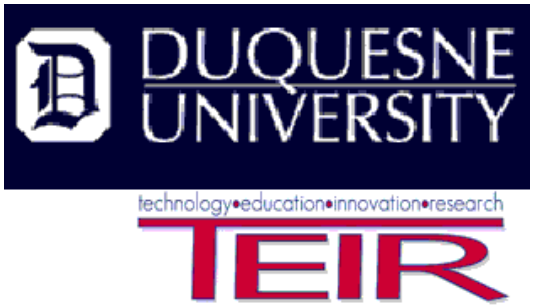
INTERNATIONAL JOURNAL OF INSTRUCTIONAL TECHNOLOGY AND DISTANCE LEARNING

May 2004

Volume 1 Number 5

ISSN 1550-6908



PUBLISHER'S DECLARATION

This Journal was established to facilitate collaboration and communication among researchers, innovators, practitioners, and administrators of education and training programs involving technology and distance learning.

An academic institution, Duquesne University, was chosen for its commitment to academic excellence and exemplary programs in instructional technology and distance learning. Duquesne University is supporting the Journal through its graduate program in Instructional Technology and its Center for Technology Education Innovation and Research (TEIR Center). In addition to its educational programs, Duquesne University has major training contracts for industry and government.

The Journal is refereed, global, and focused on research and innovation in teaching and learning. Duquesne University and its partner, DonEl Learning Inc., are committed to publish significant writings of high academic stature.

Lawrence A. Tomei, EdD
Executive Director, Center TEIR

International Journal of
Instructional Technology & Distance Learning

Table of Contents – May 2004

Vol 1. No. 5
ISSN 1550-6908

Editorial
Destruction of the Internet

Donald G. Perrin

"I cannot send in my class work - my computer is infected with virus and does not work."

"The network is down!" "
My email is down!"
"I never received your email."

This past year has seen numerous instances of interruption to internet service due to hackers, spam, spyware, virus, worms, Trojans, and malicious code causing the failure of computers, server, and networks. For distance learning it raises a question, are our systems vulnerable? Do we need to accommodate service interruptions? Or can we prevent them?

The editors of this Journal researched this topic when its web hosting company suffered a massive virus attack. Service was not restored in a timely manner and the URL was moved to another hosting service.

Are our computer systems and networks vulnerable?
The answer is yes!

Protecting your home is a useful analogy to explain the problem. Consider the following questions:

- What kind of neighborhood do you live in?
- Is your house secured with a perimeter fence and alarm system?
- When you leave your house, do you leave doors and windows open?
- Are valuables in full view and the safe unlocked?
- Do you invite in strangers and give them your credit information?
- Do you have the support of law enforcement and security services?

Protecting your computer is analogous to protecting your home. For your computer;

Neighborhood is the Internet. Your best protection is to have several lines of defense against intruders such as locks, alarms, and security systems.

Perimeter defense is a secure network with firewall and encryption. Alarms warn you when unauthorized users attempt to gain access, or malicious programs, spyware and viruses infect your email and Internet resources. Configure your computer to apply critical updates as soon as they are available. These include patches for operating system and applications, antivirus pattern files, and filters for spam and spyware.

Doors and windows include physical locks on your computer or keyboard, strong passwords, and limited permissions. Permissions determine which files and folders are shared, who can access them, and level of access for each user (read-only or read and write).

Communication ports used for email and internet are like windows into your computer. Protect them with antivirus and filters for spyware and spam.

Valuables that require special protection include personal, business and financial data. Protected against intruders (hackers) and unauthorized users by strong passwords and encryption. Internet Protocol Security (IPSec) and encryption are advised whenever data is transmitted across a network.

Strangers include emails from unknown sources and visits to URLs without certificates. (Certificates are credentials that identify trustworthy websites.)

Security services include antivirus, spyware detectors, and spam filters to eliminate unwanted email.

Vigilance and commonsense. Use the following procedures to guard against infection:

- Ensure that your computer has an effective firewall and antivirus.
- Install patches and updates as soon as they are available.
- Do not open email from unknown sources. Delete it!
- Do not open email attachments unless you are certain of the contents.
- Do not download files from unfamiliar sites.
- Never supply personal information. (A criminal can "spoof" a trusted organization and use your information to take control of your computer, empty your bank account, and steal your identity.)
- Never store passwords on your computer.
- Avoid unnecessary risks.

Yes, you can protect your computer and your data.

1. Set up several lines of defense: Physical security, perimeter defense, passwords, permissions, antivirus, firewalls, and patch management.
2. Take advantage of added security factors in the newest operating systems and software. Keep your Antivirus subscription current.
3. Be vigilant and take care with strangers.

Follow these steps and it is unlikely that your computer, or your distance learning courses, will be compromised.

Editor's Note: An important advantage of mediated instruction is the ability to test and validate the effectiveness of instruction for a specified audience. We start with a predefined set of goals and a needs assessment to define the knowledge, skills and attitudes (KSAs) of the target audience. A discrepancy analysis, sometimes called a gap analysis, defines what is to be taught and learned. In the process, we gather information about the prospective learners.

Instructional designers define content and create learning strategies most likely to be successful with the intended audience. Prototype materials are constructed, tested, and refined until they reach criterion performance with a sample of the target group, and validated by field testing. In this study, the learners are older adults. As this article shows, they have distinctive needs and learning characteristics that instructional designers must address.

Instructional Design – Considering the Cognitive Learning Needs of Older Learners

George Pate, Jianxia Du, and Byron Havard

Introduction

Within the past few years discussion has grown regarding the cognitive learning needs of older adults. In my paper, I would like to look at what research has discovered and what actions have been taken in regard to meeting those needs. I also want to know if instructional designers need to consider those learning needs in their instructional design practices.

But why should instructional designers even consider the cognitive learning needs of older adults. Aren't these older adults past the point of learning or having the need to learn? Aren't they just going to retire, relax, travel, do hobbies, visit the grandkids, and live off their retirement income?

Maybe currently, or in the past, older adults would have gone about ageing this way, but we as a society are approaching a new phenomenon that we have not experienced before. As a society we are ageing, and ageing rather rapidly.

Why? Because the baby boomer generation is beginning to reach retirement age. Baby boomers are those adults born in large numbers after World War II, from about 1946 to 1964. Because of the approaching retirement of such a large number of workers, there will begin to be a huge economic and social impact on out society. In the 1950's there were 7 workers to support each retiree, but by 2030, there will be less than 3 workers to support each retiree. This will create a huge burden on our society that will require that older workers be kept in the workforce as long as possible to help meet not only their own needs, but the needs of others. ("New Opportunities for", 1999)

Because economically and socially it will be impossible for less than 3 workers to support one retiree, we have to make sure that older adults remain in the workforce as productive contributors. Also, there will be so many baby boomers retiring that there will not be enough younger generation workers to take their place. ("New Opportunities for", 1999). These facts create an immediate need for instructional designers to begin considering older adults in educational and training instruction. Instructional designers must become more aware of ageing and the cognitive learning needs of older adults. Designers must understand these needs, because they will become responsible for creating instruction for older adults to train and educate them to remain in the workforce.

Other reasons why instructional designers need to consider the learning needs of older adults include the trend that older adults desire to remain in the workforce and continue learning. Older

adults therefore will need to be kept trained and educated on new technologies and other issues in the workforce. Research is also beginning to suggest the importance of lifelong learning for our own well-being. (Cusack, Thompson, & Rogers, 2003, p. 401-402).

Instructional Design and Cognitive Learning

For older adults to keep on in the workforce, they must continue to be educated and trained. Instructional designers will have to develop instruction and training for these older adults.

During the instructional design process the designer goes through three (3) phases of instructional development: analysis, selecting strategy, and evaluating. During the analysis phase, the designer not only analyses the environment in which the instruction will take place, but also learns as much as he/she can about the learners receiving the instruction. The designer should seek answers to such questions as: where will the training take place, how much time is available for the training, and what kinds of knowledge do the learners already possess. (Smith & Ragan, 1999, pp. 5-6). Because the analysis phase of the instructional design process is so important in analyzing the learner, I wanted to spend the most time looking at this area as it relates to cognitive learning in older adults.

Cognitive learning theories dominate the instructional design practices of today. These theories place much more emphasis on the internal factors of the learner than on the external factors of their environment. "The learner is viewed as constructing meaning from instruction, rather than being a recipient of meaning residing alone within instruction". (Smith & Ragan, 1999, p. 20). Therefore when considering the instruction of older adults, their cognitive learning abilities must be understood.

Cognitive psychology plays a very important role in the analysis phase of the instructional design process. The analysis phase places much more emphasis on prior learner knowledge and the organization of this knowledge, because the learner plays much more of a constructive role according to cognitive learning theories. Much more information is sought about the learners' ability to process information, their attitudes, motivation, and interests because these are strong factors influencing their learning. (Smith & Ragan, 1999, p. 22). In understanding these factors, the instructional designer is much better prepared to meet the learning needs of older learners.

Learning Needs of Older Learners

An important step in developing a learning strategy is to conduct a needs assessment. This will determine what is to be learned and what factors that effect cognitive learning of seniors.

> *In Purdie and Boulton-Lewis' study of the needs of older adults, they discovered that technical skills and knowledge, health and safety, leisure and entertainment, and life issues, in the order listed, were the main learning needs facing older adults. The most frequently mentioned technical skills were how to use a computer, how to operate an ATM, how to do phone banking, and how to use or program a stereo, VCR, or TV. These older adults also mentioned they would like to know how to use e-mail, a credit card, an answering machine, and a microwave. (Purdie & Boulton-Lewis, 2003, pp. 133-134).*
>
> *Regarding health and safety, the Purdie and Boulton-Lewis study revealed that this older age group wanted to know how to manage their health problems, such as loosing sight in one eye. They also wanted to know how to obtain information from their doctors regarding particular ailments they had. Sometimes they felt embarrassed because they did not understand what the doctor was telling them about a health problem and therefore did not ask questions. (Purdie & Boulton-Lewis, 2003, pp. 134-135). They*

wanted to learn more about managing and understanding their own health and health-related matters.

In the area of leisure and entertainment, a variety of learning needs were identified by the older adults in the Purdie and Boulton-Lewis study. They wanted to learn things like how to garden, how to paint, and how to play a piano. Life issues that they need to know included how to keep their financial records and how to deal with the loss of a spouse. (Purdie & Boulton-Lewis, 2003, p.135).

Maintaining an educated and skilled older workforce creates the same kinds of learning needs that younger workers have. Koopman-Boyden and MacDonald maintain that in order for us to maintain the older workforce that we will need in the future, because of the baby boomers, will require us to invest in ensuring that older workers have the same opportunities for education and training that younger workers have. Older workers need to be challenged and given new roles just as the younger workers are. (Koopman-Boyden & MacDonald, 2003.)

Barriers to Cognitive Learning in Older Learners

Because the learning needs of older adults can be identified, it does not necessarily mean these needs will be met or will even be available. Older adults experience many barriers to learning as discovered by Purdie and Boulton-Lewis. These barriers include not only physical problems, but cognitive matters, self matters, and social factors. (Purdie & Boulton-Lewis, 2003, p.136).

Physical problems identified by Purdie and Boulton-Lewis included "reduced mobility, illness, degenerating sight and hearing". Other examples of physical problems of older adults included not being able to sit for extended periods of time, poor hearing because of meningitis which was a common childhood ailment that was not medically treated as well as it is today, not being able to get on a bus or train without assistance, and arthritic knees that reduce mobility. (Purdie & Boulton-Lewis, 2003, p.136). They also experience safety concerns because many times they live alone and have to take care of themselves because of the passing of a spouse. Also they are not as strong as they once were and feel more vulnerable to violence.

In the Purdie and Boulton-Lewis study, the largest barriers to learning were identified as cognitive and self matters. The older adults identified such barriers as not being able to remember sequential procedures as well, not being able to concentrate for extended periods, and some had learning disabilities as youth that had never been addressed in their lifetime. (Purdie & Boulton-Lewis, 2003, pp.136-137). Research on performance-based behavior like those above show that intellectual capabilities do not decline significantly if at all until very old age. (Koopman-Boyden & MacDonald, 2003, p. 33). Barriers regarding the self included references to attitude. Statements were recorded that said learning was "not necessary", "don't need to know", or "not worth the effort". (Purdie & Boulton-Lewis, 2003, pp.136-137).

Older adults also had less confidence in their learning abilities particularly as they relate to technology. Cost barriers were also present in preventing older adults from acquiring computers and other technology for their personal use. (Purdie & Boulton-Lewis, 2003, p.145).

A study in New Zealand showed that while the majority of employers preferred older workers' expertise, stability, and loyalty; these same employers acknowledged that they discriminated against the older worker by hiring employees aged 25 to 50 years. Employers openly discriminated because they felt that older workers had age-related illnesses or lacked motivation to learn new things or to change. Research has shown that older workers are not incompetent

when it comes to training but they are exposed to insufficient training or training that is poorly designed. (Koopman-Boyden & MacDonald, 2003, pp.34-35).

Jennings and Darwin also found that age-based stereotyping plays an important role in how older adults perceive themselves. Older adults tend to see their memory performance and cognitive abilities more negatively than younger adults and discriminatory practices such as stereotyping decrease their confidence in these abilities. (Jennings & Darwin, 2003, p. 72)

These discriminatory social practices present learning barriers in older adults by creating low self-worth and the perception that they are no longer needed or wanted in the work place. Older workers are led to believe that they can no longer learn or contribute because of employer practices such as this. Research on training for older adults has suggested that their perceived incompetence may not be due to age, but to lack of proper training and poor training design. (Koopman-Boyden & MacDonald, 2003, pp.34-35).

Suggestions for Overcoming Barriers to Cognitive Learning in Older Learners

Koopman-Boyden and MacDonald find that age-related stereotypes still remain regarding the work performance of older adults, but that cognitive and physical changes associated with ageing can be modified. Older adults can be assisted in overcoming barriers to cognitive learning by properly designed training programs, flexible training schedules, and employer education and recognition of their learning needs. (Koopman-Boyden & MacDonald, 2003, p. 29).

Several studies have placed the level of early life education and ongoing intellectual activity in older age as two principal factors in maintaining a high cognitive performance in older age. Successful ageing has also been attributed to an active social involvement where personal isolation is prevented. A positive attitude also tended to increase the life span of the older adult and several studies found that religion was also a positive factor in the older adult's life. All of these factors tend to increase the well-being and the cognitive abilities of the adult learner. (Koopman-Boyden & MacDonald, 2003, pp. 31-32).

Variations in skill and differences in aptitude should be considered by the instructional designer when considering training for older adults. Designers should realize that older adults do not learn the same way or at the same rate as younger workers, but that this does not mean that they cannot learn. Older workers learn better among their own age group and at their own pace. Instruction for older workers must be flexible and relaxed in order to reduce their anxiety. (Koopman-Boyden & MacDonald, 2003, pp.35-36).

Conclusion

Halpern and Hakel in their article, *Applying the Science of Learning to the University and Beyond,* discusses how although every college teacher has an in-depth study in their academic area, they have little if no formal training in adult learning, memory, or learning transfer. College teachers learn about adult cognition through practical trial and error rather than through formal training, and use what they know about this subject very little, if at all in the classroom. The science of human cognition is based on a solid foundation and research-based applications that can and should be used in the college classroom and by instructional designers in developing instruction for older adults. Halpern and Hakel reveal in their article that what cognitive training instructors receive is rarely practiced. Most instructors practice instruction as they were instructed. (Halpern & Hakel, 2003, p. 36-37). Thus in order for the learning needs of older adults to be understood, barriers overcome, and successful transfer of learning accomplished; it is vitally

important for the instructor as well as the designer to receive more instruction and application on the cognitive learning of older adults.

Research has provided evidence that mental decline is not a consequence of aging. There is hope that continued learning prevents or delays mental decline. Results also show significant improvement in memory and confidence in one's mental abilities through personal physical and mental fitness. "Learning is the best medicine after all. The greater challenge is to position education as an essential life practice for quality of life across the lifespan". (Cusack, Thompson, & Rogers, 2003, p. 395-402).

After reviewing this paper, maybe you have a clearer understanding of why it is a must that instructional designers consider the learning needs of older adults. The designers need to not only understand the learning needs, but also the barriers to learning and how to overcome theses barriers. For after all, with the approaching retirement of so many older adults from the workforce, the continuation of the older worker in the workforce is our future and their learning needs have to become important to all of us.

References

Committee for Economic Development, Research and Policy Committee (1999). *New opportunities for older workers: a statement on national policy*. New York: Rowe Design Group.

Cusack, S. A., Thompson, W. J. A., & Rogers, M. E. (2003, May). Mental fitness for life: assessing the impact of an 8-week mental fitness program on healthy aging. *Educational Gerontology, 29*(5), 393-404.

Halpern, D. F., & Hakel, M. D. (2003, July/Aug.). Applying the science of learning to the university and beyond. *Change*, *35*(4), 36-42.

Jennings, J. M., & Darwin, A. L. (2003, Jan.). Efficacy beliefs, everyday behavior, and memory performance among older elderly adults. *Educational Gerontology, 29*(1), 71-92.

Koopman-Boyden, P. G., & MacDonald, L. (2003, May). Ageing, work performance, and managing ageing academics. *Journal of Higher Education Policy and Management, 25*(1), 29-41.

Purdie, N., & Boulton-Lewis, G. (2003, Feb.). The learning needs of older adults. *Educational Gerontology, 29*(2), 129-149.

Smith, P. L., & Ragan, T. J. (1999). *Instructional Design*. New York: John Wiley & Sons, Inc.

