JOURNAL OF OBJECT TECHNOLOGY

Distance Education: The Status and Challenges

Won Kim, Cyber Database Solutions, Austin, Texas, USA
Timothy K. Shih, Department of Computer Science and Information Engineering, Tamkang University, Taiwan

Abstract

In the mid-1990s, the rise of the Internet and Web technology provided a renewed impetus to distance education. Just as the rise of the Internet and Web technology led to the subsequent dot com bubble and bust, the promise of a revolution in education and society that distance education was thought to hold turned out to be overblown. However, just as the use of the Internet and Web technology is taking root in commerce, governance, mass communication, etc. after the dot com bust, the use of the Internet and Web technology in distance education is expected to take root and deliver benefits to education and society over the long haul. In this article, we examine the current status of distance education, some key lessons learned from distance learning to date, and what it will take to make distance education successful both from technology and sociological perspectives.

1   INTRODUCTION

Today the concept of distance education is fairly well-understood, and the potential importance of distance education in the future of education is also generally acknowledged. With advances in multimedia and communication technologies, distance education is being adopted by corporations as well as universities. The idea is not really new. One may regard 1922, when Thomas Edison invented motion picture and boldly predicted that motion picture would replace textbooks in education, as the starting point of the history of media technologies for learning. Although Edison's prediction has not exactly come to pass, video tapes were used by the US army during World War II for the training of soldiers. Television broadcasting became one of the pioneering technologies for distance education. In the early 1970's, Computer Based Training (CBT) and Computer Aided Instruction (CAI) became important applications of mainframe computers. The primary ideas behind CAI and CBT led to today's distance education in the early 1990's through the use of multimedia technology and the Internet. Distance

learning, distance education, cyber education, remote classroom, and e-Learning are similar concepts.

About five years between the late 1990s and the early 2000s marked the period of dot-com bubble. During this period, the tsunami of investment money chasing after just about any concept attached to the Internet and Web technology and the lack of experiences with early uses of the Internet and Web technology created a sense of euphoria and an imminent revolution in the way people work, live, interact, and communicate in a borderless world where online virtual entities replace offline counterparts and where all online contents are free for all. During this same euphoric period, many predicted that distance education would make traditional offline schools and universities obsolete, just as many predicted that online newspapers, libraries, bookstores, etc. would make their traditional offline counterparts disappear. Such predictions have not come true and are not likely to come true in the foreseeable future. Many students who took early online courses for academic credit did not get much out of the courses, partly because they tended to cram near the end of a semester, there were no human instructors to seek answers to questions, and the course materials were not adequate. Some cyber universities have sprung up that offered college degrees. However, employers and the society have been slow to accept them as equivalent to the degrees conferred by traditional universities. These are but a few lessons learned from distance education thus far.

Despite the bust of dot coms, the use of the Internet and Web technology has been steadily taking root, without the crazy expectations and predictions of the dot-com bubble period, in commerce, governance, entertainment, news media, communications, etc. The Internet and Web technology are now providing entirely new or effective additional means for organizations to communicate and conduct transactions with their customers or constituents. A sober assessment of the capabilities that advances in communication and multimedia technology can enable, along with an examination of the lessons learned from distance learning endeavors during the past several years, should similarly make it possible for distance learning to complement traditional in-class learning and make education richer and more valuable to students, both in schools and corporations.

In the remainder of this article, we will first review a general operational model of distance education, then the current status of distance education. Next, we will examine technological and sociological challenges that distance education needs to overcome to fully realize the potential of distance education.

2   AN OPERATIONAL MODEL OF DISTANCE EDUCATION

The fundamental elements of distance education are shown in Figure 1. They include policies, people, and technologies. These are the essential components which affect the development of distance learning programs.

