Aspects and Technologies of E-learning in an Architectural Context

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The Web is assigned an increasingly important role as a medium for information and presentation, also in architectural education. Course websites may present course materials, handouts, and manuals online. Students create their own website as a showcase of their work, complementing their portfolio. With support from a database, course websites are commonly extended to allow for electronic submission and immediate presentation of the students' work. Such websites may be further developed to support student collaboration and communication within the context of the course. The same tools can be provided to students in order to set up their own information environments to support groupwork. We envision this technology to become commonplace in educational environments, extending the current set of electronic information and communication tools available to students. Technological advances enable practitioners and students to make the design process more information-intensive, both in their own activities and in collaboration with others. For this purpose, it is important that students familiarize themselves with such technology and adopt it in ways that meet their needs and requirements. A flexible environment that provides them with the tools and means to adapt and apply this technology throughout the curriculum, supported by course specific e-learning offerings, is our ultimate goal. In this paper, we elaborate on the efforts at the faculty of architecture in integrating current digital initiatives into an e-learning environment and on extending this environment to support the entire architecture curriculum.

Keywords: e-learning; information environment; groupwork; architectural education.

Introduction

E-learning promises to play an important role in education. Whether this will lead to entirely virtual universities or, rather, will enable brick-and-mortar universities to adapt their educational offerings to new market expectations is too soon to predict. Currently, large IT multinationals are leading the e-learning evolution. They are recognizing the need for life-long learning for their employees and are banking on the knowledge and information base that is built up within a company's workforce. They also consider it an important service to their customers, offering them training over the internet concerning their products and related knowledge domains. Online universities are also targeting the active professional as the most profitable profile in this new market. Many offer continuing professional education, possibly customized to corporations' specific workforce needs (Scheling, 2001). For example, the University of Phoenix Online, one of the current market leaders, is an adult education school with an enrollment of about 20.000 students in various programs, including customized training. A growing number of these online universities result from partnerships between e-

learning vendors and academic institutions. "Academic institutions, the major producers of branded educational content, recognize the need to offer and distribute their programs online, but generally do not have the technical or financial capacity" (Urdan and Weggen, 2000, p. 24).

Though online education is growing rapidly, it remains a risky business, as a result of fast and continuous technological changes and the fact that few referential cases exist that may offer a lead for further developments and offerings. A comparative study of e-learning platforms conducted by French researchers in 1999-2000 identified a marked difference in products from year to year (Bouthry et al., 2000; Turbé-Suetens, 2000). Of the nine platforms presented in 1999, most were no longer in existence in 2000, while others had been extensively updated and adapted to evolving technologies.

Nevertheless, it can be argued that without the adoption of some forms of e-learning, traditional universities will no longer be able to serve the same broad audiences they currently reach out to. Since long, and still now, universities and other institutions of higher education serve to a large extent as public centers of knowledge and research. Even as these institutions attempt to adapt themselves to evolving societal needs and expectations with respect to forms of education and learning, until now, they have shown relatively little flexibility in the way students access their educational programs. The Web is by far the most effective technology to facilitate a more personalized approach to customers and clients. To some extent, it already fulfills on this promise through the integration of new technical solutions and educational techniques into the digital culture, enabling one to take one's personal, professional, and economical development better into one's own hands. If universities are intent on sustaining their role as public centers for knowledge and education within an increasingly networked environment, they will need to adopt some of the new ways of knowledge and information transfer made possible by the Web.

E-learning efforts can serve universities both to improve their current educational programs and to reach out to alumni or other interested people for extra training or for an actualization of one's knowledge. Especially, in the context of lifelong learning, a university can hardly afford to target only students who are either fresh out of high school or are prepared to study quasi-fulltime within the physical walls of the university. E-learning also enables institutions to reduce the workload of their teaching staff, thereby enabling an improvement in the quality of education as a result of the extra available time. The Dutch Institute for Educational Services (IOWO) claims that currently only 5% of a lecturing hour is effective and that more time must be given to students for information search and retrieval, and analysis and processing tasks. By means of the Web, students can prepare themselves independently for a task, such that the instructor can use his or her time more effectively by focusing more on the qualitative guidance of students rather than on transferring various information to them.

At the same time, more effort should be spent on a critical analysis of current forms of education and learning and on the continuous adaptation and renewal of the educational model to the most recent standards and expectations. In the Netherlands, an evolution in the approach to learning and education has led to a move in secondary schools to replace the traditional school model in the higher years by a study house approach. In this approach, students are led to work more independently in collecting information and processing this information into reports and papers. The use of computers and of new multimedia educational tools for information gathering and management is an essential part of the application of this study house model. As a result, universities and other institutes of higher education are necessitated to adapt their own educational model to the new type of students entering their programs (starting next academic year), in order to offer them a consistent educational path. The newest developments with respect to e-learning are hereto indispensable.

