

Chapter 1: Introduction

1.1. Introduction

The Industrial Revolution in the nineteenth century was followed by developments in various fields of technology and provided educators with different means for a new era of education. Distance education was one of the main results of this revolution. Distance education is a method of education in which the learner is physically separated from the institution. Therefore, learning materials are often structured in a way that facilitates learning at a distance (Rumble, 1989).

The distance education literature points out many examples of how higher education institutions in many countries used print and post, broadcasting radio and television and other media to deliver instruction. However, although the distance education approach was originally invented to help adults, who could not attend conventional classes, ‘distance education methods together with existing conventional systems will converge for the benefit of all learners – not just those we define as adults’ (Garrison and Shale, 1990, p. 131). In the last few years, distance education has captured the interest of many elementary and high school students. In other words, adults are no longer the only target of distance education (Dhanarajan, 1996).

The communications revolution, in particular, offered new and different solutions for delivering instruction to learners outside the traditional classes. In the last twenty years, parents’ and learners’ interest enhanced dramatically as a result of the great advances in audio-visual media, telecommunication technology, which resulted in an increase in the subject areas offered by distance education programmes. By the early 1980s, the rapid developments in computing and information technologies accompanied by easy-to-use, flexible and effective ways of storage and distribution of course materials created a new paradigm of distance education. These features, plus the interactive nature of the computer as an instructional medium for individualised instruction, have attracted distance educators more than any other

medium ever and developed the nature of distance education systems to be more effective delivery modes (Gray, 1988).

However, although these technologies are very popular and appropriate for many situations, they are characterised by many delivery and pedagogical problems (Keegan, 1988). For example, the Planning Committee of the British Open University found that 'the amount of learning materials required to meet the needs of a full range of degree courses would be too great to cover by broadcasting alone' (Bates, 1988, p. 228). In addition, the feeling of isolation from the tutor and peers, lack of tutor support, lack of convenient and effective interaction, lack of strategies for involving learners actively in the programme, inappropriateness of delivering many subject matters, difficulty of use, difficulty of access to appropriate learning resources, slowness of distributing subject material, unfamiliarity with the self-study approach, high delivery or transmission costs and problems of managing and evaluation of far students are the most common problems that characterised previous distance education technologies, such as print and post, broadcasting radio and television, audio and videotapes and teleconferencing (Keegan, 1990; Bates, 1995; Jones et al., 1996).

The real development in computer-based instruction was established when followed by a revolution in the concept of networking and Computer-Mediated Communication (CMC). Using CMC, interaction between the tutor and distance learners has been established using different forms of computer-based conferencing and students have been able to access a variety of learning resources located in other computers and exchange information with one another (Mcmillan, 1997). CMC has become more popular with the evolution of the Internet and the World Wide Web (abbreviated to WWW or Web). The Internet and the Web are the most popular and growing technology in a long history of using media and technology to deliver instruction to students at a distance. The idea of the Web is to create a system for delivering and viewing documents (called hypertext) containing text, images, audio-visuals media, programs and links to other files, located in other computers connected to the Internet, using a user-friendly graphical interface.

Today, and perhaps for the first time in distance education history, through telephone lines, local networks or channels, learners at home and schools can easily access instructional materials and databases that contain information in different formats, interact with far teachers

and peers, share knowledge and experience, co-operate with each other in small or large groups and publish information with low-level costs.

Consequently, educational institutions world-wide are in a rush to establish on-line courses and Web-based virtual classes to deliver instruction and support students at a distance. According to Powell (2001), '66% of the USA's two-year and four-year postsecondary education institutions offered distance education courses, and another 20% planned to start offering such courses (primarily via the internet) by 2001' (p. 43). However, higher education institutions are not the only sector developing on-line learning; schools are placing more course material on-line to supplement classroom situations or replace classroom instruction to meet student and society needs (Janicki and Liegle, 2001).

