with M-learning projects. Building upon our considerable knowledge of past and ongoing research related to distance learning and more lately elearning, we are piloting and conceptualizing the most effective next steps involved in developing high quality M-learning applications. For example, AU's School for Computing and Information Systems has just completed several pilot project on the feasibility of downloading courses to mobile devices for delivery to students. The pilot projects were able to convert parts of a course into XML format for downloading onto mobile phone for wireless access (Ally, McGreal et al. 2008). AU will use this recent experience and its leadership in the development of learning object repositories, formalized learning designs, and metadata standards to promote M-learning (Cheung, Stewart & McGreal, 2006; McGreal, Stauffer & Tin, 2007).

In other AU research, investigators are addressing three aspects of M-learning services: (1) managing users (student and tutors) mobility through a framework based on a "virtual home environment" concept; (2) ensuring service personalization by using mobile profiles and dynamic learning objects; and (3) providing interactive students' assessment by using mobile intelligent agents for a variety of tasks including one that will generate assessment reports using the information collected from the assessment methods implemented by the dynamic objects and the information collected from tracing the students' interaction and navigation.

These early experiments have shown us the potential of this research direction, but we, like nearly all other elearning researchers, educators and trainers, have hardly begun to articulate and undertake an integrated M-learning deployment agenda. Public institutions and private training companies are moving quickly into this area and quickly developing skills, techniques and products to meet the ever increasing demand for life long learning.

Conclusion

The growth of the World Wide Web and the consequences of Gilder's Law on the cost of telecommunications and Moore's law on the cost of computing power have opened the door for the first time to the possibilities of open and free education disseminated globally at minimal cost. This has led to the rising availability of open access learning materials that are interoperable, reusable and repurposable by many learners and learning institutions. They can access this free content from anywhere at anytime because of the ever increasing ubiquity of small powerful computers or mobile devices.

REFERENCES

Ally, M., **McGreal, R.**, Schafer, S., Tin, T., & Cheung, B. (2008). Use of a mobile digital library for mobile learning. In G. Needham & M. Ally (Eds.), *Mlibraties: Libraries on the move to provide virtual access* (pp. 217 - 227). London: Facet Publishing.

Anderson, T. (2003). Getting the mix right: An updated and theoretical rational for interaction. *International Review of Research in Open and Distance learning, 4*(2) Retrieved Oct 30, 2003 from http://www.irrodl.org/content/v4.2/anderson.html.

Baek, Young-Kyun; Cho, Hyun-Jung; Kim, Bo-Kyeong. (2002). Uses of learning objects in a wireless Internet based learning system. Proceedings of the International Conference on Computers in Education (ICCE'02), p. 1-3.

Brown, J.S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher, 18*(1), 32-42.

CanCore. (2003, 23 April). Retrieved April 25, 2003, from http://www.cancore.ca

eduSource. (2003). *eduSource Canada*. Retrieved 28 March, 2003, from http://www.edusource.ca

Cheung, B., Stewart, B., & McGreal, R. (2006). Going mobile with MOODLE: First steps *IADIS International Conference Mobile Learning* from http://klaatu-dev.pc.athabascau.ca:8080/dspace/handle/2149/413

eduSource. (2005). *eRiB: eduSource Repository-in-a-Box*. Available http://edusource.licef.teluq.uquebec.ca/ese/en/install_erib.htm

Flexible Learning Advisory Group. (2003). VET learning object repository: Green paper for discussion: Australian National Training Authority. Available http://pre2005.flexiblelearning.net.au/projects/resources/VLOR_green_paper.doc

Han, Y. (2006). GROW: Building a High-quality Civil Engineering Learning Object Repository and Portal, *ARIADNE*. Available http://www.ariadne.ac.uk/issue49/yan-han/

Harris, P. (2001). Going mobile. *Learning Circuits, ASTD Online Magazine*, July 2001, http://www.learningcircuits.org/2001/jul2001/harris.html

Herrington, J., & Oliver, R. (1999). Using situated learning and multimedia to investigate higher-order thinking. *Journal of Interactive Learning Research, 10*(1), 3-24.

Keegan, D. (2002, November). *The future of learning:ZIFF papiere 119: From eLearning to mLearning*. Retrieved October 25, 2003, from http://www.fernuni-hagen.de/ZIFF/ZIFF_PAP_119.pdf

Liu, X., Abdulmotaleb, & Saddik, E. (n. d.). *Multimedia learning object metadata management and mapping tool*. Available(eduSource, 2005) http://www.elg.uottawa.ca/~elsaddik/abedweb/publications/MMLOM.pdf

McGreal, R., Stauffer K., & Tin T. (2007). *Mobile Moodle: Using Moodle to support and enhance mobile learning. Moodle Moot Conference*. Paper presented at the First Canadian Moodle Moot. Edmonton, AB. April.

Mobile Computing Online. (2001). *Learning is mandatory; presence is optional*. Retrieved August 1, 2001, from http://www.mobilecomputing.com/showarchives.cgi?145:1

Osborne, G. T. (2005). *Towards an interoperable approach: Recommendations for an institutional learning object repository.* Unpublished Master's thesis, Athabasca University, Athabasca, AB

Rheingold, H. (2003, October 24). *Smart mobs: Lecture at Stanford University*. Retrieved November 2, 2003, from http://stanford-online.stanford.edu/courses/cs547/031024-cs547-100.asx

Ring, G. (2001). Case Study: Combining Web and WAP to Deliver Elearning, *Learning Circuits, ASTD Online Magazine,* June 2001. http://www.learningcircuits.org/2001/jun2001/ring.html

Sampson, D., & Karampiperis, P. (2004). Reusable learning objects: Designing metadata management systems supporting interoperable learning object repositories. In R. McGreal (Ed.), *Online education using learning objects* (pp. 207 - 222). London: RoutledgeFalmer.