Preface

The impact of technology on distance education is revolutionary. Distance education delivery started with exchange of printed material using postal mail with negligible or no interactions. The explosive growth of technology and the support for Internet based interactive communication has opened new avenues for the participants of distance education to collaborate, exchange messages, content, etc. This is an introductory chapter that discusses how technology has shaped and continues to shape instruction and distance education. It also introduces chapters included in this book, which covers the use of technology and the development of tools to support content exchange, delivery, collaboration and pedagogy used in distance education delivery.

INTRODUCTION

There is remarkable growth in the development, delivery and quality of distance education. In depth study would reveal that this growth phenomenon occurred in parallel to and may be credited to the innovation and development of the Internet, network transmission, computer processing technology, streaming video technology, and data and information storage capacity. Distance education has been evolving since the mid 19th century with a vision to spread education to those who could not have access to the traditional education systems because they were separated from educational institutions in distance (space), and in affordability of time. The advancement of the Internet and other related technologies have significantly changed the distance education system as a whole. It has changed the mode of teacher-student communication, student-student communication and reshaped teaching and leaning environments and coverage of distance education offerings. However, the objectives of distance education have remained the same.

This chapter includes reviews of important literature related to distance education since the beginning of distance education systems. This will help us to become familiarized with the evolution of the distance education, its concepts and implementations, and lead us to i) investigate the factors that are contributing to general shifting to online education, ii) identify issues, effectiveness and reasons for a rise in the number of institutions providing distance education, iii) find the cause of the increase in the number of people enrolling in distance education.

This chapter is organized in seven sections. Section two discusses the evolution of distance education and its development through the three generation of distance education. Section three explains the role of technology that contributed to rapid development of distance education delivery followed by its comparison with face to face education in section four and issues yet to be solved. Section five discusses the reasons for the increasing trend in student numbers shifting to distance education. Section six introduces the chapters included in this book. Conclusions and summaries are included in section seven.
EVOLUTIONS OF DISTANCE EDUCATION & TECHNOLOGY

In a report for the National Center for Education Statistics (NCES), Zandberg and Lewis (2008) defined distance education as a formal education process “where the teachers and students are in different locations and courses are delivered via audio, video (live or prerecorded), or Internet or other computer technologies.”

Sloan Consortium, which conducts research on contemporary distance learning, defines distance education as “an online course as one with at least 80% of the course delivered online without face-to-face meetings.” (Dykman, C. A., et. al., 2008)

These definitions of distance education focus mainly on the current Internet based online method of distance education and overlook historic methods of distance education.

The following paragraphs provide a brief discussion of the history of distance education and then continue to introduce the evolution of technology that contributed to widening the prospect of distance education over the years and dramatically changed the way teachers and students involved in distance education delivery can interact.

First Generation Distance Education

A literature review reveals that Sir Isaac Pitman of England first started a correspondence course in 1837 using postal mail, transported by railway, to send the printed instructional materials to those who were interested in learning the new form of shorthand—the “Pitman Shorthand” (also known as “stenographic code”). In the United States, the first distance education delivery started in 1852 when the Phonographic Institute of Cincinnati (OH) initiated a correspondence course on Pitman Stenography. The participants received a certificate on shorthand after successful completion of the course. In 1892, the Queen of England awarded Pitman the highest honor, known as the Knight title, for developing shorthand code and spreading knowledge to the people who had the desire to learn it and delivered at a cost of mailing fee. (Matthews, 1999)

Following the correspondence model, Anna Eliot Ticknor in 1873 founded the Society to Encourage Studies at Home to educate women who had to stay home to take care of their children and did not get opportunities to attend conventional educational institutions. The printed course materials sent to members through the mail were the only method of communication for teaching and learning at that time.