About the Author

George Pate earned his B.S. from Mississippi State University in Interdisciplinary Studies. His major areas of concentration were in Office Systems Technology and Business Management. George has 14 years of business level experience in software instruction and support. He began working on his M.S. in Instructional Technology at Mississippi State University in the Fall of 2003, during which he authored the article, *Instructional Design – Considering the Cognitive Learning Needs of Older Adults*. He is pursuing a lifelong dream of teaching and researching on the college level by working toward his Ph.D. in Instructional Technology at Mississippi State University. His research interests include race, gender, and age issues in instructional technology, online discussion, and collaborative learning.

Contact: George Pate, GIS Administrator, 4-County Electric Power Assn.
PO Box 351, Columbus, MS 39703. Phone: 662-245-0738 email: gpate@4county.org

Jianxia Du earned her B.A. from Southwest Normal University in China where she later served as Assistant Professor. Prior to this, she taught math and science for about 15 years at a prestigious high school, where she earned numerous teaching and service awards. She entered graduate school at University of Illinois at Urbana-Champaign and earned a M.A. in Educational Policy and Technology and a Ph.D. in Educational Technology. She has enjoyed her role as assistant professor at Mississippi State University for the past several years in the Department of Instructional Systems, Leadership, and Workforce Development. Her research interests include race and gender issues in instructional technology, online discussion, and collaborative learning.

Byron Havard earned his B.S. at Auburn University. His interest in education began very early growing up in a family of educators. While, pursuing his interest in instructional design he earned his M.S. in Instructional Design and Development from the University of South Alabama. Continuing his interest he earned his Ph.D. in Instructional Technology from Georgia State University. Byron has roughly nine years of corporate experience in instructional design, needs assessment, and evaluation. Several years ago Byron began serving as assistant professor in instructional systems at Mississippi State University. His research interests include collaborative learning, online discussion, race and gender issues in instructional technology, and instructional strategies.

Editor's Note: Najib Kofahi compares distance learning for the software industry in Saudi Arabia with those of three developing countries. He explains the funding of distance learning programs and how policies and priorities are adapted to achieve the economic benefits in a rapidly changing world. He also shows factors that are different for small or economically limited countries. Collaborative relationships of the distance learning program with university faculty and administration, industries that hire its graduates, and government funding agencies, are crucial to the program's success. In addition to analysis of distance learning from a different perspective, this paper shares valuable insights and data.

Distance Learning: Major Issues and Challenges

Najib A. Kofahi and Nowduri Srinivas

Abstract

This paper presents the state of the art of distance learning, and its impact on the booming software industrial growth. Tips on the prominent issues, major initiatives and the required actions behind the design of a distance learning system are provided. The impact of distance learning on the booming software industrial growth is also highlighted. The major factors that enable the third world countries to adopt an effective distance-learning paradigm are mentioned. The paper includes a brief case study of distance learning systems in three developed nations along with their comparative study upon certain prominent issues.

Key words: Distance learning system, distance learning education, software development organizations.

Introduction

The demand for education is growing in both academic and industrial scenarios. Even as student numbers continue to grow, there is pressure to reduce overall cost. There is also demand for flexibility to incorporate lifelong learning into day-to-day life. These factors, combined with availability of powerful communication tools and computer systems, has fostered investigation and resulted in implementation of new teaching and learning methods.

Distance learning is the new rage in the world of education. Valuable as it is, distance learning is still nothing more than a new use of familiar machine. And machines, no matter how good, do not run themselves. People run machines.

The very idea behind distance learning (DL) is to deliver education that does not constrain students to be physically present in the same location as the instructor. Continuous education and professional preparedness in various applied studies enables the student community to play a constructive role in their respective communities. Thus the most important part of DL is not the system, it is the people who will be learning from that system. Nowadays, initiation and development of public oriented models of DL education has become essential for the exceptional and unexpected future conditions of the respective nation. Indeed DL education is effectively adopted worldwide in countries as diverse in political and social systems as Australia, Indonesia, Pakistan, Britain, Thailand, China, Canada, India, Holland, Japan and the commonwealth independent countries. This form of education trains the students in self-learning mechanisms while enhancing their intellectual and thinking abilities. Thus DL is gaining in popularity due to two inbuilt tools, 'Self-motivation' and 'Self-discipline'. Self-motivation is one's inner spirit; the self-drive that makes you capable of doing what ever you put your mind to do.

In the early days, DL used to mean correspondence study through post and taking the exams at several remote places. In these days, audio, video and computer technologies became more

common delivery modes. The term DL and distance education (DE) is often interchangeable. Institutions and instructors control educational delivery while the students are responsible for learning. One can easily say that DL is a result of DE [1]. To facilitate the flexibility of student-teacher interaction during the course of learning created the need for DL systems (DLSs).

The major practical issues that influence DLS can be classified as following:

1. Separation of teacher and learner for the majority of each instructional process
2. Use of educational media to unite teacher and learner and carry course contents
3. Provision of two-way communication between teacher, tutor or educational agency and the learner.

We often come across synchronous and asynchronous as two classifications of educational delivery systems. Synchronous instruction requires the simultaneous participation of students and instructors, asynchronous implies participation at different times.

The advantage with the synchronous instruction primarily lies in its interaction with "real time", with delivery via interactive TV, computer conferencing, IRC, audio graphics, and MOO.

Since asynchronous instruction does not require the simultaneous participation of all students and instructors, students need not to be gathered together in the same location or at the same time. This gives the flexibility to the students in choosing the instructional time frame and gathering their learning materials according to their schedules.

Overall, asynchronous instruction is more efficient then synchronous instructions in the following ways:

a. **Telecommunication**: Facilities such as e-mail are helpful in the urban development.
b. **Delivery modes**: Delivery modes such as e-mail, audiocassette, and videotape courses have more human appeal.
c. **Flexibility**: Students decide their instructional time and schedule for receiving their learning materials.
d. **Parallel interaction:** Students respond independently, as when using e-mail.

This paper is organized as follows: The next section details the idea behind DL and its state of art as of today. Next, we provide the background literature about DL. The next two Sections explain the impact of DL on the booming software industrial growth, especially with reference to third world countries. This is followed by Communication Aspects of DL, case studies from three different institutions where DLS are currently in use, followed by our conclusions.

Evolution and Background of DL

In the past, several authors have expressed the ways and means of designing distance learning systems (DLSs), which has a vital role in the socio and economical status of the country. Here we list out the sample piece of the seminal work in this direction.

In the late 1950s and early 1960s: The television production technology gained its momentum and was largely confined to studio and live broadcasts [7]. In such systems the master teacher used to conduct widely broadcast classes. The main uncomforted observation here is to witness a good teacher being an expert of a subject performing badly before television cameras. In those days the cost associated with local production used to be at $165 per 15-minute program [7].

In the late 1960s and early 1970s: The emphasis moved towards a professionally designed television series introducing new subject matters (that was not being currently taught) to the students. This was an important contribution to the classroom curricula.

In the late 1970s and early 1980s: The Corporation of Public Broadcasting (CPB) funded television courses for national delivery of educational programs by Adult Learning Services (ALS). Educational programming was of general awareness rather than for course credit or degree. ALS now coordinates hundreds of public television stations and thousands of colleges to deliver telecourses. This has gained its popularity by spanning several courses and encouraging the student world to bend upon the DLSs. Very recently, CPB has extended its vision to satellite broadcasting of programs designed to be graduate and undergraduate courses.

In the late 1980s and in the middle 1990s: The technology was extended to offer complete online degree programs developed by community colleges and universities. For example, Politecnico di Milano, a technical university of Milano, Italy [1]; the university of Poland [21]; and Indiana [22] [23] are three best-suited examples in this regard**.** This era has also witnessed the intuition behind world-wide-web (WWW). Universities started offering several online courses using WebCT. The current university of the authors is offering one of its core courses, namely ICS 202 Data Structures with Java, online.

In the late 1990s and in the early millennium: DLS known as virtual universities gained widespread acceptance and accreditation. The main way of DLS has become online, with help of virtual reality [6] [8]. This has drastically reduced the very need of using a television, where the cost estimated for the high quality instructional television program exceeds $5,000 per minute.

Distance Learning: An Elegant Look

> *Distance learning technologies are expanding at an extremely rapid rate. Quite often instructional designers and curriculum developers have enamored of the latest technologies without dealing with the underlying issues of learner characteristics and their needs. These issues include: the influence of media upon the instructional process, equity of access to interactive delivery systems, the new roles of teacher, site facilitator and student role in the distance learning process [2].*

The earliest form of DL took place through correspondence courses in Europe. This was the accepted norm until the middle of this century, when instructional radio and television became popular. Now one finds the current interactive technologies were evolved from print and instructional television.

In those days, television production technology was mainly limited to studios and live broadcasts, where master teachers conducted widely broadcast classes.

During 1970s the emphasis turned from bringing master teachers into the classrooms to taking children out of the classroom into the outside world.

In order to help teachers, administrators, site facilitators and students understand distance education the next subsections present several prominent issues concerning DL; Major Initiatives and the required recommendations for DLSs; and the Required Actions for DLS Improvement.

Prominent Issues in DL

The following are seminal issues concerning the very idea of DL in any institution.

a) What is different about teaching at a distance?

The main criteria of DL lie in improving the individual ideas with a broad range of thinking capabilities. This helps in development of thought provoking views without interference of human-to-human interaction. DL will use advanced teaching materials, which are based on psychological theory of human cognition. DL facilitates effective interaction/communication between students and teachers.

b) What are the reasons for teaching at a distance?

There are many factors that come under the justification to this question, including:

1) Lack of proper transportation with ease.
2) Lack of availability of educated teachers and qualified personnel, especially in remote areas.
3) Socio-economic conditions of the remote people compiled to use DLS.

b) What are the different ways to improve planning and organization of DLS?

1) By an appropriate motivation and bend up of the mind.
2) By having a foresight and long term view towards designing an educated society.
3) By establishing a close link between industrial work force and academic world.
4) By improving the socio and economic changes within and around society.
5) By learning as individuals, groups, organizations, countries, and global society.

c) What are the different ways to meet student needs?

1) By establishing proper, continuous person-to-person meetings on a regular basis.
2) By contacting through a media such as Television, Telephone, and Web
3) By establishing a common ground for meeting at different time intervals, such as weekly or bi-weekly.
4) By proper preparation of the course materials such as solution sets/manuals.
5) By dispatching the needed documents in time by post/courier/email
6) By keeping regular (frequent) contact classes based on the category of the students, such as senior or junior or freshman.

d) What are the guidelines on teaching skills?

Here we provide few guidelines on the art of teaching skills.

1) A through preparation of handouts.
2) Reviewing the material twice before taking up the class.
3) Stressing more towards the practical and application relevancies.
4) Underlying the mathematical logic or reasoning (if any)

e) What are the different methods for improving interaction and feedback?

1) By proving a free hand to the students
2) By mixing audio-video in corporate training.
3) By establishing independent learning materials through the use of interactive communication technologies and teacher mediation [8].

Once we are sure of these prominent issues of DL, we are obligated to look for certain initiatives and needed actions.

Major Initiatives and the required recommendations for DLSs

We list four challenging initiatives and the set of recommendations for each of them for their proper implementation.

a. How do we inject DL into the mainstream of teaching and learning?

   The following are few recommendations to help to achieve this initiative:

   1) Engage the entire university faculty to participate and act as part and parcel of university DLS. The DLS will be more effectively operable only with the cooperation and support from all staff members of the university. The entire faculty in this way is integral towards a specific agenda. This will basically serve the purpose from three perspectives, viz., to fix the students motivation, to retain the talented faculty and to improve the university recognition.

   Fixing the student's motivation is more concerned with the building an educated society. There is no general process for retaining the talented faculty, but this way of making them as active participants in the university DLS, will improve their economic and academic status.

University recognition (especially with certain specific directed programs) is more concerned with the attracting increased number of students to participate in DLS, apart from attracting certain distinguished faculty from around the world.

To be precise, this is one of the possible ways of pushing the DL into the main stream of education.

1. Make the university management support as wide as possible.

   Management is vital for any institution's inter or intra operability. Especially in design of DLS, we need the management support to be as wide as possible for the following reasons:

   - Strategic decision making at several levels or institutions, such as introducing new courses/programs
   - Certain policies and procedures can be fixed easily. For example, relaxing certain pre requisites, waving of tuition fee for certain low economic group students.
   - Smooth maintenance of the DLS process, concerning with its cost and human effort.

2. Special attention towards the course (or programs) that have a rich job market.

   In this highly competitive world, more stress is vital towards specific courses and programs such as computer science, due to the rich job market for leading edge technology.

   This is important for producing students to support immediate societal needs and have a direct impact on the Nations' socio-economic conditions [16].

3. Take a noble look towards the far-reaching academic courses.

   Nowadays, certain academic domains such as information technology, have a direct and immediate impact on the society's economic status. These courses are primarily dependent on the task of knowledge processing, than on manufacturing new products.

   Every academic institute developing DLS should be prepared to meet this new challenging task. One general hurdle to meet this seminal task is non-availability of dedicated faculty.

   This is mainly to improve the university economy based on the knowledge processing – a vital component of the modern era.

4. Establish an attractive faculty/quality improvement programs for the university staff. This ensures the mental stability of the teaching staff towards their caliber and capabilities.

What steps are vital for designing, implementing and maintaining a robust structure to support DLS?

The following are recommendations to assist in achieving this target:

1. Improve the organizational (design), financial (productivity) and the physical structure(architecture) of the DLSs:

   This is basically vital for monitoring and controlling the number of remote stations of the DLS. This should be flexible to accommodate the increasing trend of the student population.

2. Provide high quality student service:

   This is a challenging issue in most of the DLSs, where orientation is bending more towards the student's free access to attract quality student community.

3. Broaden the faculty reward system:

   The very encouragement/enthusiasm for any faculty arises primarily from students. Then secondly it also comes from the management support [18] [19]. Thus we strongly feel that one should broaden the faculty rewarding system from two different perspectives:

   First, it is a well-known fact that teaching is an art, which can be acquired out of experience, rather than merely with qualifications. Change the reward system to help retain talented teachers and continue their teaching.

   Secondly it can also have an impact (encouragement) on the faculty for possible innovative thoughts that leads both faculty and students to the new seminal track, with the leading edge technology base, in this computerized world [19]. This can be clearly witnessed through the student project reports during their final semester of the course.

   As per the cognitive psychology, at times this can also have an indirect impact on the amount of knowledge transfer mutually between the teacher and student. This will improve the effective teaching aspects of the faculty.

How to minimize the gap (if any) between the DL and classroom learning?

The following are recommendations which aided achievement of this target.

- In the DL, one should increase the frequency of the contact hours [3].
- One should also decrease the number of examinations and encourage more take home assignments during the course of DL.
- In a regular classroom teaching, one is encouraged to explain the concepts with real world examples, whereas in DL it is worth explaining the examples prior to the concepts. This is especially with a view to fix the student motivation and encourage for the higher studies.
- In a regular classroom scene, the student is free to meet the teacher during the non-office hours as well, based on a prior appointment from the teacher. In DLS one can provide this facility by connectivity to the faculty cell phones for his appointment. The DLS student is encouraged more towards self-dependency. This will encourage self-motivation/confidence within the student community.

How to establish on-line Laboratories through simulation?

Certain laboratories do exist on line for the purpose of its immediate access. For example, the Anderson Laboratory at University of Illinois, USA [20], CLEAR (center for learning, evaluation

and assistant research) of University of Missouri, Columbia [22] and Orchid laboratory at Cornel University [6] offers certain technical lab assistance and consultation on line. The steps they used to establish on-line library include:

- Use of expert systems technology
- Electro chemical analysis and bonding techniques
- Nuclear fusion aspects as an application to biomedical signal processing.

The Required Actions for DLS Improvement

Here we propose a set of needed actions for betterment of DLS. These actions also, very much essential for implementing the above proposed initiatives and recommendations.

a) The university should involve the cross section of the core faculty for the improvement of the DLS, especially the technology-mediated courses [8].

b) For the purpose of monitoring the student progress, there should be some advisers available on campus.

c) There should be a strong Web infrastructure, essential for supporting course development and delivery; so as to cope up with competitive Web or Network based education.

d) The university management support or assistance (monitory and technical) should be on a continuous basis for maintaining and improving the DLS

e) In order to establish the best DL practices, we should look at new-technology, research findings, and assessment tools that support dynamic leading edge technology. This is particularly useful for the under developed countries, to rise and compete with the socio economic changes. In this connection, Internet and intranet are two useful tools coupled with the object oriented technology act as a part and parcel of any DLS.

f) There should be a close link between the DLS and the university information technology services to develop a better infrastructure and support services.

g) One should create a simulated science laboratory for conducting certain necessary online experiments [5]. This is very much recommended for the design and deliver of certain laboratory courses.

h) One should promote inter campus sharing of resources to treat the DL students on par with the regular classroom students. This makes it easier for the DL reader to follow the supplied course material, which can be at different levels such as inter college or inter university or inter continental.

i) Establish a public relation office to estimate market trends, track potential students with comprehensive information regarding the university DLS.

j) Arrange needed financial support for new curriculum development and on going course support.

The Impact of DL on the Software Industrial Growth

The very idea of DL is mostly limited to the learning aspects of those who live in the remote areas, who do not have a good transportation mode. This opens the question: How do we transition remote students to the job market in order to support software industrial growth?

There is an acute need to study the impact of DL learning on the booming software industrial growth [13][1]. In the following sub sections we throw some light in this direction.

The role of Academic and Industry relations

This vital characteristic is encouraged by most of the developing Nations around the world. This mutual relationship leads the Nation to the leading edge technology. Most industrial design and development strategies should be supported (directly/indirectly) with collaboration between academicians and their industrial counterparts.

The art of DL can now be more aptly applied to the booming software development organizations (SDO), in terms of supporting the latest information through teleconferencing or television or web. This will eliminate the very presence of the SDO staff such as, developers, project managers, and team leaders [11] [12]. This should also provide flexibility for the above staff in terms of timing/venue/subjective material. This virtually requires the SDO to configure their training units towards improving their product development as well as process improvement. This looks more economical to the SDO and stands as a source of income to the academic institutions. This will also improve the productivity and quality of the software products.