On the policy side, the evaluation criteria for distance learning programs affect the instructional quality and performance of students, which in turn influence how much
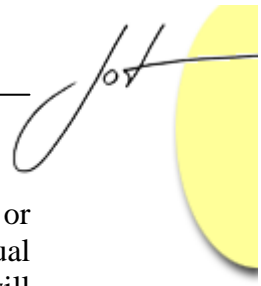
potential employers trust distance education. The granting of the credit, diploma or degree is an important consideration for students to take courses or join a virtual university. If the government or a university sets a high standard, fewer students will enroll. Thus standard evaluation criteria should be established. The overall evaluation may include teaching evaluation and a review of course contents and curriculum, as well as student performance evaluation. The standardization of courseware format and platform (e.g., SCORM) will ease the exchange of course materials. It is time-consuming to create high quality distance learning courseware. Courseware exchange has become one of the possible solutions to reduce the load on courseware designers. Each courseware has a copyright associated with it. An interesting policy issue is who owns the intellectual property (IP). In some cases, the IP belongs to the university (traditional or virtual), and corporations or corporate training businesses. This is definitely different from the IP associated with traditional textbooks, which belong to the publishers. The IP issue is different depending on different institutes and countries. Moreover, just as traditional universities have different focuses and strengths, the focuses of virtual universities are different. Other policy issues are related to sociological behaviors of students, such as how an individual trusts a friend in the virtual world.

Criteria for Credit/Diploma/Degree
Courseware/Platform Standards
Intellectual Properties
Classification of Virtual Universities
People/Sociological Considerations

Policy

Technology

People

Artist
Engineer
Administrator
Student/Customer
Education Professional

WWW
Internet/Internet II
Education Theory
Intelligent Methods
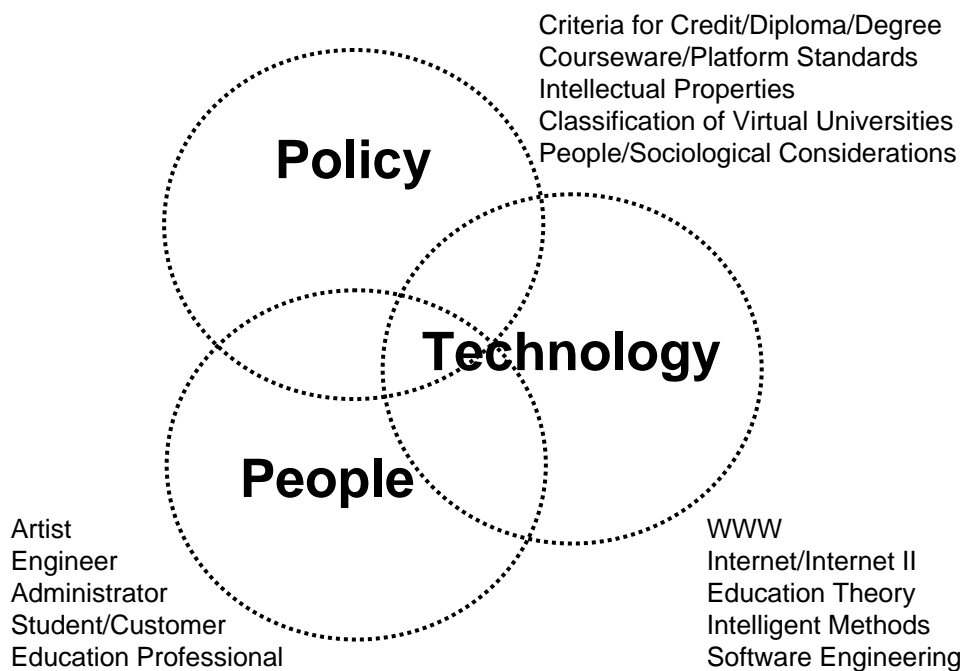Software Engineering

Figure 1: Elements of Distance Education

On the people side, several types of experts are involved. To create distance learning courseware, education professionals, engineers, and art designers need to work together. Distance learning platforms are maintained by an engineer or an instructor. The administrator reviews and manages courses as well as the curriculum schedule. An instructor can maintain the distance learning platform, as well as managing the schedule.

Various technologies are brought together to create, maintain and run distance education programs. With advances in the capacity of the Internet (and Internet 2), distance education programs can make increasing use of multimedia contents (such as video and animation). Web technology allows the installation, update and viewing of course materials. Video streaming technologies are used in video conferencing systems to support online discussions. It is possible to use education theory to develop distance learning resources and quantitative analysis of student performance.