In 1878, John H. Vincent created the Chautauqua Literary Scientific Circle (CLSC) to provide vocational and safety training courses to improve the knowledge/skills of the adults in their respective carriers. William Rainey Harper, the first president of the University of Chicago, first initiated college level distance education in 1892 in the US. The University of Wisconsin followed a similar model and started offering distance education in 1892 using postal mailing systems (Emmerson, 2004). Several other universities started offering correspondence education using postal mail to send materials to the students, which further opened university level educational opportunities to a wider group of students. One major problem with the postal mail was slow communication between teachers and learners which affected student. Postal services, printing technology and railways transportation played a significant role in the expansion of correspondence education during the first generation of distance education between the middle of the 19th century to the beginning of the 20th century.
Second Generation Distance Education: Evolution of Technology

**Radio Broadcasting:** Radio broadcasting technology was first introduced in 1921 to deliver educational programs for distance students and eventually became a popular and a cheaper method of communication. Teachers offered courses and discussed topics on the radio (asynchronous mode of communication) and simultaneously sent course materials and test materials by postal systems. The combination of these two methods helped students better learn the topics. Since radio was relatively cheaper and more available to remote areas it helped to expand the coverage of distance education. Many developing countries started to introduce distance education using this technology.

**Television Broadcasting:** The University of Iowa first used television broadcasting in 1934. Use of satellite television communications started in 1960 and the Instructional Television Fixed Service (ITFS) was introduced in 1963 to provide low-cost licensing systems for educational institutions to offer distance education (Casey, D. M. 2008). Educational institutions started offering satellite television programs to facilitate distance learning, which was considered a cost effective method of offering distance education. Businesses also found satellite technology very cost effective for training their employees and improving their professional skills. At this time radio, television and satellite communication systems were the available and popular method of communication. These also included some form of postal communication until the latter part of the 20th century. This development of distance education, guided mainly by technology, is considered the second generation of distance education.

Third Generation Distance Education: Influence of the Internet

**The Internet:** Using the Internet for distance education was still not a consideration when the Advanced Research Projects Agency (APRA), through its ARPANET project, built the foundation of the Internet in 1969 with the development of the first 50 Kbps circuit network that linked four universities: University of California at Los Angeles, SRI (in Stanford), University of California at Santa Barbara, and University of Utah. The development of applications on the Internet was accelerated after Tim Berners-Lee at the European Laboratory for Particle Physics (CERN) introduced Hyper Text Markup Language (HTML) technology for internal management and linking of files over the Internet. With the use of this technology, a commercial version of the first Web browser Mosaic, known as Netscape, became available in 1993. Further developments of different browsers including Internet Explorer facilitated the transfer of text, graphics, sound and video over the Internet. HTML remains the standard tool to link, transfer and view the files on the Internet. Universities and businesses got connected to the Internet. It grew at a tremendous rate as the cost of computers became more affordable, and individuals and homes started getting connected to the internet.

Significant changes have occurred in the 21st century due to new innovations and availability of more advanced technologies such as the Internet, the World Wide Web, email, high speed telecommunication network systems, management software, computer networks, and teleconferencing. These new and more affordable technologies, providing interactive learning opportunities with the potential of breaking the barrier of distance, are considered the third generation of distance education.

Internet media along with other supporting technologies helped to provide more flexible education at a lower cost and with more improved accessibility and ability to expand around the globe.
ROLE OF TECHNOLOGY

A study of historical development reveals that technology is one of the most important contributors to the dramatic transformation in the evolution of distance learning from inception to its current role in the 21st century. Technology has even changed the concept of distance education, enabling learners to access a variety of resources at anytime from anywhere around the globe. It has broken the geographical and socioeconomic barriers. It has made time affordable and resources which were available only to on-campus students until recently available to distance students. The concept of and approach to education systems is experiencing rapid changes with the introduction of computer assisted instructions, video courses, videoconferencing, Web-based instructions, and online delivery and learning with the help of course management software. Now, thousands of educational institutions are offering online courses using high speed Internet connections, World Wide Web and several types of course management software such as WebCT, Blackboard, Angela, Desire to Learn (D2L), etc. This has created educational opportunities to busy working people and non-traditional students. They have now the option to choose universities and courses located far from their residence or workplace without the feeling of being significantly disadvantaged compared to the on-campus students.