E-learning in design education

E-learning is not simply the result of offering course information and content on the internet. First and foremost, online courses can increase student-instructor communication and interaction, enable supplementary instruction, and provide means to track and report student progress (Schelin, 2001). Additionally, e-learning can offer students the means to organize their own learning activities and processes, both individually and in a group. Hereto, an e-learning environment should offer students, next to content, a variety of tools and instruments to facilitate information management and communication within the learning process. The initiative for adopting selected tools and techniques should come primarily from the student. At the same time, technology is all but the most important aspect in e-learning. Technology only serves to support the learning process. As such, e-learning cannot be considered solely on its own, but must be embedded in a review of the whole learning and educational experience. Particular care must be taken to consider e-learning in the context of design education.

One of the main advantages of e-learning is its ability to focus on both just-in-time learning, i.e., independently of time and place, at the moment there is a need for it, and on-demand instruction, that is, customized to the individual (Van der Biest, 2001; Van Petegem, 2001). Both fit well into design education. The design process is both information- and knowledge-intensive, concerning a wide variety of subjects, where the application of subjects, both in terms of content and time, is dependent on the specifics of the design and the design process. As such, just-in-time learning and on-demand instruction are particularly suited to support the design process in providing the individual student access to the necessary information and knowledge at the appropriate moment.

In adapting e-learning to design education, however, we must be careful to consider students not only as educational consumers, as in the traditional view, but also as valuable participants in the educational process. Especially in architecture, an established tradition exists of learning from one another through group presentations and critiques. At the same time, design and design analyses processes generate extensive bodies of information that may be of value to other students within, but also outside of, the respective studio or course. For example, students learn from design precedents and the analyses of existing designs. These may be provided by the instructor or the analyses may be performed by the students themselves as part of their design tasks. At the same time, the subjects of the analyses can be selected to support a specific design task or project, or collections of design precedents and analyses may serve a wide variety of design activities. The same applies to new designs and students' design products. Especially in the context of research by design, the organization and management of design information and results for subsequent reuse and analysis is very important. Comparably, large IT companies consider data mining and knowledge management systems as quintessential to support their business activities.

Information technologies can play an important role both in collecting students' design and analysis studies, and in presenting these studies as reference material to other students. In this way, students contribute to the information and knowledge that is present in the educational process and, as such, to each other's learning experience. Thus, students can position themselves both at the receiving end and at the contributing end of the educational economy. An e-learning environment is especially suited to integrate both the capturing and the presenting of such information in support of students' learning activities. For example, a digital environment for the presentation of design precedents may, at the same time, serve students to present their own design analyses, extending on the initial body of information (for example: Akin et al., 1999; Tunçer and Stouffs, 2000). Electronic archives play an important role in managing, indexing, and publicizing this information such that a larger audience, extending far beyond the

confines of a specific course, may profit from this work. Most important is that such tools are easily accessible to students such that each student or group may choose its own instruments in facilitating its (electronic) communication and learning.

As with traditional learning, and teaching, communication is key to an effective learning process and the same efforts that are spent on achieving quality education in the physical environment must also be applied to the virtual classroom. As such, not a single technology or methodology can serve every e-learning situation. Instead, a variety of technologies and techniques, each adaptable to a variety of different situations, should be combined in order to create an interesting and stimulating learning environment that motivates students. Means of synchronous and asynchronous electronic communication enable the creation of new lines of communication between participants that may otherwise have little or no contact. For example, educational experiences at ETH Zurich show how students' social circles may expand through initial electronic communications (Engeli and Mueller, 1999). Standard e-learning tools offer little or no support for such processes, focusing rather on student-teacher relationships and on private groupwork.

E-learning at the faculty of architecture

At the Faculty of Architecture, Delft University of Technology, the need for e-learning in education is felt especially strongly because of its current curriculum review. Pressed by the need to adopt a Bachelor-Master approach to the curriculum, in conjunction to a switch from currently five educational periods of eight weeks each to a semester-based curriculum, the imposition of a university-wide package of basic knowledge courses, and the specifics of the current educational model, primarily based on the concept of problem-based learning, a simple reshuffling of the existing curriculum no longer proved adequate. Instead, a complete redesign of the curriculum became necessary. Furthermore, as a result of the switch to semesters, the transition to the new curriculum needs to occur at once for the entire student body, from the first to the last year. It stands without a doubt that these changes will require a large effort from the teaching staff in order to prepare for the new curriculum. This both offers an excellent opportunity to invest in e-learning and, at the same time, compels a serious consideration of e-learning in order to facilitate an efficient changeover.