The Various ways of extending the DL paradigm to the SDO

In view of maintaining the quality and reliability of the software products, the ways of extending the DL paradigm to the SDO should be of three fold:

(1) Focus towards product development.

This relates to quality consciousness and can be improved with the help of DLS as follows:

(a) More views towards the coding standards and design techniques as a part of DLS course material.

(b) Communication aspects of the cognitive psychology should be coupled with the team building strategies (as a part of the DLS design course) to form a basis for the reliable/quality software production.

(2) More focus towards DLS process improvement.

This is more concerned towards minimizing the software engineering life cycle time [17]. Thus the process assigned for the DLS should take into its account the various design or coding or testing aspects of a software engineering process (SEP) with the motivation as described below:

(a) Any improvement in the design process of DLS should have a positive impact on certain pertinent aspects of a SEP. This can be achieved through the usage of certain communication aspects of DLS. This will also ensure the creation of software reusable modules. This is mainly possible due to the commonality of human-to human interaction in both (DLS as well as SEP) cases.

(b) Minimization of software maintenance cost during its development in a SDO: In order to have and retain DLS, institutions need certain special emphasis/care about the working aspects of a DLS, so is the students of DL. In this way the student of a DLS is more promising candidates to the SDO. Moreover the DLS process invariably involves the various ways of initializing, designing and maintaining a DLS. Thereby this knowledge about the process of DLS is an added advantage and should be consistent with the SEP for its possible improvement in SDO.

(3) Focus towards faculty improvement

DLSs are basically connecting the people in remote areas (X), where the DLS access is available with the developed cities (Y) where the DLS are statically located, such as a university or a higher learning institute. Where as the regular classroom teaching is

connecting the people in Y to the job market or SDO located at some other place (Z). Thus one can easily conclude that the DLS is indirectly connecting the people of X to Z.

In this connection, it is clear that faculty at DLS is dealing more with human-to-human interaction, rather than human-to-machine interaction. One can observe this within the SDO. Thus faculty at DLS can improve the faculty at SDO in several ways including teamwork building, conducting peer review, and configuration management [14] [15].

DL programs by nature will also help improving the academic qualifications of the faculty at SDO. This will intern fix the bottleneck issue of retaining the talented personnel at SDO. This can only be achieved by having a direct link between the faculty of DLS and SDO on certain selected topics of SDO interest. This typically consists of courses such as, password management, code compression techniques and the plausible methods/techniques of designing reusable design/code modules.

In this way, DL program can witness the integration of research and education that results in mutual benefit (SDO as well as University where DLSs are located). This type of DL also conveys various types of curricula settings which include information technology, software engineering, multimedia technology, networking; vital for any software industrial growth.

Impact of DL on the third world countries

The importance and significance of DL is yet to reach its maximum momentum in the third world countries due to several reasons. There are few countries adopting the DL systems on a trail basis, such as Uganda, Tanzania and Peru. This is mainly due to the slow progress in their literacy rate so that DL systems are underrated.

Here we list out few shortfall factors for the third world countries to utilize DL to its maximum extent.

Infrastructure: The infrastructure of the country plays a vital role for DL in several ways such as establishment of communication channels, political and economic constraints, and the dynamic nature of the technological evolution of terminals (audio-visual systems and computers) and telecommunication systems (switching and transmission)

Organizational: The organizational factors such as inter (intra) group coordination and communication, adequate management support, organizations of course material, student-teacher interaction mode, availability of local tutor, and financial and economic deficits (if any), all contribute to a lot to the quality and reliability of a DLS.

Human factor: This is more towards the psychological theory of human cognition. The main dominating factor in this regard is fixing the motivation either for a software engineer in SDO or to a student in a DLS.

The following are few observed human factors that are to be re-examined in detail. People's awareness about the leading edge technology, competitive trend of the job market, discrimination between local and remote students, the student needs and their social status, teacher's willingness towards on-campus/off-campus teaching, student-teacher interaction requirements for query clarifications and the characteristics of the course to be taught.

Economical factor: The prominent role of the government and its external support such as small/big business establishments contribute to the National economic growth. Thereby the DLS is proportional to the economic growth of the country. The main resource for DL in the third world countries lies in fixing their motivation towards creating an educated society.

Communication Aspects of DL

DL technology is trying to replace the traditional classroom instruction with a more sophisticated view to provide a bridge for remote learners who might not otherwise be able to attend a normal classroom program [2]. Several hurdles such as transportation limitations, children issues, and work schedules, are reasons why a distance learner cannot attend a classroom program. Supporting these students through DL programs may involve tradeoffs and compromise in aspects such as, communication, teaching equipments, preparation of course materials, etc.

The art of communication in the DL paradigm depends on the following factors:

Instructor to the student(s)

In DL the students normally meet the instructor on a weekly basis in person (or by phone), the communication between the instructor and teacher must concentrate more on the substance rather than style. This is normally one –to-many mapping. Here we provide five point formula for effective communication; stifle anger, talk brief notes, withhold judgment, listen to main ideas, and react to the message.

Student(s) to the instructor

In DL students are allowed to study anywhere, anytime, and at any place they want. Due to this flexibility the communication channels from the student to the instructor should be strategic and point focused. This is many-to-one mapping.

There are several factors that effect this type of communication including, shyness of the student, ignorance level of the student, fearfulness towards the instructor, nervousness of communication via speakerphone, etc. To some extent, few of these factors can be nullified due to emergence of certain modern tools such as Internet communication.

Effect of these two ways of communication on their individual development

In a DL setting, instructors are afforded the opportunity to uncover new methods of reacting students, while students are given a chance to improve their literacy and bridge the digital divide.

Once or twice in a year, (call it Contact Classes of the DL program) students come together to attend conferences and seasonal parties, exchange their views and email addresses, share food, and have a more traditional classroom experience [10][11][2]. This is intended to clear student-teacher communication gaps (if any) during the period of online degree program.

We propose the following factors for an effective DL communication to simulate the traditional classroom communication with in DLS:

1. The quality of the course material. This is more subjective, but should not be like a traditionally published textbook. This should contain more examples and less theoretical stress. In addition to mentioning the overall goals of the book, each chapter should have a clear indication of its objective(s) and its connection to preceding/succeeding chapters.
2. The quality of the instructor. Self motivated, truly devoted to teaching, allowing the student to talk first.
3. The quality of the students. Intelligent questioning, motivation towards higher studies, analysis before each experiment, individual thinking capability.
4. The quality and frequency of the interaction (via Internet, TV, phone). This varies from program to program; more frequent meeting with

undergraduate students over graduate students is a positive sign for a DL program.

5. The quality of Curricula preparations, assignments and solutions. Preparation of separate and restricted curricula/assignments in time and their availability over the web to simulate a DL program with a traditional classroom program. The type of examinations should be more relaxed (when compared to regular classroom students) for the DL program candidates. In DL program more weight should be given to take home tests and assignments, unlike the regular classroom student program.

Case Studies

In this section we focus on certain seminal institutions, where DLS are currently in use substantially, and throw some light on certain know–how aspects of their DLS.

Experience of DLS at the Technical University of Milano, Italy

This is a real-time interactive distance teaching activity at Politecnico di Milano, a technical university of Milano, Italy. It was started in 1995 and designed for excellence in critical education and research [1]. This DLS is designed based on two main faculties viz., Engineering and Architectural with about 30,000 and 15,000 students respectively.

The DLS is composed of mainly three parts viz., a wide screen codec, student camera-microphone tracker, and an improved eye-to-eye visual communication set up. This reflects two types of upgraded designs of the system's philosophy [1]. Different types of upgraded designs of distance teaching classrooms are proposed and analyzed.

The main characteristics of this system include:

1. Flexibility in the university education.
2. Uses a mechanism known as tele-presence classroom facility, having some positive and negative advantages.
3. Quality of learning improved based on pedagogical and cultural analysis of DL

The General Vision of DLS at Indiana University at USA

The degree or certification obtained from the DL course of this university is recognized on par with the regular university courses. The syllabi, course material and examinations are conducted by the regular university faculty [22] [23]. This fact revels and encourages the people living in remote areas, for better future prospective while enrolling.

This DLS is primarily serving the courses for form three perspectives viz., for general studies, learning partnerships, adult education and on-site noncredit courses.

Motivation of DLS at Warsaw University of Technology, Poland

Here the university DLS capable of performing certain things easily such as adjustments to curricula and other components of the system [21]. It reflects the following seminal points in its consideration: Advances in science and technology, trends on labor market, and update the system to international standards.

It's primarily focus is on 12 areas of concentration, leaving the option for its possible future updating. The main system characteristics include flexibility and adaptability in improving the quality.

Comparative study

Here we compare the following five aspects of DLS witnessed in the above three seminal institutions.

1. System Philosophy
2. System Architecture
3. System Evaluation
4. Programs/types courses offered
5. Number of students enrollment

We list these seminal points in the Table below.

Table: Comparative study among the several DLS

Nature of Functionality	The Technical University of Milano, Italy	Indiana University USA	Warsaw University of Technology, Poland
1. System Philosophy	Easily adoptable to the students with easy student/teacher interaction	Concern more towards establishing higher education and interaction with the software industry	Concern more towards engineering education with different curricula flexibility
2. System Architecture	Simulate the classroom scenario based on intercampus network	Integrate distributed education into mainstream of teaching with a robust design structure.	
3. System Evaluation	Reduces teacher-student interaction as little as possible.	More of faculty driven	Comprehensive and flexible framework
4. Programs/Courses currently offered.	Lessons, seminars and tutoring along with graduates and below	Graduates and under graduates	Engineering education courses
5. Number of faculty and participants involved	Several thousands of students per faculty	Fixed number of students per faculty	Quality conscious with flexibility and adoptability

Conclusions

We outline the major issues and challenges in DLS. We conclude that the DL strategies should promote the industrialists to the higher levels of abstraction, with the newly emerging technologies.

We suggest certain communication as well as challenging issues for the development of effective DLS. We conclude that this way of improving the DLS will serve the following needs:

1. Improvement to the academia-industry mapping.
2. Help retaining the talented people in the industry.
3. Attracting the remote sector people to the industrial job market, on par with the people residing in the cities/towns.
4. Help developing an educated/cultural society with in the Nation.

There are a few exceptional situations, in certain places, where DL courses are still under-valued when compared to the regular university courses, due to the fact that they might be lacking certain practical skills/training.

We conclude that the degree or certification obtained from DL system is well recognized by the industrial world.

There is still wider scope for the work in this direction, including establishing the DL Universities (DLU) to enhance the quality and reliability of the industrial products. This DLS also help in achieving the higher levels of the organization, such as ISO9002, SEI CMM Level 5.

References

1. Sergio C.B, A University distance lesson System: Experiments, Services and Future Developments, IEEE Trans. Education Vol. 41, No. 1, Feb. 1998.pp17-24.
2. Sherry L, Issues in Distance Learning, International journal of Educational Telecommunications, 1 (4), 1996, pp 337-365.
3. Sherry L and Morse R. A, An assessment of training needs in the use of distance education for instruction, International Journal of Telecommunications, 1 (1) pp.5-22, 1995
4. Pea R. A, Seeing what we built together: Distributed multimedia learning environments for transformative communications, Journal of Learning Sciences, 3 (3), pp285-299, 1994
5. Savery J R and Duffy T. M, Problem based learning: An instructional model and its constructive framework, Educational Technology, 35 (5), pp31-38, 1995.
6. Simon H A, Interview, OMNI Magazine, 16 (9), pp71-89, 1994.
7. Cambre M. A., The state of the art of instructional television. In G. J. Anglin, (Ed.), Instructional Technology, past, present and future (pp. 267-275). Englewood, CO: Libraries Unlimited, 1991.
8. Porters D (Ed.), New directions in distance learning: Interim report. (Available: David Porter, manger, School curriculum program, 4355 Mathissi Place, Burnby, BC Canada V5G 4S8, 1994
9. Allen B and Tucker et.al., Strategic directions in computer science education, ACM Computing surveys, Vol. 28, No. 4, December 1996.
10. Ohlsson L and Johansson C, A practical driven approach to software engineering education, IEEE Trans. Education May 1994.
11. Wilson B. C and Shrock S, Contributing to Success in an Introductory Computer Science Course: A Study of Twelve Factors, SIGCSE Bulletin Vol. 33, No. 1, March 2001.
12. Steiner C.J, Educating for innovative and Management: The Engineering Educators' Dilemma, IEEE Trans. Engg. Education, Vol.41, No.1, pp.1-7, Feb. 1998.
13. Mengel S. A, Guidelines for undergraduate software engineering education, Proc. IEEE FIE, Nov.1998
14. Edward A and David G, Engineering and education for the future, IEEE Computer, January 1998 pp. 77-85.
15. Mogee M. E, Educating innovative managers: Strategic issues for business and higher education, IEEE Trans. Engg. Mgt., Vol. 40, No. 4, November 1993.
16. Hilburn T.B and Bagret D. J, A Software Engineering Curriculum Model, Proc. IEEE FIE, Nov. 1999.
17. Tockey S, Recommended skills and knowledge for software engineers, Porc. IEEE FIE 1999.

18. Hilborn R. B. S, Team learning for engineering students, IEEE Trans. Education, Vol. 37, No. 2, May 1994.
19. Denton D. D, Engineering Education for the 21st century: Challenges and Opportunities, Journal of Engineering Education, January pp 19 – 22, 1998.
20. Murray H. G, Does evaluation of teaching lead to improvement of teaching?, International Journal for Academic Development, 2 (1), pp. 8-23,1998
21. Krasniewski A. and Woznicki J, Flexibility and Adaptability in Engineering Education: An Academic Institution Perspective, IEEE Trans. Education, Vol. 41, No. 4, November 1998.
22. http://www.dlrn.org/
23. http://www.indiana.edu/~iude/

About the Author

Najib Abdel Karim Kofahi is an Associate Professor of Computer Science. He received his Ph.D. from University of Missouri-Rolla in 1987. He is a faculty member in the department of Computer Sciences at Yarmouk University – Jordan since 1987. Currently he is on sabbatical leave from Yarmouk University and working as a visiting associate professor at KFUPM. He worked extensively in computer science curriculum development at Yarmouk University since his appointment and at Philadelphia University-Jordan in the academic year 1993-1994 while he worked as Chairman of Science Department, Philadelphia University, 1993/1994 while on sabbatical leave from Yarmouk University. He worked as Chairman of the Computer Science Department at Yarmouk University in the years 1990 -1992. Currently he is leading an online course development team to develop online course material for Algorithms course at KFUPM.

Contact Najib at nkofahi@ccse.kfupm.edu.sa

Najib A. Kofahi
Department of Information and Computer Science,
King Fahd University of Petroleum and Minerals, Dhahran 31261, Saudi Arabia

Nowduri Srinivas is currently working as an associate professor in department of Computer Science and Engineering at Birla Institute of Technology International Center. Dr. Srinivas main area of research primarily includes artificial intelligence and software engineering. He has published several papers in the area of 'artificial intelligence' (in particular to uncertainty handling) and 'software engineering' (in particular to software engineering process). Dr. Srinivas has given presentations at several international conferences and workshops. Dr. Srinivas has reviewed papers for IEEE transactions on software engineering. Dr. Srinivas is presently investigating the various ways of measuring and capturing uncertainty that arise in software engineering life cycle, while improving the engineering process.

Contact Nowduri at drsrini@hotmail.com

Nowduri. Srinivas
Department of Computer Science and Engineering,
Birla Institute of Technology International Centre,
Budaiya, Bahrain

Editor's Note: Most research is done with small samples. Web sites provide extensive data on user behavior. GradSchools.com lists over 58,000 distance learning courses from more than 2,500 institutions of higher learning. Analysis of approximately twelve million hits in the last three months of 1992 provides a rich source of data. This article integrates government data, traffic from the GradSchools.com website, and a user survey posted on the website in December 2002, to determine enrollment trends and criteria for selecting online courses. The editors are grateful to the authors for sharing this valuable information.

Understanding Why Students Select Online Courses and Criteria they Use in Making that Selection

Mark Shay and Jennifer Rees

Introduction

Across the US, students are opting for distance learning courses and fully-online degree programs in ever-increasing numbers, specifically within the last two years. Why do students choose to learn at a distance and what selection criteria do they use in choosing their education provider? Last December GradSchools.com and the University of Texas TeleCampus (marketing partners since 1999) began a combined effort to compare data to determine how and why students choose to learn online. Combined with a brief historical look at the expansion of distance education in the US, here is an informal analysis of why students choose to learn online and what selection criteria they rank most important in making their selections.

As millions of students opt for distance learning, sites like GradSchools.com, offering extensive searchable databases of distance programs, have seen explosive growth. There were eight million visitors to GradSchools.com in 2002 with nearly 10% visiting directories of distance programs.

> *Of the 2,559 graduate degree programs listed in GradSchools.com distance directories, 1,593 have joined since January 2001. Forty percent of the 257 MBA programs have joined in the past year alone. These additions to the database are a direct reflection of the growing menu of choices available to students opting to learn from a distance.*

International Data Corporation (IDC) confirms this growing interest in online learning. In its report, "Online Distance Learning in Higher Education, 1998 – 2002, IDC estimated that 2.2 million college students would be enrolled in distance education by the end of 2002, up from approximately 710,000 in 1998. While the numbers still need to be tallied, those in higher education are experiencing the surge of interest first-hand.

Why the growing interest in education? Several factors could play into this. Across the nation multiple trends are developing side-by-side. College students are getting older than the 18 – 21 average a decade or more ago, more students are enrolling in college, and the relative value of education in term of earnings potential is being realized and documented.