The advancements of technology and new software have facilitated a radical change in the method of delivery of education, instructional design and pedagogy. The use of email, chat rooms, and discussion boards has changed the approach to distance education (Beldarraian, 2006). The first generation of Web technologies helped the innovation of the new paradigm of teacher-student communication. It was further developed for student-student communication, enabling students to get support from each other and complete group tasks through email, chat rooms, and discussion boards (Godwin-Jones, 2003). Student-student communication was not possible in the first two generations of distance education.

The second generation of Web tools that includes Weblogs, wikis, podcasts or vlogs for video materials and audio blogs for audio materials is contributing to the creation of engaging learning environments. Blogs, Wiki, and Podcasts are the tools that the educators are embracing to improve collaborative learning. Ulises Mejias is a type of software that teachers can use to manage blogs posted by the students. Several institutions and teachers are embracing these technologies to promote collaboration and interactivity in distance education. Columbia University’s teachers college in the US uses software where students post their blogs and their learning progress for the course is recorded (Mejias, 2006). Educators in the Auburn University School of Architecture and Bowdoin College in the US, and Deakin University in Australia also use Wikis to promote collaborative learning, complete group projects and facilitate teamwork that needs collaborative work among the students similar to a classroom environment and can be managed by the teachers or the students. Podcasting using RSS technology can deliver audio or video created by the teachers or students, which helps in exchanging course materials and also keeps participants up to date and allows them to feel connected.

DISTANCE EDUCATION AND FACE TO FACE MODE OF EDUCATION

The performance of students and the effectiveness of distance learning versus traditional teaching methods has been a subject of debate and discussion, and a matter of research for long time. In spite of the fact that communication technologies and new applications have revolutionized the delivery of distance education to anyone at anytime and anywhere in the world at a cheaper cost, the quality of the distance education incorporating proper and genuine evaluation is still debated.
Student Performances

Bartini (2008) conducted an empirical study delivered to a 200 level psychology course to compare student performance in a traditional face-to-face course and a Web-based online course. One instructor offered the course using the same content, same quizzes, and same exams for the traditional face-to-face classroom and the online class using course management software. Exams were given on the same day to the students studying in both modes of delivery. The mean score on exams taken by distance education students was 80.68%, and the mean score obtained by the face-to-face students was 72.67%. This indicates that the distance education students performed better compared to the traditional face-to-face students. The probable cause of success of the distance education students may be attributed to the fact that online students received prompt feedback that helped them to understand difficult topics and perform better on the exams. The study report stated that there is a correlation between the proportions of online quizzes completed with the unit exam scores. However, no correlation was found between completion of in-class assignments and exam scores in either section. The research analysis concludes that students may benefit by taking the quiz and getting feedback rather than participating in an in-class activity. Online students had expressed favorable views of online quizzes. Nothing has been mentioned about the type of questions included in the quizzes and exams, or repetition of questions in quizzes to exams, or about the reasons for lower performance of the face-to-face students on the exams (Oskar and Lames, 2008).

Quality of Distance Education

A widespread concern among educators and employers is about the quality of distance education, as they believe that academic misconduct is increasing (Hard, Conway, and Moran 2006). Several studies have been conducted about student perceptions of cheating in online courses, and some reported that chances of cheating in online courses are higher, because there is no screening process that can check student identification (Kennedy, Nowak, and Raghuraman, 2000). It is impossible to know who has enrolled in the course, who is submitting and/or working on the assignments or posting discussions and who is taking the exams, especially when exams are taken in unproctored environments.