Delft University of Technology has opted for Blackboard™ as its common e-learning tool for a period of three years. The purpose is to offer all students a uniform Web environment for accessing educational material, independent of the faculty or program presenting this material. Currently, within the faculty of architecture, little information is available online and various groups and departments have adopted their own approach for presenting this information to their students. At the same time, a number of initiatives have been started that constitute valuable building blocks for developing an e-learning environment. Leaving the course-specific content to the respective instructional entities, we are particularly interested in providing students access to course-independent reference material and tools for managing information and communication.

One approach is to create digital archives collecting design information in various forms and offering students integrated access to these various archives. Next to a digital slide library, a digital collection of design precedents from various courses and studios is under construction. Hereto, we've adopted a presentation tool for architectural analysis (Tunçer and Stouffs, 2000) in order to integrate the abstractions describing the various precedents into a single information space that can be effectively searched and browsed. In our own teaching, all student coursework is submitted and presented through the Web. The Image Archive Architectural Intervention (iaai.bk.tudelft.nl: May 2001) intends to link all these archives using an independent indexing and search engine. Rather than collecting and copying information from various archives and locations, it

offers a single access point to decentralized information sources, even allowing any student to link his or her architectural project work into the archive. All links are checked on a regular basis in order to ensure reliability. Though students have free access to link information into the archive, a tight integration into other e-learning tools is important to ensure an extensive collection of information, especially in this initial phase of the project. For example, we are developing a link to our own course archives, both for publication of student work and as a source for reference material with respect to the course content. The Image Archive Architectural Intervention is also being used as a source for case information to support the development of decision support systems (e.g.: Tisma, 2001).

Another approach is to develop tools to support student communication, groupwork, and information management. One of the studio courses we are involved in emphasizes groupwork among various partners and disciplines in the building design process. Upon a first experiment two years ago, last year all groups were required to adopt the Web as a medium for information exchange and presentation. These case studies serve as a springboard for the development of flexible tools for students to set up their own groupwork environments for independent coursework. This has led to InfoBase, a web-interface to database access for document management and communication. Currently used to support groupwork, it is our intention to provide each student with a personal project space, including functionalities for portfolio presentation. Our ultimate goal is to enable students to organize their own personal and groupwork environment from the variety of digital tools and instruments that are made available, including database access, archiving functionalities, portfolio presentations, a variety of communication tools, etc. We envision this technology to become commonplace in educational environments, extending the current set of electronic information and communication tools available to students.

Given the variety of initiatives and efforts, an integrated approach is required in cooperation with all parties involved, that should lead to a single entry point or environment providing access to all information and functionalities. Cross-linking the various information sources will aid in improving the effectiveness of the offerings to the student. The Image Archive Architectural Intervention currently assumes this role. Course-specific interfaces to the archive can assist students in searching and browsing project-specific information within the context of the entire archive. By integrating these interfaces into the InfoBase project environment, these may serve as an extension to the student's own project information, while the student's design results may be linked back to the archive, within and outside of the course interface. In this way, a multi-level information and activity environment can be established that is adaptable to the course specifics, while offering a uniform interface to the student.

Discussion

While e-learning is growing rapidly and is set to overtake traditional training within a few years (according to a study by IDC and (Bouthry, Chevalier, Ravet, and Schaff, 2000)), universities have important assets that can help them assure their place within the e-learning evolution. Though most of the demand for e-learning is not coming from individuals but from companies realizing the need for continual training for their employees, this need can only be partially fulfilled by accessing and mining corporate knowledge already present within their work force. Universities are outstanding knowledge centers and as such particularly suited to become preferential knowledge partners for companies looking to extend their e-learning offerings content-wise (Van Petegem, 2001). Maybe even more importantly, e-learning can only be successful if supported by appropriate pedagogic and didactic models (Van Petegem, 2001). Universities offer excellent environments for researching and developing such models and experimenting with them in an educational setting.

The European Commission last year adopted an

e-learning initiative entitled "Designing tomorrow's education" (COM, 2000). Its intention is "to involve education and training players, as well as the relevant social, industrial and economic players, in order to make lifelong learning the driving force behind a cohesive and inclusive society, within a competitive economy" (COM, 2001, p. 2). As such, there is an important role here for university-industry cooperation in developing e-learning applications. In our own industry contacts, we have found ample interest in funding e-learning experiments within the academic environment. The industry is eager to find out how e-learning can contribute positively to their work processes. Within the academic environment, we have the excellent opportunity to evaluate these influences. Together, we can invest in the future of our students.

Our primary aim is the development of internet-based and multimedia-enabled educational tools that can be used throughout an architectural curriculum, rather than in the confines of a specific course. Hereto, these tools should be designed and developed so as to stimulate the student to explore the respective field of study independently of the instructor and to cooperate with others in achieving solutions to a problem. The specification of this aim must take into account the three main parties that have a stake in their usage. These are the students that will adopt and use these tools, the instructors that provide the content and define the applications, and the department and university that will identify itself with these.

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