3 CURRENT STATUS OF DISTANCE EDUCATION

Supporting systems or tools used in distance learning programs can be divided into two types:

- **Traditional tools:** videotape (S-VHS), cable/public television, tele-conferencing, hardcopy textbook.
- **More advanced or recent tools:** CD-ROM titles, Web browser, whiteboard, chat room, Real player, video broadcasting, satellite video conferencing, broadband video conferencing, audio conferencing, student assessment tool, and administration system.

Note that hardcopy textbooks are still widely used, even if it is possible to publish their electronic versions on the Internet. Proprietary communication tools are available to support online discussions, either in a limited bandwidth and asynchronous environment (e.g., chat room) or in a broadband real-time communication facility (e.g., video conferencing). A few integrated systems such as WebCT are commercially available that provide functions ranging from administration, courseware creation and management, communication, assessment, and sometimes even course contents.

There are three venues for distance education programs: regular and continuing education programs in traditional universities, distance learning portals, and virtual universities. In a traditional university, most courses taught in the classroom are, at least in principle, feasible for distance learning, except those that require lab experiments and physical presence (e.g., physical education, music and arts). There are a number of virtual universities. The University of Phoenix (http://www.phoenix.edu) and Athabasca University (http://www.athabascau.ca) are two of the largest virtual universities in the USA and Canada, respectively. The University of Phoenix is one of the earliest virtual universities. Among the 134 campuses, the University of Phoenix serves more than 174,000 students in 2003. The university also provides help with US federal financial aid and private loans. With the large number of enrollments, the University of Phoenix is also one of the earliest successful examples of virtual university. Athabasca University is supported by the Canadian government. More than 77,000 students are enrolled in 2003. Virtual universities allow students to take advantage of the flexibility in time and location. Students who are employed on a full-time basis are able to complete higher level education without jeopardizing their jobs. Software systems and student evaluation methods in virtual universities are similar to those used in traditional universities.
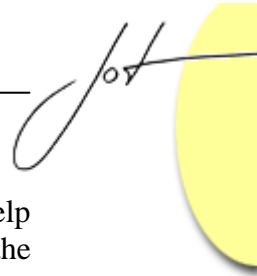
E-learning portals are another venue for distance learning. E-learning portals help small to medium size companies to offer employee training or customer service on the Internet. (Large corporations often develop and run their own employee training programs.) Courses on practical subjects, rather than on theoretical subjects, are typically offered by e-learning portals. In some cases, customized course contents can be built to satisfy the needs of individual companies. Often, e-commerce facilities are incorporated into an e-learning portal to provide additional services (e.g., book buying). Examples of e-learnig portals include click2learn (http://home.click2learn.com), CyberU, Inc. (http://www.headlight.com), Learn.com, Inc. (http://www.learn.com), SmartForce (http://www.smartforce.com), SmartPlanet, Inc. (http://www.smartplanet.com), and THINQ (http://www.thinq.com).

Although different distance learning programs have different business models and target audiences, in terms of interactions between students and instructor (and among students), distance learning can be divided into asynchronized and synchronized learning. Self-regulatory learning is a basis of asynchronized learning. Asynchronized distance learning, adopted by most e-learning portals, rely on students who can study independently. The advantage it offers to students is flexibility. Students set up their own study goals and time tables. With the assistance of a semi-automatic administration system, students study the course materials, take exams, and receive assessments. The administration system may restrict the time period in which a student can access particular (portions of) course materials. Following the social constructivism and the scaffolding theory, this type of system builds a strong scaffold (i.e., with more hints) to help students in the beginning. As time passes and goals are achieved, the scaffold may be decreased or removed, leading to a gradually more independent style of study. A major drawback of asynchronous learning is the lack of real-time interaction, which tends to reduce the chance of just-in-time answers and team collaboration. Intelligent software systems may improve asynchronized learning. For instance, a student monitoring system may review individual performance via some norm-referenced evaluation strategies and advise them of their performance. On the other hand, synchronized distance learning requires an advanced network infrastructure for video conferencing. In traditional universities with separate campuses, synchronized distance learning can help bridge the physical separation of the campuses. Online lectures can be broadcast, with bi-directional communication channels that allow real-time multi-point interactions. Collaboration and question-answer sessions are easily implemented. However, course materials still need to be online. The combination of synchronized and asynchronized approaches will force students to follow their study schedule and allow flexible interactions and discussions.