A large number of researchers have been working on the issue of quality of distance education and cheating in online classes. A study conducted by Oskar and James (2008) carried out an empirical study to find out the extent of cheating and the effectiveness of online instruction and face-to-face instruction in a “Principles of Economics” course. The authors collected data from two courses, which were identical in every respect, offered during summer 2004 and 2005. The only difference was that the final exam in the summer 2004 course was not proctored, and the final exam in the summer 2005 course was proctored. Student characteristics were considered independent variables and R-squares statistics were compared for each exam. The assumptions include that if there was no cheating took place, then same scores will be attained for all exams and, conversely, if cheating occurred in the exams that were unproctored then the scores will be different. The comparison of the R-squared statistics revealed that the variation in test scores in the unproctored format compared to the proctored environment indicate an incidence of academic dishonesty in online courses when compared to face-to-face courses. The results suggest that online exams administered in a proctored environment might equalize the incidence of academic dishonesty between online courses and face-to-face courses. The authors included findings from several other studies to evaluate the cheating and how to improve the online courses. There are several interesting studies on the testing process for distance education. Studies carried out by Edling (2000), Rovai (2001), and Deal (2002) suggested that campus proctored tests and open book testing with time constraints can improve the quality of tests and the evaluation process of distance education.
Acceptability of Distance Education

Internet technology that is not limited to any boundaries and multimedia technology based on high performance microprocessors are now widely used in distance education. Educational institutions, academicians and learners around the globe are gaining interest in distance education due to the application of these advanced technologies. The popularity of online courses has been increasing, which is demonstrated by the tremendous increase in the number of institutions offering online courses. Even prestigious universities such as Harvard, Stanford, Oxford, the University of Texas and many other universities around the globe have been offering degrees partially or entirely through online coursework. Participation in large numbers and by well known universities is contributing to the wider acceptance of distance education degrees.

SHIFT TO DISTANCE EDUCATION

The US National Center for Education Statistics (NCES), the primary entity of the federal government that publishes reports on education in the United States and other nations, reported that during 2006-07 the total enrollment for distance education courses was about 12.2 million (USDoE, 2008). According to this report, out of a total 4200 institutions, about 61% of the institutions offer online courses. About 35% offer hybrid courses (which is a combination of online and face to face courses) and 26% offer other types of college level credit granting education. These institutions include both two-year and four-year, and public and private institutions. In a report for the NCES, Zandberg and Lewis (2008) stated that during 2004-05 about 37% of school districts had offered courses on distance education, which was 9% higher than the previous year, and that the Internet was the primary mode of communication.

In an article for the Sloan Consortium, which is an online education forum that conducts research and publishes reports about contemporary online educational practices, C.A. Dykman et al (2008) stated that “the number of students in the United States taking at least one online course per year is increasing at a rate exceeding 20% in recent years, reaching more than 3.2 million in Fall of 2005.”

The reason for the shift toward online education is a research question. This is a complex issue that involves the rise in demand for flexible schedules, questions of educational access, paradigms for teaching and learning, competition and globalization among universities, the development of new and better online technologies, and the financial pressures facing higher education. A huge transition is underway (Dykman and Davis, 2008).

Financial Constraints and Technology Advances

Traditionally, higher education has been self-regulating and relatively independent of centralized governmental authority and control (Berdahl and McConnell, 1999; King, 2007). In the United States, for example, state governments have provided most of the funding for state universities, and the federal government has provided substantial research funding based upon various research grant programs to both public and private universities (Dill, 2001; Spellings, 2006). These sources of funding are tax-based and have been weakening in recent years under political pressures. Universities have been forced to look elsewhere for significant funding. Similar situations have been developing in Europe and other parts of the world (Weiler, 2000).

Higher education is expensive and government support in real terms has been on the decline (Cantor and Courant, 2003; Hemsley-Brown and Goonawardana, 2007; Longanecker, 2006). As budgets
get tighter, there is a new focus on financial accountability (Broadbent, 2007). In many cases, student tuition and fees have risen at an alarming rate, as well (Jacobs, 2005). Faced with the choice of further tuition and fee increases or expanding markets, many administrators turn entrepreneurial and see online education as a possible salvation. Distance education, now equipped with advancing technology and the level of acceptance, is considered a mostly untapped route to important new markets (Mok, 2005).

