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Introduction

# Web-enhanced higher education: a tower of Babel

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**Abstract**

The Internet has a unique number of qualities which can allow teachers at all levels to create and use new tools to introduce and personalize the learning experience for their students. This medium carries vast quantities of information in all different formats and modalities such as text, figures, video and audio (both downloadable and streaming). It is dynamic in that new information is being added and 'old' information is either being updated or removed every moment of the day and night. Much of this information is first-hand data which has been uploaded from the original sources. The information, finally, is constantly accessible (365/24) from anywhere where a telephone can be used. Making optimal use of this 'gold mine' for education means that educators must learn how to use it properly, otherwise it could become a 'Pandora's box'. This special issue presents seven articles dealing with Web-enhanced higher education from the competencies needed to design and develop it to the ways in which its use can best be evaluated and the barriers to its implementation. 

E-learning has appeal. We can already do a lot with information and communication technology (ICT) and so much more appears to be possible, especially in the field of education and learning. According to John Chambers, CEO of Cisco Systems, education is the next "killer application" on the Internet. The Massachusetts Institute of Technology (MIT) recently decided to make the materials for nearly all its courses freely available on the Internet over the next 10 years through its OpenCourseWare project (Richards, 2001). Professor Steven Lerman, Chairman of the Faculty at MIT, stated that MIT needs to make use of the enormous

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potential of the Web to further build upon MIT's tradition of sharing knowledge and innovating education. He noted the potential of OpenCourseWare to teach and to train students and young faculty in developing countries. Named benefits coming from the MIT OpenCourseWare project are:

1. Institutions around the world could make direct use of the MIT OpenCourseWare materials as references and sources for curriculum development.
2. Individual learners could draw upon the materials for self-study or supplementary use.
3. The MIT OpenCourseWare infrastructure could serve as a model for other institutions that choose to make similar content open and available.
4. Over time, if other universities adopt this model, a vast collection of educational resources will develop and facilitate widespread exchange of ideas about innovative ways to use those resources in teaching and learning.
5. MIT OpenCourseWare will serve as a common repository of information and channel of intellectual activity that can stimulate educational innovation and cross-disciplinary educational ventures.

Through Harcourt University, Harcourt may become the first major publishing house to offer accredited college degrees, pending approval from the New England Association of Schools and Colleges (Learnframe, 2000). They are also busy with an Internet high school for students planning to take high school equivalency exams and it has recently made a large investment in Family Education Network providing content for its site (Banc of America, 1999).

People speak and dream of new types of initial and post-initial education/life long learning making use of powerful electronic learning environments made up of integrated worldwide networks of multimedia computers with limitless access to interactivity between participants for education that can be delivered anytime, anywhere to anyone. We are at a loss to think of new possibilities and stronger superlatives.

But all that glitters is not gold. Real E-learning will turn a part of the world upside down, but the largest question looming at this moment is whether education (with its laws, institutions, teachers, administrators, parents, students, etc.) can 'easily' make all of the changes needed. In the present context it appears that education wants to embrace the possibilities of ICT while, at the same time exhibiting typical negative and defensive behavior towards the penetration of modern technology in the educational process. In the average school, children are better versed in the possibilities of computers and the Internet than their teachers (new learning in old schools!). Schools forbid the use of cell phones (they must be turned off in school) instead of integrating them into an interactive public address system for the school.

Furthermore, large portions of education are not equipped for this transformation nor are they easily motivated to 'experience' it. Conceptually it appears that the educational imagination is quite limited as seen by the fact that most electronic learning materials are not much more than the traditional study book or syllabus

dropped on the Web. This can also be considered a serious risk to the educational effectiveness of Web-based learning environments. A close look at many other Web-based educational environments reveal two other risks. First, it appears that instructional designers feel tempted to put too much emphasis on form and excessive use of multimedia and that this can become an end in itself. Second, poorly structured hyperlinking may cause failures in navigation and not facilitate overview and use of the materials. Real integration of ICT in the primary process appears in dribs and drabs. In the coming period we will see a large discrepancy between new developments and possibilities and the classical reflex towards conservation and security.

Finally, a small reality-check Cisco was at one point — in the bull market of 2000 — the largest company in the world based upon their market capitalization (ca. $500 billion). At a certain point in 2001 only 1/5 of this market cap remained. The lesser gods under the Internet companies had it even worse in the bear market that followed. At the moment of writing investors are very wary to invest in the Internet market. This could have deleterious consequences for Web-enhanced learning.

## 1. What is E-learning?

What is E-learning precisely? A search of recent literature (traditional and electronic) does not deliver a clear and unequivocal picture. A look in the pool of definitions results in at least five different — partially exclusive and sometimes contradictory — definitions of E-learning.

Cisco Systems defines E-learning as "Internet-enabled learning that encompasses training, education, just-in-time information, and communication." Components can include content delivery in multiple formats, management of the learning experience, and a networked community of learners, content developers and experts.