4 TECHNOLOGICAL CHALLENGES FOR DISTANCE EDUCATION

To ensure the successful operation of distance education systems, computer facilities and network infrastructures must be integrated with appropriate software systems. The current distance learning platforms allow both synchronous and asynchronous discussions. An
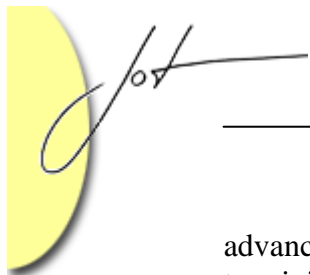
advanced technology (and methodology) is needed to help the instructors or administers to minimize cheating in exams. Technologies will be a part of the solution to the issues of motivating both the students and instructors. Below we highlight several important research issues from the technology perspective. These issues require researchers from education and information technology fields to work together. Some of the issues have been partially solved, while several issues related to intelligent technology remain open:

- **Instance hints and intelligent tutoring:** While a student is navigating an online course, an intelligent agent may analyze her behavior, and provide useful suggestions in real-time, for example, by guiding her through different learning topologies.
- **FAQ summarization and automatic reply:** It is time-consuming for an instructor to answer students' e-mails. An auto-reply system should be able to use information retrieval techniques to summarize frequently asked questions, and reply to new questions with answers to past questions.
- **Unbiased examination:** It is difficult to ensure proper behavior of students when administering online examinations without a human monitor. A surveillance tool can randomly take a snapshot of students' screens.
- **Individualized quizzes:** Some distance learning systems are able to generate different test questions for different students according to difficulty levels. This type of system should ensure unbiased examinations.
- **Online supervision of chat room discussions:** Chat room discussions can be assigned points in student's performance. An intelligent agent can be implemented to grade chat room participations. Misleading or irrelevant conversations can be reported to the instructor.
- **Universal and mobile accessibility:** Students and instructors should be able to access distance learning websites from any location with any of a variety of different devices, such as PDA or cellular phone. Wireless communication techniques may be incorporated into distance learning systems.
- **Remote lab and simulation:** Domain-specific remote labs connected to the Internet need to be developed to support online experiments. If remote labs are not available, online simulation tools (i.e., virtual lab) should be provided.

5   SOCIOLOGICAL CHALLENGES FOR DISTANCE EDUCATION

Some of the sociological issues are difficult, more difficult than technological issues, to solve. The motivation of students is one of the key factors that will determine the success of a distance learning program. Mostly, adult working individuals take distance education for professional growth. They all want to get something out of a distance education program. They want to learn something practical today and apply them at work tomorrow. Some of them want to receive diplomas or at least course credits. To such students, acceptance by the employers (industry and government) of the course credits and diplomas is very important. The (presumed) quality of education (and diplomas awarded) depends on assessment of the educational institutes, as well as the quality of
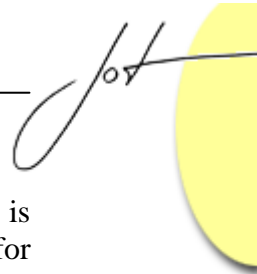
instructions. It takes many years and concerted efforts before a traditional university is established, and the same will be the case for cyber universities. It may make sense for different cyber universities to differentiate themselves from other cyber universities and traditional universities by carving out their own niches in terms of fields and course curriculum. Evaluation of cyber universities (and distance education programs within traditional universities) must include student performance, instructor performance, course materials and curriculum. It is important then that there be comprehensive and objective evaluation criteria for all these measurable aspects of distance education.