**Leveraging Existing Technological Resources**

Computer and network architectures (especially in universities) are already established and being maintained with mostly state-of-the-art equipment. Virtually everyone in every university is already highly computer literate and connected to the Internet. Adding distance learning over the Internet for a typical university will require relatively little incremental cost, especially compared to the resulting potential for market expansion. It is essentially a case of leveraging and better utilizing an already large investment in existing resources. This is a totally new strategic development that has never been possible on such a scale before. Universities can potentially increase student enrollment without significantly expanding campus facilities for classroom space, dormitories, etc. But it is not as straightforward as it sounds. One major issue is the faculty development for distance education. Teaching online is very different from conventional teaching and is not easy. Planning online coursework is much more demanding and student-teacher relationships are much more complex. Once mistakes are made, it is difficult to recover fully in an online environment. And once a professor, a department, or a student body has soured on Internet-based online education, it may take a long time to get any of them to reconsider pursuing it again.

**TOPICS COVERED IN THIS BOOK**

More details of recent developments in some specific areas are covered in different chapters of this book. The major topic areas include:

- Web Based distributed course forums and content sharing
- Cooperative learning
- A virtual laboratory on natural computing: A learning experiment
- Multimedia tools and conferencing systems
- Facial animation in distance education
- Pedagogy and technology in distance education
- Mobile e-learning

The following paragraphs provide a brief introduction to each of the areas included in different chapters of this book.

**Web Based Distributed Course Forums and Content Sharing**

The development of the Internet has extended to the distance learners of today an opportunity that was never even a dream to the learners in the earlier generations of distance education. One very important aspect is to interact with other fellow learners and with the instructors whether in asynchronous or synchronous mode. Web-based education application systems have affected the traditional teaching-learning concepts, models and methods for both distance education and face-to-face mode. By breaking the barrier
of time zones and geographic locations, these systems provide synchronous or asynchronous interactive learning environments for the teachers and students as well as among the students themselves.

In this book, the chapter by Hung Chim and Xiaotie Deng proposes a novel data distribution framework for developing a large Web-based course forum system. The proposer’s university has 3,983 different kinds of courses covering over 150 different academic programs. The major objective of this work is to build a high performance distributed Web based BBS forum system with very low communication overhead cost and also with the least hardware cost as possible. In the distributed architectural design, each forum server is fully equipped with the ability to support some course forums independently. The forum servers collaborating with each other constitute the whole forum system. All course forums are classified by their teaching content relevance. Relevant course forums are arranged on the same forum server together. The distribution framework also provides a knowledge-based taxonomic storage solution to build a large digital course teaching material library.

Over the Internet, learners are free to access new knowledge without restrictions of time or location. But there are still restrictions considering support in interconnection of learning systems available in scalable, open, dynamic, and heterogeneous environments. The chapter by Kuan-Ching Li et al introduces a distance learning platform based on grid technology to support learning in distributed environments, where open source and freely available learning systems can share and exchange their learning and training contents. A prototype is designed and implemented.

The chapter by Ying-Hong Wang and Chih-Hao Lin presents an English chat room system in which students discuss course contents and ask questions to and receive feedback from teachers and other students. The developed system checks the semantics of a sentence and contains an agent that detects syntax errors in sentences. It can also offer recommendations to the user. The system attempts to find the answers to a user query from the knowledge ontology that is stored in the records of previous user comments. It is aimed to automatically perform the tasks like in a traditional distance learning system where supervisors or teachers are available online to facilitate and monitor a learner’s progress by answering questions and guiding the users. An automatic supervisor can help monitor messages, check syntax or semantic mistakes and attempt to correct and to resolve learner-related problems.