In 1998, 37 percent of all 18 – 24 year olds were enrolled in college, up from 26 percent in 1980. For people 25 years and older, the US Census Bureau shows 44,845,000 with four or more years of college, up from 33,291,000 a decade earlier in 1990. The National Center for Educational Statistics (NCES) projected a 10 percent increase in the college-age populations between 1999 and 2009. Universities across the country are filing reports with average undergraduate ages ranging from 23 – 25. As the average college student gets older, with it come life responsibilities including family and/or professional jobs. With this comes an interest in earnings.

The US Census Bureau reported "big payoffs" from educational degrees in July 2002. Their findings included the following:

Educational Attainment	Average Annual Earnings
High school dropout	$18,900
High school graduate	$25,900
College graduate	$45,000
Professional degree	$99,300

All this leaves today's older student in the conundrum of finding a way to continue to work to pay for their education, tend to their families, and continue their education. Many have found a solution in distance education.

The UT TeleCampus, (UTTC) the University of Texas System's centralized website for fully-online degree programs and online courses, proves this trend of growing interest in online degrees. Traffic to the UT TeleCampus website has increased dramatically in just the last year.

Measurement	3rd Quarter, 2001	3rd Quarter, 2002
Hits to entire site	2,282,509	4,211,433
Page views	366,718	591,266
Visits	132,984	172,623
Unique Visitors	45,722	59,087

Source: Webtrends® report

Definition of terms related to site traffic:

Hits: a single action on the Web server as it appears in the log file. If the page being viewed contains two graphics and text, one hit is logged for the .html page, and two more hits, one for each graphic. Hits are not an indicator of how many people visit a site. They are indicator in general site traffic, especially useful for comparisons over time.

Impressions: also called page views, these are the numbers of times a webpage is viewed, regardless of how many hits that webpage contains. Graphics and supporting files are not counted.

Visits: the number of times a visitor comes to a site. Not as accurate a measure as unique users because one person could be counted several times during the month long reporting period. Default counts the person as a new visit if they are idle longer than 30 minutes.

Unique Users: Individuals who visited a site during the report period. If someone visits more than once, they are only counted one time per reporting period.

In the most recent traffic period (Reporting on 112 days, from Sep 23, 2002 to Jan 13, 2003) there were 256,183 unique visits to GradSchools.com distance program pages.

These growing ranks of would-be online learners are finding no shortage of options. The number of online courses throughout the country has expanded in an equally dramatic arc. IDC predicted the number of four-year colleges and universities offering distance education courses would jump to 84 percent by the end of 2002 increasing the number of offerings 62 percent from 1998 course offerings.

GradSchools.com continues to see an increase in the numbers of programs and in the number of institutions hosting distance programs. The quality and variety of programs continues to advance with graduate programs being joined by professional programs including subjects as diverse and

advanced as bioethics. GradSchools.com's distance directory traffic during last reporting period found prospective distance learners searching for the following.

Unique Visitors to GradSchools.com

Subject Matter	Number of Unique Visitors
MBA	8,602
Counseling Psychology	4,869
Healthcare Administration	4,402
Forensic Psychology	4,360
Nursing	3,901
Educational Counseling	3,749
Doctor of Business Administration	3,690
Public Administration/Public Policy	3,678
Criminal Justice	3,595

In December of 2002, GradSchools.com posted a Web-based survey on their site asking visitors to help identify criteria of importance in their search. The primary purpose of the Distance Graduate School survey was to determine the most influential factors affecting a prospective student's consideration of distance versus campus-based programs.

The survey was conducted from December 10, 2002 – December 30, 2003 and generated 11,509 responses. These survey results mirrored findings of UT TeleCampus student surveys. What the potential students cited as important criteria in searching GradSchools.com were the same criteria cited by UT TeleCampus students in pre-course and post-course surveys.

Respondents to the GradSchools.com survey were recruited through a link in a small pop-up window that appeared when a user entered the GradSchools.com website through its home page. (http://www.GradSchools.com) visitors who clicked on the link to the survey were directed to a screen with the first survey question, "Are you planning to begin or continue a post-baccalaureate education during the next twelve months?" Those who answered "yes" were presented with a second screen asking the question, "Are you considering: A campus-based program only; either a campus-based or a distance program; or distance program only?" Those who answered either of the last two options, campus and/or distance or only distance program, were directed to the next screen with questions focused on ascertaining the reasons and selection criteria they would use in making their selection for education provider.

Answers were recorded in a database and calculations were used to determine the percentage of responses to each answer. Results were presented throughout the final report as the actual number of responses and percentage of applicable respondents for each question and its subsequent answers. Missing data, or skipped questions were factored into the percentage calculations.

Of the 11,509 respondents, 28% (2,355 respondents) said they would consider campus based or a distance program, or a distance program only. (6,055 respondents were seeking campus-based programs.) It should be noted that GradSchools.com advertises with a variety of keywords that route students into the site as close to their interest as possible. Visitors who indicate "distance" in the search engines would not be routed to the GradSchools.com home page, but to a portal page specific to distance programs. Visitors that come to the GradSchools.com home page; therefore, typically have a general interest in graduate education, not necessarily a predisposition to distance education.

The 2,355 respondents expressing interest in distance education were asked to rate the most important criteria from a pre-selected list.

What are the most important criteria when choosing a distance program?

	Number of responses	Percent
The types of technology utilized in the program (video conferencing, email, etc.)	156	8.6
High level of interactivity between professors and students	349	19.3
Reputation of program	591	32.7
Access to video content (lectures, labs, resources)	39	2.2
Access to non-video electronic content	8	.4
Personal referral	21	1.2
Affordability	308	17.1
Length of time for degree completion	240	13.3
Other	62	3.4
No answer	32	1.8

First among criteria was reputation. With the arrival of online courses came a group of reputable providers, but also the diploma mills that provide questionable or disreputable courses via the Internet.

Students looking for graduate degrees online understand the importance of reputation and seek programs that their employers and colleagues will recognize and respect. Studies of perceptions of employers to online learning confirm this need. Employers were more in favor of online degrees if they came from established recognized universities and colleges according to a recent Vault.com survey.

It's important to note the respondents second most important criteria - high levels of interactivity between professors and students - in that this indicates increasingly discerning "buyers" wisely shopping for a program that will work for their educational needs. These prospective students understand it's a "buyer beware" scenario and they have done their homework.

There is tremendous variance in the levels of interactions in online courses and students are wise to make that a key criterion in their selection process. Research continues to point to the correlation between learning effectiveness, student satisfaction and interaction with students and peers in the online course. The days of isolated distance learners is potentially gone, based on the providers' desire to integrate effective instructional design into the course production process.

The Sloan Foundation's extensive work in asynchronous learning networks proves this point in its "Linking Student/Faculty Satisfaction and Perceived Learning to Interaction."

Sloan partner, the State University of New York spoke to this in "Measures of Learning Effectiveness in the SUNY Learning Network (Shea, Fredericksen, Pickett, Pelz and Swan) saying "When course instructors provided prompt feedback and high quality feedback significant correlations were found with high satisfaction and high levels of reported learning."

Affordability ranked as the third most important criteria in selection, not surprising given a large number of distance learners rely on some kind of financial assistance to fund their education. While many business programs provide tuition assistance, many education degrees are self-funded.

Frequently an advantage to seeking online courses through an established state university system is distance learners frequently can apply the same criteria as they would as on campus students seeking financial aid. The UT TeleCampus worked with the University of Texas System's nine academic campuses to create a financial aid consortial agreement. Many of the UT System's online degree programs are collaborative with students taking courses from several UT campuses toward a common degree plan, and the ability for student financial aid to travel with them as they take online courses from a consortium of university partners was critical.

Lifestyle choices and finding a way to integrate their studies into their typically very busy lives as older working professionals and parents also play heavily into the decision to learn online.

Why do students choose online education over campus-based programs? As mentioned, it simply fits their lives better. The GradSchools.com survey asked this question and found convenience the number one answer.

What is your primary deciding factor between a campus-based and distance program?

	Number of responses	Percent
Availability	279	15.4
Affordability	373	20.7
Convenience	501	27.7
Reputation of program	337	18.7
Length of time for degree completion	179	9.9
Portability	30	1.7
Other	36	2.0
No answer	71	3.9

What was the primary reason you chose to pursue a degree through distance education?

	Number of responses	Percent
Variety of graduate program available	24	4.4
Ability to work independently	146	26.6
Flexible hours	221	40.3
No local on-campus alternatives offering programs in my field	102	18.6
Other	44	8.0
No answer	12	2.2

Convenience was sited as the lead reason to choose a distance program over a campus program. At the UT TeleCampus students are asked a similar question in pre-course surveys with the

overwhelming response to "why did you decide to learn online" consistently remaining over three years, convenience and/or flexibility.

Of interest, those in educational programs usually cite a desire to self-select where they will study while business programs students cite when they will study as a key factor in the flexibility determination.

Additionally, mirroring the GradSchools.com survey, a smaller but significant portion say they chose to learn online because the program they wanted was not offered within a reasonable distance, and the commute took valuable time away from work, family or study.

The GradSchools.com survey aligns with UT TeleCampus surveys in many findings. Students use reputation, accreditation, interactivity and affordability as selection criteria but begin their searches because they need flexible hours and the ability to direct their own schedules to complete a degree plan.

About the Authors:

Mark Shay is Founder and CEO of GradSchools.com. Mark has been involved with advertising and marketing in the collegiate marketplace since 1982 while a student at Syracuse University. In 1989, after five years working for a Fortune 100 firm he founded the company that has evolved into Educational Directories Unlimited, Inc., the leader in the field of online recruiting of students. Through innovative services such as Distance.GradSchools.com and StudentProspector.com, EDU provides comprehensive and information-rich resources for students and effective recruiting advertising for schools. http://Distance.GradSchools.com

Jennifer Rees is Manager, Communication Services, UT TeleCampus. Jennifer has been involved with communications and organizational marketing including media placement, marketing research and analysis, copywriting, advertising design and production in higher education for more than 10 years. She acts as in-house agency for the UT TeleCampus providing communications tools to build awareness of and interest in the online degree programs offered via the UT TeleCampus. http://www.telecampus.utsystem.edu

Editor's Note: Online learning serves those who can not physically attend on-campus classes because of time and distance constraints or inability to fit class schedules. On-campus students take online courses to have flexible schedules that incorporate work, family, and other activities. Studies that compare learning online and in traditional classrooms find no significant difference. Often it is noted that distance learning attracts adult learners who are responsible for their own learning. As more on-campus students take distance learning courses, it is important to repeat these studies to ensure comparable learning and performance.

Comparing an Online Course to its Classroom Counterpart

Augustine B. Mascuilli

Abstract

At Pace University we offer Mat 107, The Development of Mathematics, both online and in the classroom. The online version is getting more and more popular but more students still take the in class version. In this paper we will compare an online course at Pace University to the traditional classroom version. We will discuss communication, student help and testing. We conclude the paper by testing for statistical differences in the grade point averages of the two courses.

Introduction

At Pace University, we offer Mat 107, The Development of Mathematics, both online and in the classroom. The online version is becoming more popular but the majority of students still take the in class version. The advantages of the online version of Mat 107 are the class' asynchronous nature. Students can read the lecture notes and complete the assignments on their own schedule. This freedom gives the students a bit more leeway in scheduling their other classes. The online setting however, is not for everyone. Some students need the face-to-face interaction between the professor and themselves that a traditional class offers. Also, an online course demands more discipline on the student's part to read the lectures and complete the assignments

In this paper we will compare an online course at Pace University to the traditional classroom version of the same course. The topics we will discuss include testing, communication with the students, and student help. We will then compare the grade point average of the traditional classroom version of the course to its online counterpart.

Background

Mat-107 is a three-credit math course designed for students with non-mathematical majors. This course covers selected topics chosen from problem solving with sets, logic, probability and expectation, introductory statistics, development of number systems, basic algebra and applications. This course is offered in the fall, spring and summer of each year while Mat-107 online is offered in the fall of each year. The students that take Mat-107 online are generally Pace students based on either the New York City campus or the Pleasantville campus. The students that take Mat-107 come from a wide range of mathematical backgrounds. Some students find the course to be easy while others think it is very hard.

Communication with the online students is done mainly through email. If a student is stuck on a problem he or she can email it to the instructor and the student receives the solution by email or fax. Students use the discussion board to communicate with the instructor as well as each other; however, I've observed that they don't use it as much as the other online course that I teach at Pace (A. Mascuilli, Effectiveness of Teaching Mathematics Online, ALN Magazine, December2000, Vol. 14, Issue 2.). Another form of communication is the chat room. This form of

communication is not that popular with the students, but on request, I can meet a student in the chat room. The chat room allows me to work out problems on the white as the students look on. The last form of communication, and the least used, is the telephone. When the telephone is used, the questions asked are usually not math related. The in class students frequently ask questions in class but only occasionally visit my office hours. On the other hand, my online students visit my office hours more often than the in class students.

Method

Whenever we discuss grade point averages we have to comment on test security. In this online course, the students are required to show up in person for three exams and a final exam. Because of this, test security is not an issue. The three exams are each worth 20% of the final grade and the final exam is worth 40% of the final grade. For both the online version of Mat-107 and the in class version for which I taught, I administer and proctor the exams and the final. For the other in class versions, the tests are given by the professors that teach them.

The test we will use to analyze this data is a standard hypothesis test for the difference of means

(Small samples). We will test for differences in the grade point average for the fall 2001 online Mat-107 against the in class version of Mat-107 for the academic year of 2001 on the Pleasantville campus. The grade point average is computed using the following scale.

A	A-	B+	B	B-	C+	C	C-	D+	D	F
4.0	3.7	3.3	3.0	2.7	2.3	2.0	1.7	1.3	1.0	0.0

The grade distribution for the five in class sections of Mat-107 for the academic year of 2001 is summarized in table below.

A	A-	B+	B	B-	C+	C	C-	D+	D	F
14	11	5	7	8	5	2	3	4	5	3

The grade distribution for the online section of Mat-107 is summarized in the following table.

A	A-	B+	B	B-	C+	C	C-	D+	D	F
1	0	0	2	2	1	2	2	1	2	0

Results

To test for difference in the grade point average of Mat-107 online fall 2001 against the in class sections of Mat-107 for the academic year of 2001 we will use a t-test of differences of means for independent samples (Pelosi, Marilyn K and Sandifer, Theresa M. Doing Statistics for Business, pp468-469. New York: John Wiley & Sons, Inc). We will test the claim that there is no statistical difference in the two means. For the fall of 2001 the Mat-107 online the GPA was $\overline{X}_1 = 2.18$ with a standard deviation of $s_1 = .88$, and number of students was $n_1 = 13$. The combined G.P.A. for the in class sections of Mat-107 was $\overline{X}_2 = 2.79$ with a standard deviation of $s_2 = 1.14$ and the number of students in these classes was $n_2 = 67$. One should note that this is a two sided hypothesis test with the following setup.

$$H_o: \mu_1-\mu_2=0$$

$$H_a: \mu_1-\mu_2\neq 0$$

The numbers above yield the test statistic of

$$t = -1.793$$

With this t value we fail to reject H_o at the alpha level of $\alpha = .05$. Failing to reject H_o means there is no statistical difference in the two grade point averages.

Conclusion

Traditional classroom taught courses are still more popular but online classes are growing in popularity. The results of this paper show that there is no statistical difference in the grades between the online version of Mat-107 and the in class version of Mat-107. This fact can be used to justify the claim that online teaching is an effective method of education.

About the Author

Augustine B. Mascuilli is an assistant professor of mathematics at Pace University. He teaches both online and in the classroom. Dr. Mascuilli's research interests lie in real and complex analysis. He received his Ph.D in mathematics in 1996 from the State University of New York at Albany and since that time he has been with Pace University.

Contact Information:
Augustine B. Mascuilli, Ph.D
Mathematics Department
Pace University
Pleasantville, NY 10570

E-mail: amascuilli@pace.edu
Phone: (914) 773-3935, Fax: (914) 773-3418

Editor's Note: At Eastern Mediterranean University in Turkey, a team of faculty and students examined the respective roles of teachers and students in Distance Learning. This in-depth analysis provides a detailed perspective and definitions based on research and practice

Roles of the Students and Teachers in Distance Education

Aytekin İşman, Fahme Dabaj, Zehra Altinay and Fahriye Altınay

Abstract

Distance Education is a new, global technology-based education to facilitate easy, immediate learning and interaction for communicators, teachers, and students in education programs. Distance Education can provide mass-education for everyone. It leads people to learn individually and shifts responsibility for learning from instructors to students. It facilitates student selection of courses and content to reflect their needs and motivations. It provides creative and qualified ideas and information to motivate students from diverse backgrounds.
To be effective, distance education programs need to redefine the roles of teachers and students in the learning-teaching process.

Introduction

Technology changes every life style and human activity to become fast, global, and time-critical. The computer facilitates speedy access to useful information. Social, global, cultural, and educational competitiveness are influenced by educational technologies that positively affect style, duration and method of learning for groups and individuals. Technology impacts *where* we learn. Distance learning in homes, offices, and libraries complement classical learning in classrooms (Clark, 2001).

Distance Education refers the interactive, educational process between student and teacher separated by physical distance (Harry et al., 1993, p.32). It adapts to individual differences and the way students react to media. Personality, intellectual abilities, cognitive and learning styles are important concerns in distance education (Harry et al., 1993).

Distance education is expanding rapidly as it gains worldwide acceptance by students, educational institutions, employer organizations, and the public at large. It makes education accessible to underserved populations, and flexible in fitting into complex lifestyles, schedules, and responsibilities of today's learners. The quality of Distance Education is no longer in question, and focus has moved beyond defining what it is to determining what it can do.