Some studies suggest that college education influences and shapes how students speak, think, and behave. Social behavior will be different in a virtual environment; and education received solely in distance learning may put the students at a disadvantage. It appears that the best education is the conventional in-class education augmented by distance learning for a part of the overall curriculum. For example, students may establish a base of their social networking and a starting point for studying and learning in college. Most classes they take in college may be the traditional in-class variety, while others may be either purely online or a combination of in-class learning and distance learning. After graduation, they may take from e-learning portals training courses that either their employers encourage them to take, or from cyber universities or continuing education programs in traditional universities courses they consider interesting or necessary for professional growth.

There are some additional interesting sociological considerations for distance education. Will there be a threat from "the super professor" and "the super university?" Since there is no geographical limitation in distance learning, will there be a professor who teaches, say calculus, so well that all freshmen take her course? Is it possible that a particular institute becomes so popular that all students receive credits from it? How will professors react to these possibilities? Another consideration is from the student's view. If students seldom see each other, how does the social life in universities change?

6   EPILOG

Distance learning is still in its infancy today. This is due to the limitations of network infrastructures, experiences, manpower, effective policy, and acceptance from the employers. Currently, distance learning is primarily limited to colleges and corporate training. Secondary and elementary schools have not adopted it. Sometimes synchronized distance learning is used between two countries. However, due to time differences and limitations of network infrastructures, international collaborations are rare. However, the potential of distance education cannot be ignored. As pointed out in the study "The No Significant Difference Phenomenon" (http://teleeducation.nb.ca/nosignificantdifference/), if student performance has no difference between traditional and virtual universities, convenience and flexibility of distance learning certainly become a significant and, sometimes, compelling advantage.
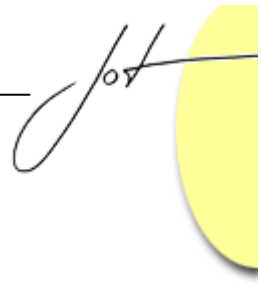
Technical and sociological challenges may take a long time to be adequately solved. However, a few practical observations can help make a distance learning program more successful. Courses on practical subjects and subjects of recent interest will increase enrollment. A good distance learning program should also motivate and help the instructors. Generally, the load on an instructor teaching a distance learning course is higher than that for a traditional course. Appropriate rewards should be given to the instructors. Moreover, most instruction designers are not natural-born art designers. Art designers should be brought in to help instruction designers to develop attractive course materials.

As new technologies unfold, some interesting trends in distance learning may evolve as well. Some of them are summarized below.

- Virtual Reality-based communication and situated learning use augmented panorama and real-time communication technologies in a distance learning CAVE. Students can feel and experience the outdoor facilities inside the classroom.
- Wireless communication to access encyclopedia and e-books will be available. Mobile students can participate in a lecture, use online references, or read class notes.
- By making use of game technologies in education, it may be possible to attract students and to increase their attention and motivation.

REFERENCES

http://www.phoenix.edu
http://www.athabascau.ca
http://home.click2learn.com
http://www.headlight.com
http://www.learn.com
http://www.smartforce.com
http://www.smartplanet.com
http://www.thinq.com
http://teleeducation.nb.ca/nosignificantdifference/

About the authors

Won Kim is President and CEO of Cyber Database Solutions (http://www.cyberdb.com/) and MaxScan (www.maxscan.com) in Austin, Texas, USA. He is also Dean of Ewha Institute of Science and Technology, Ewha Women's University, Seoul. Korea. He is Editor-in-Chief of ACM Transactions on Internet Technology (http://www.acm.org/toit), and Chair of ACM Special Interest Group on Knowledge Discovery and Data Mining (http://www.acm.org/sigkdd). He is the recipient of the ACM 2001 Distinguished Service Award.

Timothy K. Shih is a Professor of the Department of Computer Science and Information Engineering at Tamkang University, Taiwan, R.O.C. He is also a senior member of IEEE and a member of ACM. Dr. Shih is the founder and co-editor-in-chief of the International Journal of Distance Education Technologies, published by Idea Group Publishing, USA. Dr. Shih's publications and services can be found at http://www.mine.tku.edu.tw/chinese/teacher/tshih.htm.