Cooperative E-Learning

Technology developments have extended the opportunity for distance learners to be involved in cooperative learning. Cooperative learning requires creation of an environment where a group of heterogeneous students may support their own learning as well as that of others in the same group. In this instructional paradigm, the students recognize that all group members share a common fate, but also retain individual accountability by having assignments of vital, distinct yet overlapping tasks. Research has shown that cooperative learning techniques have the potential to promote student learning and enhance learning performance of students through improved information acquisition and retention, increased self-efficacy, higher motivation and development of higher-level thinking skills. It also helps to improve interpersonal and communication skills, social skills and self-confidence, which were not available in the traditional first or second generation distance education delivery. In this book, the chapter by Pei-Jin Tsai et al discusses a concept-based approach and proposes a computer-assisted approach to organizing cooperative learning groups based on complementary concepts to maximize students’ learning performance. In this approach, in a given course, each concept is precisely understood by at least one of the students in each group. To evaluate the performance of the proposed approach, an experiment has been conducted on a computer course entitled, “Management Information System.” The experimental results conclude that this approach is helpful in enhancing student learning efficacy.
The chapter by Lai-Chen Lu and Ching-Long Yeh discusses some collaborative e-learning and semantic blog technology, and then introduces functions, implementation and how collaborative e-learning appears in semantic course blog. Using a developed semantic course blog, instructors can import the course lectures. Students can team up for projects, ask questions, mutually discuss problems, take the comments, support answers, and query the blog information. Semantic blog combines semantic Web and blog technology that the users can import, export, view, navigate, and query the blog. It provides a platform for collaborative e-learning framework.

Virtual Laboratories: Learning Experiments

In most current Web-based applications virtual labs are designed to provide students some practice in theory, allow them to complete pre-experiments and review contents of experiments. The emergence of high speed Internet has opened the possibility for the development of powerful Web based multimedia applications and integration of virtual reality into these applications. These applications have raised the expectations of implementing more effective virtual laboratories to provide students access via the Internet to experiments in various fields including science and engineering laboratories, which are regarded to be challenging to complete over the Internet. The Carnegie Mellon Virtual Lab and the University of Virginia’s Virtual Lab represent innovations in the educational use of information technology.

In this book, the chapter by Leandro Nunes de Castro et al discusses a virtual laboratory on natural computing (LVCoN) to support the teaching and learning of natural computing whose goal is to provide didactic contents about the main themes in natural computing in addition to interactive simulations, videos, exercises, links for related sites, forums, and other materials. Natural computing is a terminology used to describe computational algorithms developed by taking inspiration from information processing mechanisms in nature, methods to synthesize natural phenomena in computers, and novel computational approaches based on natural materials. This chapter describes an experiment with LVCoN in a school of computing in Brazil. Most students liked the experience of working with a virtual laboratory, and considered a hybrid teaching approach (i.e. one mixing lectures with virtual learning) very appropriate and productive.

The chapter by J.A. Gómez Tejedor et al in this book describes a Java-based virtual laboratory. This remote laboratory enables students to build both direct and alternating current circuits. A graphical user interface resembles the connection board, and also the electrical components and tools that are used in a real laboratory to build electrical circuits. The design of access patterns to the virtual tools is attempted to replicate real touch and allow the lecturer to adapt to the behavior and the principal layout of the different practical sessions during a course.