However, although institutions have invested much in developing on-line environments or using already established commercial platforms, only few studies have been conducted to investigate the effectiveness of on-line courses based on empirical data (Jung and Rha, 2000). A review of the literature showed that although enormous number of studies were conducted in the area of on-line education, most of them investigated the effectiveness of Web-based interaction or Internet conferencing on learning, not the entire learning environment (Atkinson, 1992; Fulford and Zhang, 1993; Foley and Schuck, 1998; Graham and Scarborough, 1999; Harris, 1999). Even in those studies that investigated entire on-line environments, student achievement was the most common indicator for evaluation and no other indicators or factors (such as student satisfaction), which may influence students' achievement, were investigated to give more comprehensive understanding of the effectiveness of Web-based distance education (Lockee et al., 1999).

To promote understanding of the phenomenon of on-line learning, this study attempted to investigate students' perceptions of various aspects of on-line learning environments (such as access, interactivity and user-friendliness), learning outcomes in comparison to the traditional classroom, factors influencing students' on-line experience and the cost-effectiveness of establishing an on-line learning environment.

1.2. Statement of the problem

The lack of evidence of the quality and the cost-effectiveness of on-line learning, inadequate information about the factors that may contribute to students' academic success and satisfaction with on-line learning, in conjunction with the long history of contradictory results of distance education technologies, may lead to inappropriate and costly educational and policy mistakes (Clark and Salmon, 1986). Therefore, the need is emphasised to clarify and evaluate the effects of using the Web in teaching students at a distance using a comprehensive approach and a multi-level evaluation framework (Clark, 1994). This plan might help distance educators to explore the positive features of on-line learning and eliminate weak features, as shown below.

Previous studies in distance education and on-line learning claimed that evaluation of on-line learning needs to provide information about students' reactions to both instructional (e.g., interactivity, quality of teaching, quality of resources, etc.) and technical aspects (e.g., speed, ease of use, ease of access, etc.) of the medium and technology, with an indication of students' achievement of learning objectives and the cost-benefit/savings of implementing the new programme (Fulford and Zhang, 1993; Bates, 1995; Clark, 1994; Thorpe, 1998; Lockee et al., 1999; Whalen and Wright, 1999; Jung and Rha, 2000).

Bates (1995), for example, argued that evaluation of distance education technologies should be based on a more generic framework that addresses the various aspects of the medium. He proposed a framework called the ACTIONS model (Access, Costs, Teaching and learning functions, Interactivity and user-friendliness, Organisational issues, Novelty and Speed) to help in analysing and evaluating distance education technologies. In addition, Smith and Dillon (1999) indicated that evaluation of distance education media should consider conceptual attributes of the medium, such as types of interaction supported by the medium (one-way/two-way), bandwidth (amount of information that can be sent from one site to another), realism (providing high realistic images and motions and audio-video rather than abstract symbols) and system interface (access to multiple information resources and control branching).

Second, to conduct such analysis and evaluate an entire on-line course, there is a need to use an already established learning environment or establish a new and reliable on-line

learning environment, in which learning can take place and students' learning and experience can be investigated, which is a problem in its own right. Janicki and Liegle (2001) argued that the Web is a relatively new technology and most current offerings of Web-based courses are established by individuals who have authoring skills, 'but are not necessarily knowledgeable about educational concepts'. In addition, Powell (2001) found that:

'despite the established base of online courses, online course design and facilitation is still uncharted territory for many college and university faculty. Many faculty members struggle with how to successfully use the available tools and technologies to organize instructional content into well-crafted teaching systems that support learning' (p. 44).

Although an enormous number of guides and articles have been published to help educators to establish on-line learning, 'they do not provide a comprehensive and practical guide to the challenges faculty encounter when designing complex Web modules' (Weston and Barker, 2001, p. 15). On-line learning environments should meet many instructional, structural and technical principles of design and development to be more than information dumping, and to avoid eyestrain from endless text screens, confusing navigation and long download times (Spitzer, 2001).