The American Society for Training & Development (ASTD, 2001) along with WR Hambrecht and Co. employ a much broader definition of E-learning, namely "anything delivered, enabled, or mediated by electronic technology for the explicit purpose of learning. The term includes online learning, Web-based learning, and computer-based training. It excludes things that might fit under "distance learning" BUT are non-electronic, such as books. It also includes learner-to-learner interactions, as occur in our online learning community."

The Masie Center sees E-learning as the use of network technology to design, deliver, select, administer and extend learning. The ultimate goal is to "...bring learning to people instead of bringing people to learning." (Learnframe, 2000).

US Bancorp sees E-learning as E-xploration, E-xperience, E-ngagement, E-ase of use, and E-mpowerment via the web.

E-Learning Showcase sees E-learning as a system of five components that work seamlessly together to personalize and deliver learning. The components are:

1. Real-time *collaboration* technology for deployment opportunities beyond traditional instructor-lead training.
2. *Content Providers* for learning content.

3. *Competency Assessment* to accurately evaluate an individual's competency of different skills.
4. *Skills Management* to enable employees and managers to validate on-the-job experience.
5. *E-Learning management* to tie all of the solution components together with tools to integrate the process of scheduling, delivering, and measuring the success of your curriculum.

Although there are many definitions, the 'gurus' agree that:

> The e-Learning sector is just beginning to emerge. Just as the Internet has transformed the retail market, we remain confident that it will also transform the education and knowledge markets. As stated in a New York Times article summarizing John Chambers' (CEO Cisco Systems) comments at 1999's COMDEX Conference, "The next big killer application for the Internet is going to be education. Education over the Internet is going to be so big it is going to make e-mail look like a rounding error." As more individuals become connected, the Internet will penetrate deeper into our everyday activities, including the way we learn (Close, Humphrys, & Ruttenbur, 2000).

We, and this journal, have decided to use the term Web-enhanced learning for this special issue. Web-enhanced learning is learning (and thus the creation of education) where the Internet plays an important role in the delivery, support, administration and assessment of learning.

## 2. Goals of E-learning/E-promises

If we are to believe the literature, E-learning is the most promising development in education since Gutenberg's invention of movable type. A grab at the goals/promises are:

increased access to learning;
more personalized learning;
more individualized learning;
stimulation of collaboration and cooperation of all participants at all levels;
empowerment of learners;
increased accountability;
increased currency (up-to-date) of content;
increased efficiency and effectiveness of education;
reduced costs;
reduced learner time to competence; and
rapid adoption of new information and new programs.

Beyond this, E-learning is said to have enormous possibilities for business and commerce such as:

increased productivity,
increased profitability, and
strengthened employee loyalty

In short, E-learning is a panacea! In this special issue we, and the separate authors, will attempt to add a touch of reality to what Web-enhanced learning is and what it can become. To this end, seven articles will be presented highlighting seven different aspects of Web-enhanced education ranging from approaches to Web-enhanced learning, through assessment of IT-support through training of teachers in design methodologies.

In the first article of this special issue of *Computers in Human Behavior* entitled Web-Enhanced Learning, Tennyson aims to improve the general field of instructional technology as well as work in the field of Internet-based learning by defining the basic core knowledge associated with expertise of instructional technologists. He argues that the competency of the instructional technologist in the three basic core knowledge areas of educational foundations (EF), instructional systems development (ISD) methodology, and instructional development (ID) process is an important variable determining the success of instructional development processes in solving learning and performance problems in technology-based environments. It is interesting to compare Tennyson's core competencies with those, for example, of the International Board of Standards for Training Performance and Instruction (http://www.ibstpi.org/summary.html). Depending on their level of expertise in each of the core knowledge areas, Tennyson distinguishes between three types of instructional technologists, namely, the IT novice, the IT apprentice, and the IT expert. In the appendix to Tennyson's article, the readers can find an ID core competency worksheet that can be used to evaluate their competency as an instructional technologist. The outcome of this self-evaluation can be used in any educational planning or IT experiences.

In the following article Christensen and Dunnagan expand upon this notion by immediately focussing on increasing the instructional developer's foundations in the instructional technologies available for the designer. The article highlights both currently available instructional technologies and the trends for future instructional support systems in the context of an informed instructional development (ISD) practitioner, giving the reader a sense of the depth and breath of applying technology to instruction.

In line with Tennyson's claims, Hoogveld, Paas, Jochems, and Van Merriënboer trained teacher trainers in using an instructional systems design approach to improve their instructional design competency. This third article reports on an experimental study into the effects of Web-based training in an instructional systems design approach on teachers' instructional design behavior. They argue that the teachers' conventional design approach, which is focused on the teaching principle of knowledge transmission, cannot be used to implement new learning process-oriented educational principles into the instructional design process of study units. They provided teachers of Dutch Polytechnics with a Web-based ISD training and compared the effects to a control group of teachers that was trained to optimize their conventional

design approach. The results suggest that an ISD training can effectively support teachers' instructional design strategies for competency-based education.