Learning by means of virtual laboratories tools would be more effective if they were specifically tailored to each student’s needs. The virtual teaching process would be well adapted if an artificial tutor could identify the correct acquired knowledge, recognize the erroneous learner’s knowledge and suggest a suitable sequence of pedagogical activities to improve the performance of the student. The chapter by Mehdi Najjar proposes a knowledge representation model which judiciously serves the remediation process to students’ errors during e-learning activities. The model is inspired by recent research on computational representation of knowledge and by cognitive psychology theories that offer a refined modeling of the human learning processes. Experimental results, obtained via practical tests, show that the knowledge representation and remediation approach facilitates the planning of tailored sequences of feedback that considerably help the learner.
Multimedia Tools and Conferencing Systems

Multimedia systems have opened a wide range of applications by combining a variety of information sources, such as voice, graphics, animation, images, audio, and full-motion video. The integration of high speed network and multimedia helped to develop important tools used in distance education. In this book, the chapter by Noritaka Osawa and Kikuo Asai describes a multipoint, multimedia conferencing system called FocusShare that uses IPv6/IPv4 multicasting for real-time collaboration, enabling video, audio, and group awareness information to be shared. Multiple telepointers provide group awareness information and make it easy to share attention and intention. In addition to pointing with the telepointers, users can add graphical annotations to video streams and share them with one another. The system also supports attention sharing using video processing techniques. Users evaluated FocusShare more positively than conventional video conferencing.

The chapter by S-A. Selouani et al presents systems that use speech technology to emulate the one-on-one interaction a student can get from a virtual instructor. A Web-based learning tool, the Learn IN Context (LINC+) system, designed and used in a real mixed-mode learning context for a computer (C++) language) programming course taught at the Université de Moncton (Canada) is described in this chapter. It integrates an Internet Voice Searching and Navigating (IVSN) system that helps learners search and navigate both the Web and their desktop environment through voice commands and dictation.

The chapter by Sami Habib and Maytham Safar presents an Internet tool called WEBCAP that can schedule the retrieval of multimedia Web documents in time while considering the workloads on the WWW resources by applying capacity planning techniques. The results shown demonstrate the effectiveness of WEBCAP in scheduling the refreshing of multimedia Web documents.

Facial Animation in Distance Education

Several researchers consider emotion deficiency as an issue in distance education systems. Facial emotion recognition and speech emotion recognition technologies are countermeasures proposed in Web based education systems. Online interaction with 3D facial animation is an alternative way. The chapter by Yushun Wang and Yueting Zhuang presents a novel 3D facial modeling solution that facilitates quasi-facial communication for online learning. The experimental results show that the proposed algorithm can robustly produce 3D facial models from images captured in various scenarios to enhance the lifelikeness in distant learning.

Pedagogy and Application of Technology in Distance Education

Successful education delivery requires an understanding of how technology relates to pedagogy and content. Technology, pedagogy and content can not be seen in isolation. (Mishra & Koehler, 2006; Koehler & Mishra, 2008).

The chapter by Pei-Di Shen et al discusses use of innovative learning designs such as problem-based learning (PBL) and self-regulated learning (SRL) to increase students’ learning motivation and develop practical skills. A series of quasi-experiments were conducted in two classes of 106 freshmen in a semester course at the Institute of Technology in Taiwan to examine effects of these designs mediated by a Web-based learning environment. The results of the experiment revealed that effects of Web-enabled PBL, Web-enabled SRL, and their combinations on students’ skills of application software have significant differences.
Computer games technology can be used to make learning more interesting. Attempts are being made to employ games for constructivist learning and teaching. The chapter by Morris S. Y. Jong et al in this book introduces game-based learning and its intrinsic educational traits from motivational, cognitive and socio-cultural perspectives. It also reviews two recent foci of game-based learning: i) “education in games” which is an approach for adopting existing commercial games for educational use and ii) “games in education” in which the games are designed specifically with underlying pedagogy for some curricula.

The chapter by Keita Matsuo et al discusses design and implementation of new functions such as interface changing function, new ranking function and learner’s learning situation checking function to improve the system performance of a previously implemented e-learning system that was able to increase the learning efficiency by stimulating learners’ motivation.

The chapter by Dawei Hu et al proposes a personalized e-learning framework based on a user-interactive question-answering (QA) system, in which a user-modeling approach is used to capture personal information of students and a personalized answer extraction algorithm is used for personalized automatic answering. The experimental results show the efficacy of the proposed user-modeling approach.