Specifically, the problem of this study is defined as to establish a reliable on-line learning environment, evaluate its effectiveness using a generic and comprehensive framework and identify factors, which may influence student academic achievement and satisfaction.

1.3. Purpose of the study

The purpose of this study was to establish an on-line learning environment for teaching students at a distance and perform a multilevel assessment of students' reactions to on-line learning, academic achievement and cost effectiveness.

Establishing the learning environment would be achieved based on the answers to the following questions:

1. What is the meaning of distance education?

2. What are the characteristics, advantages and limitations of previous distance education technologies?
3. How is the educational relationship in distance education systems?
4. What are the technical features of the Internet?
5. What are the instructional capabilities of the World Wide Web?
6. What are the essential features of on-line learning environments?
7. What are the elements that should be available in on-line learning environments to serve these features?
8. What instructional design model, or models, is most appropriate to develop the on-line learning environment?
9. How can an on-line learning environment be structured and organised?

However, evaluating the learning environment requires investigating students' perceptions of different aspects of the learning environment, quality of instruction and learning outcomes (Clark, 1994; Bates, 1995). Therefore, the second purpose of this study was to investigate the views of on-line tutors, distance educators, Web developers and subject matter experts on the strengths and weakness of the learning-environment, particularly when students are not able to provide objective feedback. Quantitative and qualitative methods were used to help in exploring what does work and what does not, under what conditions and with which students, as well as to identify variables related to students' learning and perception. Quantitative analysis was based on the results of an achievement test, students' demographic information and students' and experts' responses to closed-ended items in the evaluation questionnaires. Qualitative analysis was based on cost analysis, students' and experts' comments and feedback to open-ended questions, students' logs and records and analysis of interaction via discussion boards.

This investigation was mainly guided by Bates' (1995) ACTIONS model. Bates argued that any distance education technology should be described, compared or evaluated in terms of:

1. access (does the technology easy to access? Does it facilitate access to new and high quality teaching and learning resources? Does it facilitate access to the tutor and peers?);

2. costs (what is the cost structure of the technology in terms of fixed costs, variable costs? Is there any cost savings in using the technology?);
3. teaching and learning functions (how efficient are course objectives and content, course materials and resources, presentational features, teaching/learning approach, learning outcomes and time demands?);
4. interactivity and user-friendliness (how do students interact with the tutor, the content and themselves? How friendliness is the technology in terms of ease of use, delivery methods, programming, user-interfaces, technical design, navigation and structure?);
5. organisational issues (how well is the learning environment organised? What are the factors that influence students' perceptions and achievements? What are the factors related to students' success?);
6. novelty (how new is this learning technology?); and
7. speed (how long do students spend in learning? Does the system quick?).

In addition, the objectives of this study were to identify instructional and media-related factors influencing students' achievement, perception of on-line learning and instructional activities in the learning environment.

1.4. Significance of the study

This study may contribute to the field of Web-based distance education as follows:

1. Although the comparison approach in media studies is criticised by many researchers (e.g., Lockee et al., 1999; Vrasidas and McIsaac, 2000; Jung, 2000), since it may offer little conceptual contribution, it is relatively new to the field of distance education and useful if it explains how and why the technology is used, and not only to provide the results of such comparison (Smith and Dillon, 1999). Understanding how students learn, under what circumstances and what variables could contribute to student learning may improve the design of further distance education systems and provide useful information for policy makers.
2. Considering the fact that there is little research in the area of Web-based instruction, in general, and for young learners, in particular, this study may assist

educators in planning, designing, organising and evaluating quality Web-based distance education in a manner that facilitates learning at a distance.

3. The study used a relatively new evaluation framework to assess the cost-effectiveness of Web-based distance education.
4. A Web-based learning environment was designed, developed and implemented, as a model for developers who may want to develop Web-based courses.
5. A coding system was adopted, which could be used in future studies of asynchronous Web-based learning to assess the quantity and quality of students' responses.
6. The study provided evidence to the distance education literature, which suggests that a Web-based learning environment is equally effective as face-to-face education.