Web-based or Web-enhanced multimedia learning packages with functions such as hypertext links, floating captions and the ability to open parallel windows (e.g. running a second browser while the first is still open) allow designers, developers and users of instructional materials to present or retrieve information exactly when it is necessary or desirable (just-in-time presentation). This is immensely different from traditional didactic instruction or instructional materials and, though often considered to be positive, can also create problems for learners primarily due to the extra demands that it places on the processing of the 'extra' information. In the fourth contribution to this special issue, Kester, Kirschner, Van Merriënboer, and Baumer present a just-in-time information presentation (JIT) model and an exploratory study investigating the relationship between the model and learners' natural behavior. The JIT model was based on the Four-Component Instructional Design model (Van Merriënboer, 1997) and assumed that to attain the learning outcome of transfer, information that is supportive to the performance of non-recurrent aspects of a complex skill should be presented before practicing task clusters and information that is prerequisite to carry out the recurrent aspects of the skill should be presented during practice of learning tasks. Kester et al. hypothesized that learners who show behavior that is consistent with the model will achieve higher transfer test performance than other learners. The results have important practical implications for the realization of Web-enhanced education.

The fifth article, by Retalis and Skordalakis, introduces a promising methodology for developing Web-based instructional systems. The authors' dissatisfaction with existing answers to the instructional developers' question of how to profit from the specific strengths of networked technologies, stimulated them to merge the instructional system design methodology (ISD) with the artificial systems development methodology (YASM) into the CADMOS methodology. Some preliminary evidence is presented that CADMOS can support instructional developers in taking advantage of the added value of networked technologies for educational use of the World Wide Web.

Stavredes used a system dynamics approach to develop a dynamic model for understanding the variables that are important determinants of the success of implementing technology-enhanced learning environments within higher education. For successfully implementing and sustaining technology programs, the model identifies the importance of the role of faculty perceptions of program value, and it distinguishes between the three key resources of time, skill, and support. The model can assist stakeholders in understanding the dynamic interaction of department and university support and the resulting patterns of commitment to technology implementation by faculty. Also, it may contribute to our understanding of faculty adoption rates of technology use in the classrooms of higher education.

The final contribution to this special issue by Wedman and Diggs, provides a performance improvement framework for identifying and dealing with a broad set of interrelated factors that function as barriers to technology-enhanced learning. The framework is illustrated with a case study that focused on identifying barriers to

creating and implementing a technology-enhanced learning environment in the Columbia teacher development program of the University of Missouri.

## 3. Conclusion

A general assumption underlying all contributions to this special issue is that, currently, it is almost impossible to find real 'Web-enhanced' education. A recent special issue of the journal *CyberPsychology & Behavior* (Hall, 2000) on Education, Hypermedia, and the World Wide Web makes clear that this is not an isolated assumption. In that issue, Schank (2000) expressed this issue aptly by stating that most existing virtual courses are basically parodies of existing courses.

From the current special issue, the absence of Web-enhanced education can be argued to originate from the combination of the lack of instructional design competence and the lack of specific instructional design methodologies. The first cause can be derived from Tennyson's contribution. To be able to develop instruction for a technology-based environment, the instructional technologist needs to be competent in the three core knowledge areas of educational foundations, instructional systems development methodology, and instructional development process. It is clear that there are only a few people who have expertise in all of these core knowledge areas. The second cause, which was articulated by several authors, is that the available methods for developing Web-based instruction are not yet mature enough to enable developers to produce real "Web-enhanced" education, simply because they take no account of the added value of networked technologies.

For both problems, the current issue also provides solutions. Tennyson's competency rating scale can help instructional designers in identifying gaps in their expertise. If instructional designers are aware of these gaps they can take the appropriate action to fill them in. Then, if a competent designer develops according to new instructional development methodology as presented by Retalis and Skordalakis and takes care of the suggestions of Kester et al., real Web-enhanced education can be produced. Next, to guarantee successful implementation, attention should be paid to the determinants and potential barriers identified by Stavredes and Wedman, respectively. Simple!

## References

ASTD (2001). http://www.learningcircuits.org/glossary.html#E.

Banc of America Securities. *(1999). The e-Bang Theory* (September), 101–109.

Close, R. C., Humphrys, R., & Ruttenbur, B. W. (2000, March). *e-Learning and knowledge technology* (SunTrust Equitable Securities Report).

Hall, R. H. (2000). Education, hypermedia, and the World Wide Web (special issue). *CyberPsychology & Behavior*, *3*(1).

Learnframe (2000). *Facts, figures & forces behind e-Learning*. UT: Draper.

Richards, P. (2001). *MIT to make nearly all course materials available free on the World Wide Web*. Press release (4 April; http://web.mit.edu/newsoffice/nr/2001/ocw.html).

Schank, R. C. (2000). The virtual university. *CyberPsychology & Behavior*, *3*(1), 9–16.

Van Merriënboer, J. J. G. (1997). Training complex cognitive skills: a four-component instructional design model. Englewood Cliffs, NJ: Educational Technology Publications.