Instead of traveling to attend regularly scheduled classes at a teacher-centered campus, students can access internet courses virtually anywhere. Despite the physical distance between students and teachers, communication technologies offer many opportunities for interaction. These same communication technologies facilitate rapid dissemination of new concepts in disciplines such as science and technology. Distance learning is a positive influence for change and global implementation in all disciplines. Pedagogy in traditional institutions of learning has been affected by distance education.

For societal development; education should be a leader in providing easy access to knowledge, effective ways to learn, and growth opportunities for qualified people. Distance education enables

people to learn individually at any time or place. They learn from computer assisted programmes, interactive multimedia, and internet discussions rather than from lectures and classroom methods of instruction. Distance Education is really related by the discovery of truth for gaining antithesis sides of the thoughts to get the exact knowledge (Willis, 2002).

Distance educators refer to three distinct applications of computers in the off-campus study environment: Computer Managed Instruction, Computer Aided Learning, and Computer Conferencing.

Computer Managed Instruction facilitates management and administration of the learning process. It provides opportunities for electronic counselling of students, on-line registration, institutional record keeping, evaluation, and tracking student progress.

Computer Aided Learning includes software applications to teach students different subjects and concepts through pre-structured and programmed materials. Courseware either replaces or supplements material that students are expected to learn through other media (print, video, audio cassette). Lesson formats range from tutorials to simulations. Students can also use Internet resources for exploration and research.

Computer Conferencing uses the electronic network to enables individuals to communicate via computers at the same time (synchronous) or delayed time (asynchronous), either as a group or between two individuals. Typical formats include email, bulletin board, threaded discussion, net meeting (with the possibility of audio, video, and shared "blackboard" displays), and databases.

Distance Education requires alternative learning process, roles of teacher and students (Clark, 2001). People roles in distance education can be categorized in four subtitles;

1. **Students**: In distance education, students have role to learn. In that process, student has difficult and different roles according to traditional learning process.
2. **Teacher**: The main role of the teacher is the design of the course and setting the needs of students. Teacher has role to guide the students.
3. **Designer Groups**: These persons determine goals, content, delivery systems, interaction, and evaluation. Usually it is a team of subject matter experts, educators, instructional designers, and production personnel. They design the cyber and digital environment for the effective teaching and learning.
4. **Directors**: In the all institutes, there are people who direct planning, implementation, and evaluation of the education process.

Interdependence, distance and interaction interplay with the roles of students and teachers. There are three types of interaction within the distance education:

- Learner-content interaction
- Learner-instructor interaction
- Learner-learner interaction

These three types of interactions play a key role in distance education. As in face-to-face communication, they share ideas through email and chatting (Harry et al., 1993).

In summary, distance education is evolving based on changing economical and social contexts. Knowledge has become one of the most important economic forces; knowledge is rapidly expanding and its useful life time becomes increasingly shorter. To survive in the market, companies need to change, to train and retrain their employed; unemployed workers also need to be retrained. Investing in the human resources seems to be the only way for a sustainable development (Mario and Heinze, 2001).

The pace of change, the need for lifelong learning, and diminishing educational budgets are pressuring educational institutions to create alternative efficient ways to learn through distance education.

The Aim of Research

Distance Education is a form of education in which course content is delivered and interaction provided by the technologies and methodologies of the Internet. The online environment allows people to interact with others asynchronously or synchronously in collaborative environments; to gain access to remote multimedia databases for active, resource-based learning; and to manage self-paced, individualized learning in a flexible way. Moreover, the Internet allows students to enroll in courses from anywhere in the world at almost any time.

There is a new vision developed during the past 15-20 years, strongly influenced by the social and cognitive sciences. The educational system now focuses on learning rather than on teaching. The focus of learning theory has changed to learning styles and perception. Knowledge is considered as socially constructed through action, communication and reflection involving learners (Huebner and Wiener, 2001).

To design effective distance education programs, it is important to understand how learning occurs and the factors that influence motivation, communication, perception, and learning. Learning strategies may consider 1) cognitive learning strategies 2) metacognitive activities for planning and self-regulation 3) learner's goals and motivation. Cognitive strategies can not be divorced from learner's purpose in using them. Therefore, learner goals and motivation highly influence the cognitive strategies. The distance education requires intrinsic motivation to support skill development, intellectual interests, challenge or personal growth consistent with the results of relevant research (Gibson, 1997).

Moore and Kearsley have enumerated design considerations for distance education:

1- Good structure
2- Clear objectives
3- Small units:
4- Planned participation
5- Completeness
6- Repetition
7- Synthesis
8- Stimulation
9- Variety
10- Open-ended
11- Feedback
12- Continuous Evaluation (Moore, Kearsley, 1996, p.122).

Reflection in distance education means engaging individual students to explore their experiences to lead to new understanding and appreciations. Holmberg (1995) handled the guided didactic conversation between teacher and student as pervasive characteristic of distance education;

1- Those feelings of personal relation between the teaching and learning parties promote study pleasure and motivation.

2- That such feelings can be fostered by well-developed self instructional material and two way communication at a distance.

3- That intellectual pleasure and study motivation are favourable to the attainment of study goals and the use of proper study processes and methods.

4- That the atmosphere, language and conventions of friendly conversation favour feelings of personal relation.

5- That messages given and received in conversational forms are comparatively easily understood and remembered.

6- That the conversation concept can be successfully translated, for use by media available, to distance education.

7- That planning and guiding the work, whether provided by the teaching organization or the student, are necessary for organized study, which is characterized by explicit or implicit goal conceptions (Holmberg, 1995, p.47).

Learner autonomy should be the goal of distance education. It is good for students to be self-directed, motivated, evaluative, and responsible for their own learning. This changes the traditional role of the teacher from disseminator and manager to designer, moderator, guide and coach. Learner autonomy is realized when distance learners participate in setting learning objectives, implementing their program of study, and evaluating their personal learning and performance. Instead of face-to-face instruction, distance educators design learning environments that stimulate productive learning activities. Students use these activities to achieve course goals and meet their individual needs.

Learning environments range from teleconferences to interactive multimedia via the Internet. They are designed to engage the learner. For example, in audio conferencing there are four major strategies for the teacher:

a- humanizing and relating to the learner

b- participation and interaction

c- message style presentation of information

d- feedback to determine effectiveness of learning and teaching

Television and computers are tools used by educators to disseminate and manage instruction. It is important for educators to know the values and limitations of different communication media and techniques.

The coordinator of distance education should establish competence, continuity, control and confidence. Large group one-way communications should be supported by small group activities and interactive computer experiences. Even in distance learning, there may be a need for individual tutoring with real time interaction between students and teachers, or peer learning where students work together and support each other. Students need guidance, encouragement and reassurance; constructive criticism and advice, fair and objective grading, and timely response from the instructor.

For the most part, distance education students are adult learners. Compared to school-age students, they are self-reliant and responsible for their own learning. They should be encouraged to assume responsibility for setting objectives, self-direction, personal responsibility, personal experiences, making decisions, learning to solve problems, and maintaining intrinsic motivation (Moore, Kearsley, 1996).

Research in distance education encompasses the changing roles of teachers and students, the role of interactive technologies, and its global impact on traditional and underserved populations of learners. It describes distance education as synchronous and non-synchronous, anywhere and anytime, and learner focused. It adds a vocabulary of technical terms related to computers, television, and interactive multimedia.

Some studies compare the quality of learning; others examine the quality of the learning experience. For example, a study of Ohio's distance education courses via microwave television compared student perceptions based demographic variables (İşman). "The level of student satisfaction in the class was not high. More than 50% of the observational data indicated that students did not agree that they learned as much in the interactive television class." Test results revealed no relationship between gender and students' perceptions. Age and college classification were strongly related to perceptions of interactive television courses. Less significant relationships were found between academic major and graduate/undergraduate status (İşman).

Teachers should share their knowledge and experience with students by providing consulting, helping, directing, and advising. Distance Education embraces whole of the student activity, responsibility and willingness for formulating and asking relevant questions and seeking answers. Many Distance Education programmes use discussion and question-answer type media, or decisions based on short scenarios or simulations. The main consideration is here to define and measure role effectiveness of teacher-student communication on learning at a distance (Willis, 2002). Distance education is new technological power for developing a dynamic self-concept for students. The constructivist approach changes the role of educators. Distance Education emulates this approach by leading the students (learner) to develop his or her own strategies, objectives, evaluation, implementation under guidance of a teachers (Gibson, 1997).

Importance Roles of Students and Teachers

Distance Education, or earning a degree online is a rapidly growing industry already slated to be worth billions. While many people waste countless hours surfing on the net, others invest the same time and technology to improve their education. Higher education institutions, business, industry, government, health care, and more recently K-12 schools are embracing this new opportunity for learning.

Distance Education resolves distance, time and some financial aspects of education. Distance learning empowers individuals to participate in self improvement and career development.

Related Research

Wilson, et al. (1991) describe the development of a distance education, professional development program for teacher education that promotes two-way communication between tutor and student through use of the telephone, electronic mail, and facsimile transmission. In 1986, McGill University in Montreal began by offering education courses to five teachers in remote areas, with enrolment expanding to 320 by 1991. Educational computing and media courses were adapted for distance education, representing the department's first major venture in developing specific instructional materials for distance learners. Additionally, the geographical area served grew to include all of Quebec, the Northwest Territories, the Yukon, New Brunswick, Nova Scotia, and parts of Newfoundland and Labrador.

It is noted that, although the relationship between teacher and student in *distance education* seems to imply a form of learning that is remote, impersonal, and indifferent, students of the McGill

program praise the courses for their "human" atmosphere and the "warm" interaction." It is concluded that the McGill University program is a success, and will continue to establish more substantial programs in continuing education for professionals. It is also expected that future research will find immediate application in establishing new guidelines for tutor training. It is important to understand the real interaction among the students and teacher with their roles.

Clark (1993) describes a study that was conducted to examine the receptivity of faculty at two-year and four-year colleges and universities to distance education. It examines attitudes toward distance education, the influence of previous experience with distance education and educational media, and barriers to distance education.

Garrison, Anderson (1999) contrasts large distance education programs in industry with an approach called "little distance education" that is consistent with the traditional goals and values of creating knowledge through a critical community of learners. It discusses meeting the needs of a new market for continuing distance professional education. The effects of distance education and its shortcomings are evaluated.

Levin (2001) examines distance education in postsecondary institutions, specifically in community and technical colleges in the United States, as an educational domain where information technologies have a central place. Looks at characterizing features of distance education management through a group of distance education managers; it explores their role as professionals to identify what, to them, are critical issues in distance education. It reflects perceptions from the management and its influence on the program.

Rockwell, Furgason, Marx (2000) describe the participation of distance educators in a Delphi study to identify and rank future research and evaluation needs/issues. The study focused on planning for distance education; structuring decisions required for distance education; the implementation process; and evaluation needs in documenting outcomes. Four themes emerged: cooperation and collaboration among institutions; designing the educational experience for the distance learner; teacher preparation; and educational outcomes.

Giltrow (1997) discusses the role of distance education for K-12 as enrolment increases in the next 10 years. He notes distance education development needs, obstacles to addressing large-scale educational problems using distance education, and necessity for a three-part analysis of America's distance education. When investigating effectiveness, it is important to evaluate alternatives and negative aspects of distance education.

Merisotis (1999) discusses the Outcomes of Distance vs. Traditional Classroom-Based Learning. It embraced the question "What's the difference between distance learning and traditional classroom-based instruction?" This question has become increasingly prominent as technology has made distance learning much more common. A web site maintained by Thomas Russell at North Carolina State University (and a recently published companion book) is called The No Significant Difference Phenomenon, and compiles various articles, papers, and research studies on distance learning. This site is important because evaluates and compare relative strengths of traditional and distance education.

Dominguez (2001) illustrated a new, parsimonious model that investigators interested in distance education can use to ask meaningful questions about the relative quality of distance education courses (Dominguez & Ridley, 1999). The approach moves the emphasis from student-level data to course-based data. Sample data comparing online and traditional higher education courses covering nine disciplines were reported. These data revealed that preparation for advanced courses was statistically equivalent whether the course prerequisites were online courses or their traditional classroom counterparts. The article further explored the usefulness of this framework

for identifying a significant discipline-related difference in the relative effectiveness of online and traditional prerequisites as preparation for advanced courses.

Jones (2000) wrote an article which was about that these Australian educators, the ongoing American debate over distance education reported in the daily press, The Chronicle, and Change, is surprising because the essential debate is long over in Australia. Respected Australian universities have been awarding indistinguishable degrees to on-campus and off-campus students for decades. Nearly 14 percent of university students study at a distance. When we look, as Australians still occasionally do, toward Britain, we see Open University degrees recognized as representing a rigorous, thorough British education. This article is important to see the alternative view on distance educational disciplines.

The above reviews of research define distance education in relation to information technology and Internet based access in education. They define the roles of teachers and students, different management perceptions, communication models and communication barriers.

Findings and Comments

Distance Education requires an individualized learning process where the learner can access knowledge from computer-assisted programs and/or other technologies such as television. With development of high technology, learners look for fast, easy, any-time, anywhere education opportunities. They expect high educational standards based on global competition. Distance Education may serve as an alternative to traditional on-campus instruction or "blended" to combine distance with on-campus courses.

The changing roles of students and teachers in distance education are influencing classical education standards and pedagogy. According to research findings on the roles of the students' in distance education are;

1. Be disciplined and on task
2. Consult with and seek guidance from advisors through required access methods
3. Assume responsibility for your own learning
4. Develop effective interaction with teachers and counselors (like classical learning)
5. Evaluate and judge your own performance
6. Combat prejudice and communication barriers

According to research findings on the roles of the teachers' in distance education are;

1. Assume responsibility for preparation and presentation of learning tasks
2. Immediately consult with students to correct problems and keep them on task
3. Be aware of student needs and wishes; respond promptly to communications and tests
4. Build student motivation
5. Combat prejudice of communicational barriers
6. Establish an effective environment for student-teacher and student-student interaction

Research provides data to compare effectiveness of the teaching and learning in a great variety of situations. Learning in a high-tech, global environment presents new roles and responsibilities for both teacher and learner. In addition; there is a radical change in construction and delivery of course content. Media to facilitate interaction between and among learners, teachers, and content

increases the opportunity for in-depth and meaningful learning (Gibson, 1997). Constructivist techniques support learning and teaching, self-development and self evaluation (İşman, 1999). Constructivism is an integral part of distance education. The focus is on the student and his active role in learning supported by technology.

Teacher Role in Distance Education based on Constructivist Approach;

1. Teacher promotes learner autonomy and is aware of individual differences.
2. Teacher uses relevant and current information to transmit knowledge. Teacher constantly researches the curriculum and provides concrete up-to-date examples.
3. Teacher gives importance to the thoughts of students and promotes student research, evaluation, discussion, and reporting.
4. Teacher is aware of individual student differences when designing course materials
5. Teacher knows student prerequisite skills and knowledge and uses this foundation to build new knowledge. In addition, the teacher knows how learner can learn.
6. Teacher initiates student-teacher interaction, and has communication and technological skills to effectively implement distance education.
7. Teacher constructs student-centered learning with opportunities for interaction. Students are responsible for learning and responsible for contacting teacher when needed.
8. Teacher collaborates with student in self-development and responsibility.
9. Teacher provides environment, materials, and guidance for collaborative learning, interactive discussion groups, individual learning, and research.
10. Teacher provides prompt and accurate feedback to students to facilitate learning.

Student Role in Distance Education based on Constructivist Approach;

1. Students use appropriate technology to interact collaboratively with each other and teacher, and use feedback and consultation to develop and refine knowledge, skills, and attitudes.
2. Students are self-responsible for their own learning. They should decide what they want to learn, establish their goal, research and develop their subject.
3. Students research current data to answer questions and solve problems
4. Students learn to solve problems by assessment, data collection, and developing and implementing strategies using relevant information.
5. Students identify communication barriers, their causes, and solutions.
6. Students promote life-long learning and know how to access and use information when instruction is finished.

The roles of students and teachers under the constructivist approach are listed above. These roles should be in the consciousness of communicators to develop effective distance education processes and resolve interaction difficulties (İşman, 1999). Tearchers and students need to be responsible collaborative planners, communicators and evaluators in their distance education roles. Together they can break down communicational barriers and overcome limitations in the technology and its implementation. Substantial benefits will result from taking personal responsibility, improving the process, and solving problems to create a rich interactive learning environment.

References

Arbour, Dominique (2002) "Computer-Assisted Language Learning and Distance Education" http://cade.athabascau.ca/vo14.1/7_abrioux.html

Clark, Melody (2001) "The Soft Technology of Distance Education" http://www.uc.edu/ucitnow/summer_ol/softtech.html

Dominguez, Paula (2001) "Assessing Distance Education Course and Discipline Differences in Their Effectiveness" http://www.findarticles.com/cf_0/m0FCG/1_28/73535502/print.jhtml

D.R., Jones (2000) "The Distance Education Debate an Australian View" http://www.findarticles.com/cf_0/m1254/6_32/67884314/print.jhtml

Harry, Keith, John Magnus, Keegan, Desmond (1993) "Distance Education: New Perspectives" Rutledge in London and New York.

Holmberg, Bore (1995) "Theory and Practice of Distance Education" Rutledge in New York.

Huebner, Mary Kathleen and Wiener, R. William (2001) "Distance Education in 2001" http://www.afb.org/jvib/JVIB950902.asp

Is man, Aytekin? (1997). "Students' Perception of A Class Offered Through Distance Education" Dissertation. Ohio University.

İşman, Aytekin (1999) "The Conceptual Sides of Educational Technology: The Effects of Constructivism in Education, Instruction Environment" Symposium of Contemporary Approaches in Teacher Education. Dokuz Eylül University Buca Education Faculty, İzmir.