1.5. Procedures and overview of the study

Based on the problem and the purpose of the study, as mentioned above, the following procedures were followed:

1. A theoretical study was conducted on:
 - Key issues in distance education, including characteristics, advantages and limitations of previous distance education technologies, the educational relationship in distance education systems, theory of development and evaluation of distance education technologies and costs of distance education technologies (Chapter 2);
 - Technical features of the Internet and the World Wide Web, delivering media via the Web and developing for the Web (Chapter 3); and
 - Instructional capabilities of the Web, models of using the Web in education, theories and types of Web-based learning, cost-effectiveness of on-line learning, elements of on-line learning environments and instructional design for the Web (Chapter 4).
2. A Web-based learning environment was established for teaching students at a distance, as follow (Chapter 5):

- Participants, course content, learning objectives, appropriate teaching/learning approach and the technical requirements were defined and front-end analysis was conducted;
 - The elements of the learning environment, including tutorials and assessment, support utilities, interaction tools, management and monitoring tools and help and on-line support, were designed and developed; and
 - Developmental testing of the learning environment, including expert appraisal and student try-out (September 1999-February 2000), was conducted.
3. The research instruments (including students questionnaire, student achievement test and experts' questionnaire), were planned, developed and piloted, the sample of study selected and preparation made for implementation (Chapter 6).
 4. The learning environment was implemented (February and March 2000) and the research instruments administered to collect, analysis and discuss the results of the study (Chapters 7, 8, 9 and 10).
 5. Conclusions and implications were drawn from the study in terms of design and development, practice and further research (Chapter 11).

1.6. Delimitation of the study

- **The population:** The population of this study was limited to first year secondary 'language schools' students in Egypt and the sample was limited to students enrolled in the first year at three public secondary 'language schools' in Cairo (El-Maadi Experimental Language School, El-Hadayek Experimental Language School and Hafez Ibrahim Experimental Language School).
- **The topic of learning:** The topic of learning was the first part of the second semester maths course for first year secondary 'language schools' in Egypt.
- **Teaching method:** Two teaching methods were used in this study; traditional classroom/face-to-face instruction (for the control group) and Web-based instruction (for the treatment group).

1.7. Limitations of the study

The present study is a preliminary investigation of the effectiveness of teaching students at distance and had many limitations, as follows.

1. The study included only one on-line class, due to the small sample available for the study. The decision of the Ministry of Education in Egypt and district administrators as to which school within the district would participate affected number and the location of schools selected for the study.
2. Since quantitative analysis was limited due to the small sample, the results may not be generalised beyond this specific population of students.
3. The number of male and female students enrolled in Grade 1 in the selected schools and classes led to unequal numbers of male and female participants.
4. The length of the study was an eight-weeks course, which may have an impact on the way that students experienced this course.
5. A post-test only control group design was implemented due to the difficulty of examining students prior to the study. This limitation was treated in the research design.
6. Control and treatment group students were taught by different teachers, which may have had an impact on students' learning.
7. The analyses of students' records were done by the researcher, and some degree of subjectivity is hence inevitable.
8. Experts' and students' perceptions and achievement were measured as experienced only throughout the learning environment designed in this study.

1.8. Definition of terms

In this study, many operational variables and instructional and technical terms are used. These variables and terms are defined as follows.

- **Asynchronous interaction:** Asynchronous interaction is time-independent and does not require real-time dialogue. It allows the tutor and learners to send and receive messages at any time (using e-mail or discussion boards), without the need to immediate response and give them the chance to read, reflect on their own ideas (Liaw and Huang, 2000).

