

Original Article

Computer in Education

Virtual Classrooms through the Ages: Prospects and Challenges

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ABSTRACT [ENGLISH/ANGLAIS]

Virtual classrooms and online-learning have developed through the ages and are growing in popularity. This paper examines the prospects and challenges posed by these forms of classrooms by identifying traditional virtual some factors limiting the potential. Expensive bandwidth for audio and video, the resultant transmission quality, poor collaborative work and limited feedback during virtual classroom sessions are some of the problems that need to be addressed. Successful distance education systems involve interactivity between teacher and students, between students and the learning environment, and among students themselves, as well as active learning in the classroom. This paper presents information on the challenges of developing various components of a virtual classroom system with a focus on collaborative learning between students and tutors at remote locations where students can engage in group activities and also collaborate with tutors. In the presented system, each student sees a common shared window on which text or graphical objects may be added and shared online. Students can work either in collaborative groups or in teams as directed by the tutor with the help of built-in chat room that supports collaborative dialogue.

Keywords: Online learning, virtual classroom, collaborative learning, remote location, chat room, collaborative dialog

RÉSUMÉ [FRANÇAIS/FRENCH]

Les classes virtuelles en ligne et d'apprentissage ont développé à travers les âges et sont de plus en plus en popularité. Ce document examine les perspectives et les défis posés par ces formes de salles de classe en identifiant traditionnels virtuelles certains facteurs limitant le potentiel. Bande passante coûteuse pour l'audio et la vidéo, la qualité de transmission résultante, une mauvaise collaboration et la rétroaction limitée au cours de séances de classe virtuelles sont quelques-uns des problèmes qui doivent être abordés. La réussite des systèmes d'enseignement à distance impliquent l'interactivité entre l'enseignant et les élèves, entre les élèves et l'environnement d'apprentissage, et entre les élèves eux-mêmes, ainsi que l'apprentissage actif en classe. Ce document présente des informations sur les défis du développement de divers composants d'un système de classe virtuelle en mettant l'accent sur l'apprentissage collaboratif entre les étudiants et les tuteurs à des endroits éloignés où les étudiants peuvent s'engager dans des activités de groupe et aussi collaborer avec les tuteurs. Dans le système présenté, chaque étudiant voit une fenêtre commune partagée à laquelle les objets de texte ou graphique peut être ajouté et partagé en ligne. Les élèves peuvent travailler soit en groupe ou en équipes collaboratives comme dirigé par le tuteur à l'aide de haut-salle de chat qui prend en charge le dialogue coopératif.

Mots-clés: L'apprentissage en ligne, classe virtuelle, apprentissage collaboratif, à distance, forum de discussion, de dialogue collaboration

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INTRODUCTION

Education has been a means of transmitting one's culture from one generation to another. It is the process of bringing about a relatively permanent change in human behaviour. As the oldest industry, education is the main instrument used by society to preserve, maintain and upgrade its culture, norms and values. It is a veritable tool in determining technological advancement of a society. Therefore, the future of a society depends largely on the quality of its citizen's education.

Distance education or learning has been proposed in various works. These include [1-4]. In Garrison [1], it was

noted that the hallmarks of distance education or distance learning are the separation of teacher and learner in space and/or time, the control of learning by the student rather than the distant instructor and non-contiguous communication between student and teacher, mediated by print or some form of technology [1]. At its most basic level, distance education is a process in which a significant number of the teaching is conducted by lecturers who are in remote locations to the students [4]. Two categories of distance learning systems can be identified: on-line distance learning and off-line distance learning [3].

In Baron and Orwig [3], on-line distance learning was defined as “New technologies for education” and a type of learning system in which students work on their own at home or at the office and communicate with faculty and other students via e-mail, electronic forums, videoconferencing and other forms of computer-based communication. On-line distance learning is becoming especially popular with companies that need to regularly re-train their employees because it is less expensive than bringing all the students together in a traditional classroom setting. Baron and Orwig emphasized in their paper problem of bulk mails, which can slow down learning pace of the remote students. It was pointed out by Baron and Orwig that we can actually use the powers of the computer to do better than what normally occur in the face-to-face class.

Distance education technologies are expanding at an extremely rapid rate. In [4] it was shown that distance learning is changing for the following well-known reasons:

- a. The economic and social contexts of people have changed;
- b. The number of unemployed workers is increasing and all they need is to be retrained;
- c. Knowledge has become one of the most important economic forces;
- d. Knowledge is rapidly expanding and its life time becomes increasingly shorter;
- e. To survive in the market, companies need to change, to train and retrain their employees;
- f. Investing in the human resources seems to be the only way for a sustainable development.