İşman, Aytekin et al. January. (2002) "The Effects of Constructivism in Science Education" TOJET (The Turkish Online Journal of Educational Technology). v.n.2 http://www.tojet.sakarya.edu.tr/archive/v1i1/p11.html

Jones, Edmund et al. (2002) "Faculty Philosophic Position Towards Distance Education" ERIC NO: EJ649246

Levin, John S. (2001) "Is Management of Distance Education Transforming Instruction in Colleges?" ERIC NO: EJ629905

Mario, C. De Norma and Heinze, Toni (2001) "The Status of Distance Education in Personnel Preparation Programs in Visual Impairment" http://www.afb.org/jvib/JVIB9509903.asp

Merisotis, James (1999) "What is the difference?" http://www.findarticles.com/cf_0/m0HCZ/4_26/63323078/print.jhtml

Moore, G. Michael, Kearsley, Greg (1996) "Distance Education System View" Wadsworth Publishing Company in United States of America.

Notar E. Charles, Wilson Janell, Restauri L. Sherri, Friery A. Kathleen (2002) "Going the Distance: active learning" http://infotrac.london.galeg

Perraton, Hilary (1993) "Distance Education for Teacher Training" Routledge in London and New York.

Rockwell, Kay-Marx, David (2000) "Research and Evaluation Needs for Distance Education" ERIC NO: EJ623507

Willis, Barry (2002) "Distance Education Glance" http://www.vidaho.edu/eo/distglan.html

About the Authors

Aytekin İşman is an Associate Professor in computer and educational technology lecturing in the Department of Educational Sciences of the Faculty of Education at the Eastern Mediterranean University. He received a B.A. in educational measurement and evaluation from the Hacettepe University, Turkey, and M.A. degree in educational communication and technology from the New York University, USA, and Ph.D. degree in instructional technology from the Ohio University, USA. His current research interests are in education, in particular, educational technology and distance education.

Contact: Aytekin İşman. Eastern Mediterranean University, Faculty of Education Gazimagosa – KKTC, Mersin 10 – Turkey. Tel: +90 392 630 2295 Fax: +90 392 630 4044
aytekin.isman@emu.edu.tr **http://www.emu.edu.tr**

Fahme Dabaj is a lecturer in the Department of Educational Sciences of the Faculty of Education at the Eastern Mediterranean University. He received a B.A. in Civil Engineering from the Eastern Mediterranean University, M.Sc. degree in Computer Science from the same University, and currently he is a Ph.D. student in the field of communication barriers in distance education. His current research interests are in education, in particular distance education and educational technology.

Contact: Fahme Dabaj, Eastern Mediterranean University, Faculty of Education Gazimagosa – KKTC. Mersin 10 - Turkey Tel: +90 392 630 2429 Fax: +90 392 630 4044
fahme.dabaj@emu.edu.tr **http://www.emu.edu.tr**

Zehra Altınay is a research assistant in the Department of Educational Sciences of the Faculty of Education at Eastern Mediterranean University. She received B.A. in Faculty of Communication and Media Studies from the Department of Public Relations and Advertising at Eastern Mediterranean University. Currently, she is master student in the field of distance education in the education department with the subject of students and teachers views towards online courses and program and their roles at Eastern Mediterranean University. Her current research interests are in education, distance education and teacher education in educational technology and quality in distance education.

Fahriye Altınay is a research assistant in the Department of Educational Sciences of the Faculty of Education at Eastern Mediterranean University. She received B.A. in Faculty of Communication and Media Studies from the Department of Public Relations and Advertising at Eastern Mediterranean University. Currently, she is master student in the field of distance education in the education department with the subject of students' and teachers' perceptions about communication barriers in online courses and program at Eastern Mediterranean University. Her current research interests are in education, distance education and teacher education in educational technology and quality in distance education.

Editor's Note: Problem solving requires analysis, synthesis, and evaluation, the highest cognitive skills in Bloom's Taxonomy of Behavioral Objectives. Electronic bulletin boards focus expertise to solve problem for which there is not yet a solution, or to find a solution if one exists. The bulletin board provides a display space for requests and responses for asynchronous dialog and brainstorming. Dave Knowlton proposes bulletin boards as a way to transitioning from classroom learning to solving real-world problems.

Electronic Bulletin Boards as Medium for Asynchronous Problem Solving in Field Experiences

Dave S. Knowlton

Keywords: assessment of student learning; asynchronous communication; computer-mediated communication; curriculum development; electronic bulletin boards; field experiences; higher education; instructional strategies; online pedagogy; problem solving; teacher education

Higher education should provide students with a liberal arts education, heightened self-awareness, and preparation for the workforce. None of these purposes can be achieved apart from a problem-based learning curriculum (Knowlton, 2003a). Within this view of higher education's purposes and the need for a problem-based learning curriculum, computer-mediated communication (CMC) may be a valuable tool for students as it has been shown to support two of these purposes - problem solving in the liberal arts tradition (e.g., DeVries, Lund, & Baker, 2002; Knowlton, 2002) and solving problems that likely will create heightened self-awareness (e.g., Merryfield, 2002). The purpose of this paper is to offer connections between CMC and the third purpose of higher education - problem solving within the labor market.

One way that college students can prepare for the workforce is to participate in field experiences, and CMC can serve as an efficient problem-solving tool for these students. Some existing literature supports this contention. CMC can support field experiences (Admiraal, Lockhorst, Wubbels, Korthagen, & Veen, 1998), and more specifically, bulletin boards can serve as an asynchronous communication tool for supporting field experiences (Doering, Johnson, & Dexter, 2003). CMC also can support certain types of problem solving (Uribe, Klein, & Sullivan, 2003; Jonassen, 2002; Jonassen & Kwon, 2001). Beckett and Grant (2003) have made cursory connections *among* CMC (specifically, bulletin boards to support asynchronous communication), problem solving, and field experiences. Scarce within the literature, though, are firm theoretical frameworks and pedagogical models supporting a connection among all three.

This paper begins with a theoretical framework that discusses the nature of problem solving within field experiences and describes the potential role of electronic bulletin boards in problem solving activities. After these theoretical connections, a model for using asynchronous communication to support collaborative, field-based problem solving is described. The last section discusses implications and recommendations.

Theoretical Framework

The theoretical framework offered in this section serves as an argument for using asynchronous discussion in the context of field-based problem solving. In sum, the argument has two premises: (1) Students must solve problems to be successful in field experiences and (2) asynchronous bulletin boards can serve as efficient tools for solving many types of problems. If these two premises are true, then a conclusion follows: asynchronous discussion may be useful as a tool for solving problems that students encounter as they participate in field experiences.

Problem Solving and Field Experiences

When students move from classroom settings to field settings, they will experience a shift in what it means "to learn." In classrooms, learning is often the result of memorizing and regurgitating a database of information. In field experience settings, learning occurs through the act of solving problems. This view is consistent with Jonassen (2002) who notes differences between classroom learning and learning in the "real world."

Even when professors try to incorporate problem solving into traditional classrooms, they must acknowledge a difference between classroom problems and problems encountered in field experiences. In classrooms, problems are often artificial and well structured. They are artificial because professors, in essence, manufacture problems for the express purpose of creating a problem for students to solve. Little - if any - "real" utility exists, then, in solving the problem. The problems are well structured because professors sometimes want students to find one pre-determined answer, or answers that fall within a narrow range of possibilities.

In field experiences, problems are neither artificial nor well structured. Instead, problems are authentic because they emerge naturally from the context of the field experience and students - who now have been recast as human capital - must analyze and solve the problem in order to be considered a "successful employee." So, one way to describe the authenticity of the problem is to note the "stakes" of not successfully solving the problem. Furthermore, problems are ill structured because of their variety, frequency, and complexity. In addition, problems may be ill structured because they involve confluent and competing factors. Solving one element of a problem might exacerbate other elements.

The authenticity and ill-structured nature of problems that students will encounter in field experiences reinforce the importance of faculty members who supervise field experiences. Because field experiences are meant to provide students with a smooth transition from the classroom to the world of work, faculty members must adopt a sound pedagogy for helping students solve problems. In formulating and implementing this pedagogy, faculty members must maintain a careful balance. The pedagogy must scaffold students' abilities to analyze and solve problems encountered in the field, but professors must not usurp students' authority by solving the problems for them, or even providing a close-ended structure that leads students to a finite range of solutions (Beckett & Grant, 2003).

Asynchronous Discussion and Problem Solving

Jonassen's (2002; 2003) point that not all online learning environments lend themselves to all forms of problem solving is clear. Still, asynchronous discussion among students is a useful strategy for promoting solution finding for many types of problems. This paper support this perspective first by pointing to the ways that asynchronous bulleting boards can serve as an efficient cognitive tool for problem-solving. Second, it points to the role of asynchronous communication as an agent for increasing social learning among students in field experiences.

First, asynchronous bulletin boards can support many problem-solving processes, such as representing problems in written form and manipulating the problem space. That is, writing contributes to problem solving in that students better understand their own perspectives, views, and beliefs as they write (Lindemann, 1995). Even though a contribution to an asynchronous discussion is not a formal type of writing, it still serves as an opportunity for students to make their ideas concrete. "Seeing" their problem and their own ideas about their problem can better help students develop a useful perspective of the problem. In essence, asynchronous discussion becomes a cognitive tool for representing problems; and as Jonassen (2003) notes, problem representation is an essential part of the problem-solving process, particularly if students are expected to transfer their problem solving skills beyond the immediate problem. These

representations can be both an attempt by students to represent the problem for themselves - to make the ineffable, effable. But, asynchronous discussion also can provide the opportunity for students to represent the problem for a real audience to understand. Depending on a student's comfort and skill with asynchronous discussion, this distinction between internal problem representation and representing the problem for an external audience may be unnecessarily obtuse (Jonassen, 2003). Conceptually, though, considering these procedures as separate may be useful in delineating a theoretical framework for using asynchronous bulletin boards as a problem-solving tool.

Second, asynchronous discussion increases opportunities for social learning and collaborative thinking - for cognition to be distributed across a community of learners who are engaged in field experiences but in different contexts. Students in field experiences are separated by distance and sometimes by time. In isolation, these students are situated in a specific context, but particularly for students who are accustomed to traditional classrooms, the isolation can be disconcerting. When students are embedded within a specific situation or context, their thinking becomes both bound by and free within that context - their cognition is situated. Students recognize themselves as situated because they accept "the mutual relation of content and context, of individual and environment, and of knowing and doing" (Barb, Moister, Moore, Cunningham, & the ILF Design Team, 2001, p. 73).

Perhaps there are varying degrees of being bound within a context as one's participation moves from the periphery of that context to the center of contextual activity (Lave & Wenger, 1991) and as one comes to understand the fluid and iterative relationship between plans and actions (cf., Such man, 1987). This is true for students in field experiences. Such situations benefit students by getting gets them beyond the walls of an artificial classroom. It also is a hindrance because some benefits of classroom learning - discussion and collaboration among students, for example - are lost. In short, students in field experiences can benefit from thinking within a context, but they need to participate in a type of distributed cognition in order to fully appreciate the uniqueness of their situation. Asynchronous discussion can support this shift from situated cognition to distributed cognition.

The above two points - bulletin boards as a cognitive tool that supports internal and external problem representations and asynchronous discussion as a socializing medium that allows cognition to be distributed - intersect at the point where students engage in dialogue to analyze and solve real problems that they encounter in the field. As students use asynchronous bulletin boards to solve problems collaboratively, they develop a sense of productive community - a sense of distributed cognition that ultimately can transform students (Palloff & Pratt, 1999). No longer individually situated to think about their own contexts, students come to distribute their ideas across the community. Students in field experiences recognize that asynchronous discussion allows them access to new perspectives through dialogue; dialogue contributes to knowledge construction. Students begin to recognize that other participants' contributions, interpretations, and constructions are situated within specific and unique contexts, as well. The power of the individual resides in the community, yet the power of the community is dependent on the contributions of the individual.

A Model for Analyzing and Solving Field-based Problems through Asynchronous Discussion

This section presents an overview of the context in which the CMC model was used and a description of the discussion participants. It then describes the assignment guidelines and summarizes two problems that were shared and analyzed by the community of participants.

Context of the Field Experience

The participants in this asynchronous discussion were pre-service teachers in a midwestern university's two-year, field-based teacher-certification program. These pre-service teachers were assigned to K-12 classrooms in partnership schools. During the first year of the program, the pre-service teachers often assumed a periphery role, assisting the full-time classroom teacher as a paraprofessional or aide. Over time, however, the pre-service teachers moved toward the center of teaching and learning activities within the classroom. This movement culminated in a formal "student-teaching" experience during the last semester of the two-year program.

Throughout the two years, a team of university faculty delivered weekly content seminars where the pre-service teachers were given opportunities to discuss their classroom experiences and learn various theories and methods that may serve them as future teachers. During each of the first three semesters of their field experience, the pre-service teachers were enrolled for one credit hour of educational psychology - the content that I was responsible for overseeing. "Courses," though, were non-existent. Instead, each courses' content was completely integrated within the seminars.

Because of time constraints, educational psychology was given short shrift within the weekly seminars during the third semester of the two-year program. CMC was used to fully engage the pre-service teachers in considering the ways that key principles of educational psychology manifest themselves in the pre-service teachers' day-to-day problems within the partnership schools.

Assignment Guidelines for the Computer-Mediated Discussion

This CMC project was designed to (a) help participants analyze problems that they were experiencing in field experiences, (b) allow participants to share those problems with a community of peers, and (c) promote collaborative problem solving and inquiry among participants. The assignment guidelines were posted on my website so that the discussion participants easily could access them and regularly refer back to them. The guidelines were similar to those proposed by Knowlton (2002) in that participants were divided into two groups and the discussion was based on a three-week cycle of sharing and response. At the end of each cycle, roles were reversed so that students in one group performed the responsibilities of the students in the other group.

During the first week of the cycle, each participant in group one was responsible for posting the details of a problem that she or he was experiencing in the classroom. The participants were instructed to provide enough detail and background so that a reader could understand the problem fully. The participants also were instructed to describe any strategies that already had been implemented in an effort to overcome the problem. As the assignment guidelines noted, "We should all feel like we experienced this problem firsthand. But, please make sure that you are discussing the problem professionally - avoid personal attacks on those involved, for example." Since the main purpose of the field experience was to improve pre-service teachers' skills in designing lessons, teaching, assessing students, and evaluating their own lesson design and delivery, the assignment guidelines dictated that the problems shared must involve instructional issues. To scaffold the pre-service teachers' understanding of how they might describe a problem, the assignment guidelines included a link to an example problem description. Participants in group two had no formal responsibilities during week one of the cycle, but the assignment guidelines did encourage them to "reply with questions and comments that might help [their] classmates in group one clarify their individual problems."

In week two of the cycle, each group two participant was responsible for replying to two problems that were posted during week one. Importantly, the replies were to serve two purposes. First, the reply should frame the problem theoretically by pulling ideas and concepts from an

Educational Psychology textbook or other resources, like academic journal articles or credible web-based resources. Specifically, the assignment guidelines informed group two participants that their responsibility was "to do more than offer a one-liner - 'Maybe a role play would help.'" Instead, their responsibility was "to summarize [a] theory, instructional strategy, or [pedagogical or design] model thoroughly enough for [others] to understand the connection to the problem." By meeting this responsibility, participants were theoretically framing the problem offered by a classmate. This approach supported a type of learning-on-demand, where readings were not assigned in advance of the discussion. Rather, participants found readings based on their own view of how the problem might be theoretically framed.

A second purpose of week two replies was to offer potential solutions to the problem. That is, once group two participants had theoretically framed the problems being discussed, they were responsible for offering solutions. These solutions could come from participants' own experiences in the field, but they were encouraged strongly to "discuss the role of Educational Psychology theory in solving the problem." That is, they were urged to address a question that connects theory to practice: "What do you understand about theory - from your own independent reading - that you now can apply to the problem at hand in an effort to help your classmate solve the problem?"

During the third week of the cycle, participants in both groups one and two were responsible for two additional contributions to a discussion thread. They could add additional ideas to a thread in which they had already participated, but they could expand their responses to the other threads that contained different problems, as well. Regardless of which thread participants responded to, their week three responsibilities obligated them to reply to a discussion contribution from week two, not an original problem posted during week one. This criterion created a continuation of the discussion based on theories and solutions that had already been described. In other words, participants were not replying to the original problem; they were replying to the various analyses and suggested solutions to the problems. This provided a richer discussion that provided more analysis of related theory and deeper critique of proposed solutions. Because week three contributions were the most nebulous in terms of purpose and scope, the assignment guidelines included a bulleted list of possible (but not necessary) approaches for contributing during week three:

- Pick two replies to the same problem and discuss why you think one would work better than the other.
- Pick a reply to a problem and discuss the strengths and/or weaknesses of the proposed solution.
- Pick a theory that someone wrote about during week #2 and apply that theory differently (or more thoroughly) to the problem offered during week #1.
- Describe innovative exercises, assignments, or activities based on the ideas in the week #2 contribution.
- Discuss your experiences with how a solution has/has not worked in the classroom.
- Write a summary of replies to your own problem and describe the biggest insights that you have gained by considering the advice of your classmates.

Examples: Problems and Corresponding Discussion

Since over sixty pre-service teachers participated in the implementation of this CMC model, it is not practical to include a description of each problem and solution posted by students. An overview of two of the threads of discussion is illustrative of the types of problems and responses that were offered.

Example #1: Teaching Reading. One participant shared frustrations about her students' struggles to comprehend readings. This participant recounted several examples where she had read a story to her students, checking for understanding throughout the reading of the story. She noted that if students had questions, she would answer them and check again for students' understanding. After hearing the story, students routinely completed a worksheet about the story and took a quiz to check their comprehension of the story. "My difficulty," this participant wrote, "is that the students have not been doing well on their worksheets and quizzes. I ask them if they understand, and they all nod their heads that they do. I don't know that they don't understand unless they let me know. I can't read their minds! What do I do? Please help!"