The chapter by Huan-Chao Keh et al presents an application of distance education in advanced military education with well-chosen technology to assist officers around the world in becoming more skilled and qualified for future challenges. The chapter presents a prototype of the architecture of ‘Advanced Military Education – Distance Learning’ (AME-DL). It combines advanced e-learning tools, simulation technology, and Web technology to provide a common standard framework for a military training program and a set of military learning and training subjects that can be accessed easily from anywhere, at anytime through a Web browser. It is aimed at reducing training costs while providing a high quality learning experience.

**Mobile E-Learning**

A relatively development is mobile technology. This technology has the potential to make real use of the fundamental terminology in distance education “education anytime and anywhere.” Learners may be at work, in a meeting, on the road on a bus or a train, shopping at a store, or eating, etc. However, with flexibility comes more issues: a small screen with limitations for reading a large amount of content, viewing graphics, or seeing moving graphics in a distracted environment where mobile devices are mostly used. Accordingly, much research and review is needed for technology, content and pedagogy in mobile environment.

In this book, the chapter by Tin-Yu Wu develops an environment for mobile e-learning that includes an interactive course, virtual online labs, an interactive online test, and lab-exercise training platform on the fourth generation mobile communication system. This system uses a variety of computer embedded devices to ubiquitously access multimedia information, such as smart phones and PDAs.

Inter-networking has become one of the most popular technologies in mobile e-learning for the next generation communication environment. The learning mode in the future will be an international, immediate, virtual, and interactive classroom that enables learners to learn and interact.

**Other Web-Based Tools for Distance Education**

Research is being done to define learning objects, their standards, and building tools for developing Web-based courses. Research in this area also includes the use of agents and ontologies with learning objects employing their intelligent search and selection capabilities.
The chapter by Karen Stauffer et al presents a methodology for developing Extensible Markup Language (XML) based learning objects for courses using the IMS LD specification and to design a runtime environment for these learning objects. The chapter first investigates the IMS LD specification, determining how to use it with online courses and the student delivery model, and then applies this to a Unit of Learning (UOL) for online computer science courses. This chapter also looks at how the specification used for the learning objects can be extended by using intelligent agents and more advanced levels of the IMS LD.

The chapter by Jui-Fa Chen et al proposes an interactive feedback mechanism in a virtual campus that can parse, understand and respond to Chinese sentences. This mechanism utilizes a specific lexical database according to the particular application. The aim of this work is to develop an automatic interactive feedback system for e-learning Websites.

SUMMARY AND CONCLUSION

In this chapter, we have observed that technology has significantly contributed to shaping instruction and the future. In discussing how technology is shaping instruction and distance education, we looked back to the past history of distance education in America and other countries around the world. The major highlights include:

- how technology has helped to change the communication media and contributed to growth of distance education;
- development of course management technology that created virtual distance education systems which extended educational opportunities to all who desire education and who cannot afford to attend institutions due to socio-economic reasons, time constraints or geographical separation.

Over the last few decades, the innovation of new technology and revolutionary changes in communication systems has played a convincing role in changing peoples’ attitudes towards distance education. This has contributed to changes in educational policy, increased support by academics and acceptance of degrees by institutions around the globe. Over the past decade, we have seen a significant growth in numbers of institutions offering distance education and also an increase in the number of students of all ages and races seeking a degree.

The development of new technology and changing dynamics of delivery options, interaction and collaboration using asynchronous or synchronous mode of communications created a new dimension to distance learning of the 21st century.

It is expected that more sophisticated communication and teaching tools that would help to further improve the quality of distance education will be available in the future. The growth of technology, its availability, and its affordability will contribute to overcoming the limitations of quality of test and evaluation process of student’s knowledge. It appears that educational institutions will need to adopt one or more iterations of distance education to maintain and fulfill the expectations and requirements of current and future students.

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