- **Bandwidth:** Bandwidth is the capacity of communication channels to carry and transfer data among users at any given second. This capacity is limited and depends on the connection type.
- **CGI Scripts:** CGI (Common Gateway Interface) is not a programming language in itself but a collection of protocols that allows Web clients (browsers) to run programmes on a Web server and receive their inputs again. CGI scripts in conjunction with HTML forms can respond to the user's inputs and generate appropriate pages for the user's entries.
- **Discussion boards (bulletin boards):** Discussion boards are virtual place at which users can post and read others' messages. These messages might be sent via e-mail or directly using discussion input forms.
- **HTML:** HTML (Hypertext Mark-up Language) is the major language of the Web. It is the set of 'mark-up' symbols or 'tags' inserted in ASCII files, at certain places in a text, to deliver documents via the Web and present them using a Web browser. HTML tags tells the Web browser how to display (font, colour, margin, spaces, etc.) the elements of a page (texts and images).
- **Hypertext:** Hypertext is an approach to organise and access information on the Web. In hypertext documents, information is stored in a network of nodes connected by links. These nodes may contain plain text, graphics, audio-video clips, programs or other or other types of information (Balasubramanian, 1994). Hypertext pages are the essential component of the Web and provide a non-sequential method of accessing information.
- **Hypermedia:** A hypermedia system is a hypertext system with links to various forms of media such as images, graphs, sounds, movies and other objects, such as Java applets.
- **Interactivity:** Interactivity is a descriptive term used to describe student communication with the tutor (via e-mail, chat, on-line tests, etc.), peers (via discussion boards, e-mail, chat, personal pages, presentation boards, etc.), course content (on-line quizzes, form inputs, etc.) and user-interface (menus, navigation aids, hyperlinks, buttons, etc.).
- **Java:** Java is a general-purpose, client-side and cross-platform programming language, developed by Sun Microsystems, designed to deliver and run applications via the Internet. Java applications are small size files, called applets, which can be downloaded and run in the user's machine.

- **JavaScript:** Java Script is a cross-platform Web scripting language, developed by Netscape Communications. JavaScript code is inserted directly into an HTML page and run in the Web browser.
- **Experimental Secondary Language Schools:** Experimental Secondary Language Schools (14-17 years), are a relatively new type of public secondary schools in Egypt established in early 1990s. These schools constitute about 10% (about 1000 schools) of secondary schools in Egypt. The government founded Experimental Schools to teach the national curriculum in English. They are called experimental because the Ministry of Education's statute did not grant it the right to establish language schools, but gave the Secretary for Education the right to experiment.
- **On-learning activities:** Learning activities refer to all tasks students are required to accomplish on-line, including logging-in and logging-out, contacting the tutor and peers in the on-line class, search and access Web resources, publishing course-related work, etc.
- **On-line tutor:** On-line tutor is a descriptive term used to refer to the human instructor who is responsible to monitor students' tracks and records, respond to students' questions and provide appropriate feedback, suggest learning activities, maintain and develop course materials and tests as appropriate, maintain and encourage students to participate in class activities and assess students' progress.
- **Students' perceptions:** Students' perceptions of on-line learning experiences refers to results of students' answers to questionnaire items solicit information about students' satisfaction with the instructional and technical design of the learning environment.
- **Students' records:** Students' records is a descriptive term used to refer to the course documents in digital format (HTML, TXT and MS Access MDB format) produced by the learning environment as a results of students' entries or participation in instructional activities (e.g. discussion boards and tests).
- **Students' responses:** Students' responses refer to the student behaviour in the learning environment, including responding to e-mail messages, discussion boards and on-line quizzes and tests.

- **Synchronous interaction:** Synchronous interaction is real-time interaction similar to telephone dialogue or audio-video conferencing systems. Many protocols are available on the Web (such as chat) for conducting real-time conferencing.
- **WYSIWYG Editor:** WYSIWYG (What You See Is What You Get) editor is a tool for designing and editing hypertext pages without the need to learn HTML. It allows developers to see what the hypertext page looks like while it is being created. Developers can easily enter text and add images, tables, form fields or other display elements to Web pages.