Over the next two weeks, participants offered sixteen responses. One participant suggested that students have a fear of failure and admitting that they do not understand a reading is tantamount, in the students' mind, to failure. Other participants, though, suggested direct strategies for solving the problem. For example, one participant rhetorically asked how the reading lessons might be structured so that students can depend on each other to clear up their own confusion. Another participant raised an issue about the specific stories and readings that were being selected. She noted that students would understand stories better if they are stories that interest the students. Another participant extended the idea of selecting stories that interest students, but offered a more academic slant by referring to an Educational Psychology text. This student noted three components of reading comprehension: broad background knowledge, the ability to apply comprehension strategies like summarizing, and an understanding of how to monitor one's own reading through metacognitive strategies. The participant suggested the need to incorporate these components into the reading lessons.

Example Problem #2: Questioning as a Teaching Strategy. One participant shared a problem that dealt with her use of questioning in the classroom. Specifically, she had concerns about students' abilities to understand her questions and reply to them in a short amount of time:

"Sometimes it seems that the students are really thinking about the answer [to a question that I have asked, but] it is just taking them a long time. Other students seem to be wasting time, [or perhaps they] know what they want to say but cannot verbally express it. Currently, if a [student] does not give an answer fairly quickly, [then] I ask another student. Should I give the students more wait-time and cut down the lesson? Should I just skip the student? Or are there other options?"

Over the next two weeks, participants contributed fourteen replies to this discussion thread. One participant suggested that the K-12 students could be asked to jot down their thoughts in writing before answering the question. This type of informal writing, the participant argued, might help students clarify their thoughts so that they could "see what they are thinking" prior to participating orally. Another participant agreed, but noted that the strategies for helping students clarify their thoughts might vary with the level of thinking being required. If students were simply being asked to report factual information, then a large amount of time to formulate thoughts may not be necessary. If, however, the questions were more open-ended, then more thorough strategies might be useful. Another participant suggested that providing clues or rewording questions might be useful strategies for helping students process the question and arrive at an answer.

Importantly, not all contributions to the thread were ideas for immediate solutions. Some participants, for example, described the ways that various theories would inform the use of questioning in the classroom (e.g., how would a behaviorist use questioning differently from a cognitivist or constructivist?). Other participants raised tangential issues to the problem. One participant, for example, raised questions about students' self-esteem and the long-run effects on a students' self-efficacy if they did not know the answers. Other participants raised questions about classroom management and urged the participant who posted this problem to consider how classroom rules and processes may influence students' willingness to answer questions during lessons. Other participants rejected the opportunity to answer in academic terms, but instead turned their reactions into an opportunity for answers based on their own experiences: "One of the worst feelings in the world is getting asked a question [and] either having no idea what the answer is or not having time to think about [the answer]."

Conclusions and Implications

I have described the use of CMC as a tool to support problem solving among students who are participating in field experiences. The underlying assumption is that helping students solve problems in field experiences will better lead them to opportunities to be transformed by CMC (cf., Palloff & Pratt, 1999). This idea of transformation is consistent with views about the purposes of educational psychology courses (cf., Dembo, 2001).

Admittedly, I am not the first to use CMC as a problem-solving tool to support the learning of educational psychology in field experiences (cf., Bonk, Malikowski, Angeli, & East, 1998). Where this previous article, though, focused on empirical rigor to analyze the use of CMC in field experiences, I focus on pedagogical rigor by offering a theoretically-grounded model of CMC. Furthermore, new here are the unique connections among problem solving, CMC, and field experiences.

Importantly, the model discussed in this paper is not inherently tied to a specific discipline. This model could be used by participants in field experiences across a variety of disciplines, from clinical experiences in the medical profession to internships in business to archaeology expeditions in the far reaches of earth. For faculty members who might consider implementing this model, though, numerous questions must be considered. The remainder of this paper raises some of these salient questions that have emerged from my experiences developing and implementing this model.

Is broad analysis of a problem better than depth in analyzing a problem?

Notably, within this model of CMC described here, probability of participants offering a discussion of the solution that was actually implemented seems slim. While a three-week cycle of discussion does allow broad participation in analyzing and offering potential solutions that might be implemented, it does not provide the participant who owned the problem with enough time to implement a proposed solution, evaluate that solution, and report on the implementation to the participants in the CMC discussion. From a problem-based learning (PBL) perspective, the emphasis on breadth over depth is not typical, as a hallmark of PBL is usually an in-depth analysis of the example problem (Dods, 1997).

Faculty members who implement this model might overcome this problem in two ways. One way would be to leave some flextime at the end of the semester that would allow students to revisit the problems that they contributed to the computer-mediated discussion. This flextime might give students the opportunity to share the ways that they used input from other participants to solve the problem. A second way to overcome the breadth versus depth issue might be to require the completion of a separate but related assignment - such as requiring students to write a more

formal reflection paper that includes a discussion of field-based problems and corresponding solutions. A formal writing of this type even might be a capstone of the field experience.

How does student independence need to be balanced with faculty guidance?

As noted in the description of this model, numerous devices were used to scaffold participants' potential for success within the discussion. For example, links to example problem descriptions were offered. In addition, questions to guide participants' week three contributions were included in the assignment guidelines. The degree to which CMC participants need such scaffolding depends on many factors, not the least of which might be their prior experiences using CMC to solve problems. If participants are nascent users of CMC, faculty members might consider providing additional scaffolding to support participants. For example, a link was provided from assignment guidelines to a job aid that described strategies for making CMC more productive. These strategies proved useful to many of my students, but the job aid included items that may be little more than statements of the obvious to expert CMC users - for example, sign contributions to the discussion, double space between paragraphs, and adopt a tone of respect toward opposing opinions.

How will assessment of students' efforts be considered?

Numerous articles and resources can guide faculty members as they consider student assessment (e.g., Anderson, Bauer, & Speck, 2002; Bauer & Anderson, 2000; Anderson & Puckett, 2003; Knowlton, 2003b). Often in online discussions, students receive most of their credit simply by participating. Participation is not in itself a sufficiently rigorous assessment of students' contributions to CMC. Conversely, though, my experiences suggest that professors can get bogged down in "grading" students. This can be counterproductive because grading is not necessarily congruent with assessing, providing feedback, and other activities that denotatively are quite different, not to mention more educationally salient. (For a discussion of the language of grading, see Speck, 1998).

One way to overcome this problem was through the use of a form that students completed and e-mailed to the instructor at the end of each three-week cycle. This form asked students to report factual information about their participation for that cycle. For example, the form asked students to list the subject line of the threads in which they participated. The form also asked students to briefly list the resources that they used in theoretically framing a problem to which they were responding. This form was not a self-assessment as much as it was a productivity report. When students submitted their forms, they were matched to a list of threads that defined their contributions. This made the process of "grading" less time consuming.

Beyond using a productivity report to track students' contributions, faculty members might consider implementing self-assessments that go beyond reporting participation. Such self-assessments could obligate students to assess their own work against the "purposes" of the discussion itself. Similarly, faculty members might implement formal procedures for peer assessments. Self- and peer-assessments can come in forms as simple as dichotomous or Likert-scale checklists, but they also might involve processes indicative of a more careful analysis of students' contributions, such as qualitative and open-ended assessments (Knowlton, 2003).

What mechanism will allow for systematic revision of assignment guidelines?

Whereas assessment focuses on student learning, evaluation focuses on the success of the model's design and implementation. While the model described in this paper is sound, problem-solving processes vary among disciplines and exact assignment guidelines may be idiosyncratic to different professors even within the same discipline. Therefore a solid plan is needed for refinements of the model prior to its implementation. (The prototyping of this model from an Alpha version to a Beta-B version is the subject of a forthcoming article.) In general, student

input should be considered as one data source for justifying changes to the assignment guidelines. Further, as a professor better comes to understand participants' roles in their various field experiences, changes to the assignment guidelines may be needed.

References

Admiraal, W. F., Lockhorst, D., Wubbels, T., Korthagen, A. J., & Veen, W. (1998). Computer-mediated communication environments in teacher education: Computer conferencing and the supervision of student teachers. *Learning Environments Research, 1*(1), 59-74.

Anderson, R. S., Bauer, J. F., & Speck, B. W. (Eds.). (2002). *Assessment strategies for the online teacher: From theory to practice.* San Francisco: Jossey-Bass.

Anderson, R. S. & Puckett, J. (2003). Assessing students' problem-solving assignments. In D. S. Knowlton & D. C. Sharp (Eds.), *Problem-based learning in the information age*, (pp. 81-88). San Francisco: Jossey-Bass.

Barab, S. A., MaKinster, J. G., Moore, J. A., Cunningham, D. J., & the ILF Design Team (2001). Designing and building an online community: The struggle to support sociability in the inquiry learning forum. *Educational Technology Research and Development, 49*(4), 71-96.

Bauer, J. F. & Anderson, R. S. (2000) Evaluating students' written performance in the online classroom. In R. E. Weiss, D. S. Knowlton & B. W. Speck, (Eds.) *Principles of effective teaching in the online classroom,* (pp.65-72). San Francisco: Jossey-Bass.

Beckett, J. & Grant, N. K. (in press). Guiding students toward solutions in field experiences. In D. S. Knowlton & D. C. Sharp (Eds.), *Problem-based learning in the information age*, (pp. 67-72). San Francisco: Jossey-Bass.

Bonk, C. J., Malikowski, S., Angeli, C., East, J. (1998). Web-based case conferencing for pre-service teacher education: Electronic discourse from the field. *Journal of Educational Computing Research, 19*(3), 269-306.

Dods, R. F. (1997). An action research study of the effectiveness of problem-based learning in promoting the acquisition and retention of knowledge. *Journal for the Education of the Gifted, 20*, 423-437.

Dembo, M. H. (2001). Learning to teach is not enough - future teachers also need to learn how to learn. *Teacher Education Quarterly, 28*(4), 23-35.

DeVries, E., Lund, K., & Baker, M. (2002). Computer-mediated epistemic dialogue: Explanation and argumentation as vehicles for understanding scientific notions. *The Journal of the Learning Sciences, 11*(1), 63-103.

Doering, A., Johnson, M., & Dexter, S. (2003). Using asynchronous discussion to support pre-service teachers' practicum experiences. *TechTrends, 47*(1), 52-55.

Jonassen, D. H. (2002). Engaging and supporting problem solving in online learning. *Quarterly Review of Distance Education, 3*(1), 1-13.

Jonassen, D. H. (2003). Using cognitive tools to represent problems. *Journal of Research on Technology in Education, 35*(3), 362-381.

Jonassen, D. H. & Kwon, H. I. (2001). Communication patterns in computer mediated versus face-to-face problem solving. *Educational Technology Research and Development, 49*(1), 35-52.

Knowlton, D. S. (2003a). Preparing students for educated living: The virtues of problem-based learning across the higher education curriculum. In D. S. Knowlton & D. C. Sharp (Eds.). *Problem-based learning in the information age*, (pp. 5-12). San Francisco: Jossey-Bass.

Knowlton, D. S. (2003b). Evaluating college students' efforts in asynchronous discussion: A systematic process. *Quarterly Review of Distance Education, (4)*1, 31-41.

Knowlton, D. S. (2002). Promoting liberal arts thinking through online discussion: A practical application and its theoretical basis. *Educational Technology & Society, 5*(3), 189-194.

Lave, J. & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation.* Cambridge, MA: Cambridge University Press.

Lindemann, E. (1995). *A rhetoric for writing teachers* (3rd Ed). New York: Oxford University Press.

Merryfield, M. M. (2001). The paradoxes of teaching a multicultural education course online. *Journal of Teacher Education, 52*(4), 283-299.

Palloff, R. M. & Pratt, K. (1999). *Building learning communities in cyberspace: Effective strategies for the online classroom*. San Francisco: Jossey-Bass.

Speck, B. W. (1998). Unveiling some of the mystery of professional judgment in classroom assessment. In R. S. Anderson & B. W. Speck (Eds.) *Changing the way we grade student performance: Classroom assessment and the new learning Paradigm*, (pp. 17-31.) San Francisco: Jossey-Bass.

Suchman, L. (1987). *Plans and situated actions: The problem of human machine communication*. New York: Cambridge University Press.

Uribe, D., Klein, J. D., & Sullivan, H. (2003). The effect of computer-mediated collaborative learning on solving ill-defined problems. *Educational Technology Research and Development, 51*(1), 5-19.

Weiss, R. E. (2000). Humanizing the online classroom. In R. E. Weiss, D. S. Knowlton, & B. W. Speck (Eds.), *Principles of effective teaching in the online classroom*, (pp. 47-51). San Francisco: Jossey-Bass.

About the Author

Dr. Dave S. Knowlton is an Assistant Professor of Instructional Design & Learning Technologies, Department of Educational Leadership**,** at Southern Illinois University. Edwardsville IL He is coeditor of *Principles of Effective Teaching in the Online Classroom* [Jossey-Bass Publishing, 2000]. He is also coeditor of *Problem-Based Learning in the Information Age* [Jossey-Bass Publishing, 2003]. For more about his professional interests, please visit www.siue.edu/~dknowlt. He can be contacted atdknowlt@siue.edu

Editor's Note: From London, we get a bird's eye view of learning technologies and distance learning from the perspective of a multimedia and web designer. It summarizes key information about historical roots and current developments.

Learning Technology: The Myths and Facts

John A Finnis

Abstract

This paper considers some of the major issues in the field of learning technology. It seeks to identify areas in which technology has greatest potential to contribute to the learning process, and also those areas in which the application of technology is inappropriate or detrimental.

Issues include the support of different kinds of learner, learning environments, reusability and accessibility. Questions raised include the changing role of learning in the information age, extent to which learning materials may be re-used, and how misunderstandings between various contributors to learning technology projects may be overcome.

The paper concludes with a hypothetical example of an effective application of learning technology.

What is Learning Technology?

Learning Technology, Educational Technology, Instructional Technology, e-Learning, Computer Assisted Learning (CAL), Computer Based Training (CBT)….. One or more of these closely related terms seems to occur in almost every discussion on education and learning these days. But what do they mean? And how might they shape the educational landscape of tomorrow?

A widely accepted definition of Instructional Technology is that provided by the Association for Educational Communications and Technology Definitions and Terminology Committee.

> *"Instructional Technology is the theory and practice of design, development, utilization, management, and evaluation of processes and resources for learning." (Seels & Richey, 1994).*

This paper employs a slightly simpler definition of learning technology as any application of technology, particularly computer and information technology, which contributes to the learning process.

Learning technology *per se* is not new. The first mathematics teacher to bring an abacus into his classroom was using technology to aid learning. Projectors, tape recorders and televisions have featured in schools for decades. Even the use of computers is in education is not new. Riley (2002) describes how simulations and modeling programs "were in the mainstream of 1980s computer-assisted learning". This author can remember a modem connected teletype unit in his maths class of the mid-70's.

However, rapid advancements in the power and capability of desktop computers along with the proliferation of the Internet have led to intense interest in the potential of the computer as a learning tool.

This paper seeks to provide an overview of learning technology and to explode some of the myths surrounding the field. It identifies areas where technology is most able to add value to the

learning experience and also raises a number of questions which need to be addressed if the potential of the discipline is to be fully realized.

What Learning Technology Can - and Cannot - Do

Learning Technology has the potential to bring improved learning opportunities to a larger audience than previously possible.

It is able to support a more active learning experience through a high degree of learner involvement, thus promoting deeper understanding. Dale's "Cone of Experience" (adapted from Wiman & Meirhenry, 1960) suggests that people remember 10% of what they read, 20% of what they hear, 30% of what they see, 50% of what they hear and see, 70% of what they say and write, and 90% of what they say and perform at a task. Confucius makes the same point even more succinctly: "Tell me and I'll forget. Show me and I'll remember. Involve me and I'll understand". My own experience as a student in a master's course in multimedia revealed that I learned least in formal lectures, a little more in organized tutorials, and most of all during the completion of assignments. Active learning is an effective approach for developing deployable skills.

Learning Technology places the learner in control of his or her own education. It is better able to meet the individual's learning requirements by providing a (potentially) unique experience to every learner, tailored to individual circumstances and characteristics.

It is able to support communicative and collaborative activity irrespective of the physical distance that may separate participants. Communicative activity reinforces and extends knowledge promotes a broadening of understanding through the sharing of ideas. Even where an individual comes into conflict with the group consensus, that conflict forces the individual either to justify opposition or to modify belief.

Learning Technology does *not* obviate the need for work on the part of the learner. It is *not yet possible* to download knowledge and experience directly into the brain. To understand something we must engage with it, a process which requires effort.

Learning Technology does not obviate the need for work on the part of the educator. Delivering content electronically does not automatically transform it into an effective aid to learning. In fact what might have been a very good aid to learning in its original form may lose its merits through inappropriate "electronification". The most effective use of learning technology requires considerable planning and effort on the part of the educator to best exploit the strengths of the target media.

Learning in the Information Age

The final decade of the twentieth century saw exponential increases both in computing power and the number of people able to access computers and the Internet. Numerous commentators have described the proliferation of information and communication technologies (and in particular the growth of the Internet) as bringing about a transition as marked as that of the industrial revolution. We are said to be moving from the industrial age to the *information age*, in which radically different rules apply in every aspect of society, education being no exception. (N.B. a *Google* search on the phrase "information age" retrieved some 725,000 results.)

Society's transition to the information age is likely to impact learning and education in two ways. Firstly, rapidly improving technology will enable higher quality learning to be made available to an ever-growing audience through increasingly sophisticated modes of presentation. Secondly,

the very nature of the information age may require a different kind of preparation (i.e. learning) than was the case in the industrial age.

In the industrial age the majority of human roles could be described as algorithmic. Most circumstances determined a pre-defined procedure to be followed upon their occurrence. People left school or college, learned the rules of a given trade of profession, and expected to remain within that trade for life. Large corporations, with deep hierarchies were the norm. In these hierarchies, instructions from above were expected to be unquestioningly carried out. It could be argued that an approach like Skinner's behaviorism which sought to develop specific responses to given stimuli was most suited to industrial age learning.

Members of the information society will need to learn continually throughout their lives to keep up with rapid and relentless change that is characteristic of this age. Perpetual studenthood is unlikely, so learning must be presented in increasingly flexible ways to fit with professional and family schedules (e.g. distance learning, open learning, part-time and mixed mode study).

It is likely that traditional corporate structures will be forced to change to survive in the new economy. Small (2000) describes the limitations, in the information age, of the traditional managed team operating as part of a rigid hierarchy. Instead he proposes the concept of temporary, virtual teams, brought together by an initiator, someone able to "identify a win-win situation where cooperation can produce benefits" and "produce enough evidence that profits will result from [the] proposed cooperation". Such teams aren't "held together by rules, but by benefits of mutual advantage."

Structural changes together with the increasing mechanization of algorithmic tasks imply the need for more creative, innovative and interpretive skills. Such abilities are more likely to emerge from a constructivist approach to learning in which individuals construct their own individual mental models of the world in order to make sense of their experiences. Learning is the process of adding to or refining this mental model.

All Kinds of Learner

The continued and increasing state of social and economic flux of the information age means the need for lifelong learning will become a reality for most people in the twenty-first century.

Rather than being something that tales place between infancy and early adulthood, learning becomes a cradle-to-grave activity. Rather than catering only for those with a certain predisposition, effective post-compulsory learning will need to be accessible to the majority.

Rather than being an activity that takes place mainly in a classroom with rows of students seated at desks paying close attention to a teacher standing before a blackboard, learning will take a variety of forms. These will complement rather than replace institutional learning that takes place in classrooms on campus. But distance learning is set to become a major growth area in the twenty-first century, offering learners the chance to study where and when they choose, scheduling their learning around work and family commitments. A third category of learner may also be identified, the *attached* learner. Attached learners fall somewhere between the extremes represented by their institutional and distance colleagues. Attached learners spend some of their learning time on campus while the rest is spent at a distance. They may be part-time students, or those out on work placements.

For distance learners, learning technology can provide access to tutorial and peer support as well as relief from the inevitable isolation. The lone learner is brought into contact with colleagues and mentors from around the globe. Technology provides an efficient mechanism for delivering learning materials on demand. Such materials may be traditional study texts or fully interactive

multimedia learning experiences. Simulations offer the distance learner almost the same degree of involvement as their institution-based counterparts by way of virtual laboratories and rich, interactive models. The World Wide Web provides access to a huge volume of content. Quality assured digital libraries and portals may serve as a roadmap to the more valuable resources.

On-campus learners may also benefit from learning technology, albeit in different ways to those at a distance. Simulations and models extend conventional laboratory facilities in supporting active learning by enabling ideas introduced in the classroom to be put into practice. *Learning environments* (see below) can provide access to pre- and post-lecture materials and serve as a gateway to a wide range of digital resources. They may also provide a shared workspace for group assignments as well as extending the learner's immediate peer group by linking them with others from around the world.

Learning Environments

Known by terms including Virtual Learning Environments (VLEs), Online Learning Environments (OLEs) and Managed Learning Environments (MLEs) these technologies offer mediated support for the learning process. MLEs offer access to institutional administration systems allowing learners to view grades, update personal details, and pay fees online.

Technology-based Learning Environments may offer any, or all, of the following features:

- A repository of learning materials, e.g. lecture handouts, PDF files, PowerPoint presentations etc., i.e. the environment serves as an efficient distribution mechanism.
- A portal to additional (i.e. external) quality assured resources.
- A communication facility which may be synchronous/asynchronous, tutor-student, student-tutor and/or student-student. This facility could include inter-institutional communities and/or guest lectures/seminars.
- Archiving of real-time events for those unable to participate at that time.
- A shell for interactive/multimedia course materials. In this case the environment would provide each learner with access to the right materials at the right time, possibly determined by personal preference and/or prior performance.
- Online assessment - both formative (for guidance only) and summative (assessed as part of final grade).
- A collaborative working environment, e.g. a communication facility plus shared file space for group assignments.
- Links to administration systems, i.e. the environment is an MLE.

Many institutions use "off the shelf" technologies, the current market leaders being WebCT and Blackboard. Others develop their own environments to suit their specific needs. Considerations in selecting a learning environment include:

- How easy is it to use - for academics, tutors, administrators - and learners?
- To what degree can it be customized / accessed at HTML or server level?
- What does it cost? And how is it licensed - institutionally, per user, per seat (i.e. per user per course)?
- Does it conform to accessibility (see below) guidelines?
- Does it conform to emerging interoperability (see below) standards?

- Can it be used off-line (e.g. for distance learners with poor Internet connectivity), or is there an alternative such as e-mailed discussions?
- What is the minimum platform/connection required to run it?
- Will it interface with the institution's administrative systems?
- Does it support single sign-on authentication?, i.e. once logged in will students be able to access other resources without having to repeatedly log in?
- Can closed access discussion areas be created for group work?
- Does it support communication using the pull (e.g. bulletin board) or push (e.g. mailing list) model, or both? Ideally a combination of the two supports learners and e-mails informing them of new additions to the VLE. Additionally, there is a web-based, searchable archive of messages, such as Frequently Asked Questions (FAQs).

Accessibility

Technology may make learning available to a wider audience and has the power to promote more equal access to learning for as large and diverse a group as possible. In particular, it supports learners with disabilities, and offers access through assistive technologies such as screen readers.

Accessibility concerns are not solely altruistic. The number of people worldwide with some form of disability represents a massive potential market for education and training. Accessibility legislation is concerned, not only with human rights, but with enabling people with disabilities to contribute to the economy, or even become self supporting.

In the USA, Section 508 of the 1998 Rehabilitation Act requires Federal agencies' electronic and information technology (including Web) content to be accessible to people with disabilities. In the UK the Special Educational Needs and Disability Act (SENDA) makes it illegal to discriminate against disabled students by treating them less favorably than others. Institutions are required to make reasonable adjustments for students with disabilities who would otherwise be at a substantial disadvantage. SENDA came into effect on 1 September 2002.

Learning technology practitioners should make their courses accessible to as wide an audience as possible. To achieve this, they must be aware of legal requirements governing their work. Further guidance may be found from the World Wide Web Consortium (W3C) Web Accessibility Initiative (WAI - see http://www.w3.org/WAI/). Authoring software producers such as Macromedia (Dreamweaver, Flash) also publish guidelines to develop accessible applications with their software (see http://www.macromedia.com/macromedia/accessibility/).

e-Learning or Blended Learning

The oft-used term e-learning implies that learning is delivered by a computer. This author advocates a broader definition that recognizes the computer as one possible medium through which learning may be presented. Radio, cinema, television, video continue to be widely used, and do not necessarily replace media which pre-existed them. Indeed. The oldest mass medium, the printed word, continues to flourish.

Just as older media thrive alongside computer technology in the information age, so do more traditional learning media such as the printed word, audiocassette, and videocassette. Learning technologies can draw upon the strengths of many media in a "blended" approach to learning.

There are numerous examples of so-called learning technology that do little more than transfer the contents of the printed page to the computer screen. This does not enhance learning and may even be detrimental to the comprehension and comfort of the recipient.

Nielsen (1998) states “people read about 25% slower from computer screens than from printed paper”. Reading from screen is certainly less comfortable than reading printed text. The UK Health and Safety Executive (1998) found that “long spells of VDU work can lead to tired eyes and discomfort”. In fact UK law requires employers to plan the work of those using VDUs so there are breaks or changes of activity (HSE, 1998). Paper is portable and robust and will continue to play a significant role in learning.

Reusability

The concept of reusability is a holy grail in the learning technology field as witnessed by the intense interest and activity in reusable learning objects. The concept of reusable learning objects is a simple one. Learning is packaged in discrete chunks that can be used in a variety of contexts.

Definitions of what constitutes a learning object vary. The IEEE Learning Technology Standards Committee (2002) defines a learning object as " any entity, digital or non-digital, which can be used, re-used or referenced during technology supported learning." This is not very useful since almost anything can be referenced during technology supported learning.

Other, more precise definitions exist. Knowledge Planet, a learning content management system vendor, states “A learning object has four components: an objective, content, a means of assessment, and metadata.” (Knowledge Planet product literature).

The rationale for the learning object approach is similar to that for the use of object oriented programming in computing. Rather than continually develop software to represent common entities such as people, orders, accounts etc., the software industry produces one (or a small number of) very good representation(s) of these entities. When a programmer needs to code these entities in software he plugs in a pre-written, quality-assured object.

Rather than every mathematics teacher develop his own way of introducing students to differential calculus, he can call upon one or more proven learning objects to do the job. This releases time for mathematics teachers to support student’s understanding of those objects.

Some examples:

- A single object introducing differentiation is offered on courses in engineering, science and economics.
- The learning object on introductory differentiation is multi-purposed into print, Web and CD-ROM versions.
- A degree level management course is created as a series of reusable learning objects. A subset of these learning objects forms the basis of a short, vocational course.

The best learning objects would be made available, at a cost, to the entire educational community. Widespread adoption of the learning object paradigm would see a separation between the traditionally integrated functions of content preparation and learner support.

Reusability in education is not new and has not until recently been seen as controversial. A textbook is a reusable learning object. A textbook on basic calculus might be used in courses on mathematics, physics, engineering etc. with different groups of students in numerous schools and colleges throughout the world. It may be translated into different languages to further extend its

reusability. Learning objects take the reusability concept a step further, extending it to the entire content component of the learning experience.

Downes (2000) makes a compelling case for the economic benefits of the learning object approach, claiming "there will be sharing, because no institution producing its own materials on its own could compete with institutions sharing learning materials."

One criticism of this approach comes from the recognition that knowledge does not exist as discrete chunks, but is inextricably related to other knowledge as well as to the context in which it is applied, i.e. the learning object approach is too reductionistic to meet the learning needs of the real world.

The term *digital divide* has been coined to describe the division between those that have access to technology and those that do not. In March 2003 an estimated 649 million people, some 10% of the world's population, had Internet access (Global Reach). It is sobering to reflect that 90% do not have such, thus the technology that promises to make learning opportunities more widely available than ever before is effectively excluding the vast majority.

This difference in the levels of access to technology is driving the goal of multi-purposing learning objects across a range of delivery media, e.g. it should be possible to present printed, low-bandwidth and high-bandwidth versions of a particular object. The problem in meeting this ideal is that material is written to the strengths of a target medium, e.g. a novel and a screenplay of the same story are quite different. Thus in trying to author an object for a number of formats there is a risk of compromising the strengths of each and delivering a mediocre product.

Despite these criticisms reusable learning objects will most likely play a major role in the future of learning presentation. The focus at this stage should be on identifying those scenarios in which the approach has most to offer.

Interoperability

Closely related to the concept of reusability is that of interoperability. Essentially this means ensuring that where reusable learning materials are created they are truly reusable by different institutions and across different delivery platforms.

To this end a number of bodies are working towards the development of standards. These bodies include the IEEE Learning Technology Standards Committee (LTSC), Advanced Distributed Learning (ADL) Initiative (developers of SCORM - the Sharable Content Object Reference Model) and the Instructional Management System (IMS) Global Learning Consortium. Specifications are emerging to describe things like learning object metadata, content packaging and question and test interoperability. The UK Centre for Educational Technology Interoperability Standards has described the adoption of standards as being "key to the realisation of Life Long Learning and a global education marketplace." (CETIS 2002).

Although much work is being done in this area few standards have been officially ratified. The learning technology practitioner would be advised to become acquainted with the current state of affairs and to ensure that any deliverables are broadly compatible with existing recommendations whilst watching closely for further developments.

The Understanding Mismatch

One difficulty in implementing learning technology is coordination of diverse range of skill sets. In traditional education, those with the greatest subject knowledge aren't always the most able to

impart it to others. In higher education in the UK, academic staff are selected solely for expertise in their field and are not required to possess qualifications in education. In technology mediated learning, subject specialists and educationalists team with technical experts such as system administrators, web/multimedia designers/developers, television producers, and support staff.

The successful development of a learning technology project from conception to delivery requires each of these specialists to work together, each having an appreciation of the role played by the others. Without this mutual understanding, there is a danger that subject experts will simply regurgitate what they know without regard to how the learner will engage with it; educationalist will have unrealistic expectations of the technology or have little understanding of it's potential; and technologists will create excellent demonstrations of their skills and works of art but do little to enhance the learner's understanding.

In an attempt to address the problem of understanding mismatch two relatively new professions have emerged from the learning technology industry, namely the instructional designer and learning technologist (or educational technologist).

The instructional designer is able to work with subject experts to create a learning experience appropriate to the target learner. It is a role that should be found throughout educational establishments, particularly those of higher education. In the UK, higher education institutions are introducing learning and teaching units to help academics improve the quality of teaching and learning.

The learning technologist is technically skilled, able to communicate with other technical experts, and aware of the potential of technology to promote learning. Most importantly he/she is able to communicate with subject experts and/or educationalists to advise where and how technology can enhance the learning experience. The learning technologist may demonstrate a range of examples to inspire ideas, and then work to refine those ideas into a realizable form.

These roles are intended to serve as an interface between subject specialist and technical expert. They will ensure that the right amount and level of subject knowledge is presented to the learner in the appropriate form for the most effective learning to take place.

As the discipline of learning technology matures it is likely a number of project lifecycle methodologies that enshrine best practice will emerge. However, it is the author's opinion that the field is currently too young to be so rigidly constrained and that further experimentation and innovation are required if its full potential is to be realized.

Effective Learning Technology

How is learning technology most effectively deployed? And what are the characteristics of the resulting learning experience?

Technology has the potential to facilitate communication across physical boundaries. It has the potential to engage the learner, particularly the distance learner, and present an interactive and highly personalized learning experience.

An effective technologically mediated learning experience offers the opportunity for communication and collaboration with similarly minded individuals around the world. These individuals would comprise both peers and mentors and form communities in which different members could take the lead at different stages of the learning process. The communication facility could take any form from the simple e-mail list and/or discussion board through to intelligent avatars inhabiting three-dimensional virtual worlds.

The experience would employ different media to achieve different ends. Many courses would have a significant reading component delivered as bundles of paper or distributed as PDF files to be printed locally. Files would be fully indexed and searchable to enable the learner to quickly retrieve and organize relevant content.

Interactive multimedia stimulates learner involvement. Rich simulations and models will allow the learner to experiment in a variety of novel situations, learning from the experience of active participation and the resulting feedback. There is no pre-determined pathway through the computer-presented component. Instead it adapts to the responses, characteristics, needs and performance of the individual learner. Audio and video elements will be included where appropriate.

Conclusions

Learning technology is currently attracting intense interest due to the rapid increases in technological capability and in the size of the audience able to access it, and also due to the increasing demands upon the education system as the need for lifelong learning becomes reality.

Technology can provide quality learning to a mass audience, and by offering greater learner involvement and a more personalized learning experience can deliver the kind of learning most suited to the information age. But if technology's potential is to be fully realized its strengths and weaknesses need to be understood by learning providers. The computer is just one of a range of media that should be used to present learning in a blended approach.

Reusability, and in particular the topic of reusable learning objects, is the subject of much activity. The concept is attractive from an economic standpoint, but does not represent an educational panacea. Major criticisms of the approach are that it is too reductionistic and of compromising the quality of purpose-made content.

Further work is needed to identify the boundaries within which reusability might be most effectively applied, e.g. are there differences in the applicability of the approach between arts and science subjects, introductory and advanced topics, or academic and vocational contexts? Work is also needed on the development of models for the efficient authoring, representation, storage, distribution, presentation and production of learning objects.

A major difficulty in learning technology project implementation is due to the diversity in the skill sets that need to be involved and the potential for misunderstanding that might occur between them. The problem of understanding mismatch may be alleviated once learning technology implementation methodologies become established. However there should be no rush to move to rigid methodologies at the expense of widespread experimentation and innovation in this evolving field.

References

CETIS, the centre for educational technology interoperability standards, (2002), Learning Technology Standards: An Overview, http://www.cetis.ac.uk/static/standards.html

Downes, Stephen, (2000), Learning Objects, http://www.atl.ualberta.ca/downes/naweb/Learning_Objects.doc

Global Reach, (March 2003), Global Internet Statistics (by Language), http://www.global-reach.biz/globstats/index.php3

Health and Safety Executive, (1998), Working with VDUs, http://www.hse.gov.uk/pubns/indg36.pdf

IEEE 1484.12.1-2002 Draft Standard for Learning Object Metadata (2002). http://ltsc.ieee.org/doc/wg12/LOM_1484_12_1_v1_Final_Draft.pdf

Knowledge Planet product literature, http://www.knowledgeplanet.com/newsletter/kp_content%207-17-01.pdf

Nielsen, Jakob, (1998), Electronic Books - A Bad Idea (Alertbox for July 26, 1998), http://www.useit.com/alertbox/980726.html

Riley, David, (2002), Simulation modeling: educational development roles for learning technologists.

Seels, Barbara B., Richey, Rita C., (1994), Instructional Technology: The Definition and Domains of the Field, Association for Educational Communications & Technology.

Small, Peter, (2000), The Entrepreneurial Web, FT.com, http://www.ft.com

Wiman & Meirhenry, (1960), Educational Media, on Edgar Dale.

About the Author

John A Finnis is a Web and multimedia designer specializing in educational applications. He is currently working with the Faculties of Engineering and Physical Sciences at Imperial College London to promote and support the use of learning technology among teaching staff. He has previously worked with Imperial College's Distance Learning programme.

John is particularly interested in the role of technology in meeting the learning demands of the 21st century (or information age). Contact him at ceo@twinisles.com and view his web page at http://www.twinisles.com/index.htm