Many higher educational institutions offering distance education courses have started to leverage the Internet to improve their programme’s reach and quality. The Virtual University of the Monterrey Institute of Technology in Mexico uses a combination of print, live and recorded broadcasts, and the Internet to deliver courses to students throughout Mexico and in several Latin American countries. Similarly, the African Virtual University, initiated in 1997 with funding support from the World Bank, uses satellite and Internet technologies to provide distance learning opportunities to individuals in various English-speaking and French-speaking countries throughout Africa [5].

TYPES OF DISTANCE LEARNING

Traditional Virtual Classroom

Distance education dates back to 1728, when an advertisement in the Boston Gazette stated that Caleb

Phillips, Teacher of the new method of Short Hand was seeking students for lessons to be sent weekly [6]. The earliest form of distance learning took place through correspondence courses in Europe according to Holmberg in [6]. Many institutions, both public and private, offer university courses for self-motivated individuals through independent study programs. Students work on their own, with supplied course materials, print-based media and postal communication, some form of teleconferencing and/or electronic networking, and learner support from tutors and mentors via telephone or E-mail.

Correspondence Method of Teaching and Learning

A search for the origins of the twentieth century pattern of correspondence teaching leads to the individual stories of a number of persons in different countries, who saw in it a method of meeting differing needs.

In 1856 in Germany, Charles Toussaint, a Frenchman who was teaching French in Berlin, and Gustav Langenscheidt, a member of the Society of Modern Languages in Berlin, cofounded a school for teaching languages by correspondence.

In the United States of America, Thomas J. Foster, a newspaper proprietor and editor in Pennsylvania in 1891, shocked at the loss of life in mining accidents, directed the writing of a course of instruction on mine surveying and machinery designed to teach safety measures. This course was the beginning of the International Correspondence Schools of Scranton, Pennsylvania. Also during the last half of the nineteenth century, there was a movement in the United States for the extension of university teaching. In keeping with the trend in universities during this period, on 14 July 1891, the Regents of the University of Wisconsin approved a faculty resolution for the development of university extension correspondence study courses [7].

The prospect and challenges in the introduction of teaching by correspondence and its characteristics can be summarized as follows:

- a. It was introduced to address enormous shortage of teachers, buildings and equipment.
- b. In this method of teaching, students received set of learning materials through mails. The materials usually include text books, student guide and assignments that must be done within specified time.
- c. No teacher support was provided.

- d. This form of learning did not include any kind of feedback and communication with other participants of the educational process.
- e. Correspondence teaching is effective in all subjects that can be taught by the lecture method. That is, in all subjects in which the basis of teaching is words that are easily written and read as spoken. In subjects where practical demonstration and supervision in laboratory work are essential, only the theory can be taught by correspondence.

Educational Radio and TV Programmes in Distance Education

The radio is an invention that enables the transmission of the human voice over a long distance by electromagnetic waves without the help of a wire. Distance learning programmes can be transmitted through the use of radio and this helps to create access. Distance institutions use radio and television to disseminate information, counselling and to facilitate their courses at specific hours. Since radio broadcast can be received even in very remote areas, then it becomes an important tool in distance learning. Television broadcast can be in the form of live broadcast where educational events are directly telecast or recorded broadcast where pre-recorded programmes are telecast per transmission scheduled for the convenience of the producer and the students [8].

Radio and television have been used widely as educational tools since 1920s. There are three general approaches to the use of radio and TV broadcasting in education [9]:

- a. direct class teaching, where broadcast programming substitutes for teachers on a temporary basis;
- b. school broadcasting, where broadcast programming provides complementary teaching and learning resources not otherwise available; and
- c. general educational programming over community, national and international stations which provide general and informal educational opportunities.

The notable and best documented example of the direct class teaching approach is Interactive Radio Instruction (IRI). Extensive research around the world has shown that many IRI projects have had a positive impact on learning outcomes and on educational equity. And with its economies of scale, it has proven to be a cost-effective strategy relative to other interventions [10]. The Farm Radio Forum, which began in Canada in the 1940s and which has since served as a model for radio discussion programs worldwide, is another example of non-formal educational programming [5].

The design of these programmes has undergone many changes through the years, shifting from a “talking heads” approach to more interactive and dynamic programming that “links the community to the programme around the teaching method. The strategy meant combining community issues into the programs, offering children an integrated education, involving the community at large in the organization and management of the school and stimulating students to carry out community activities”

The prospect of using radio and television made it possible to teach languages and some science subjects that require practical demonstrations that could not be taught by correspondence. However, these methods of teaching faced a number of challenges being purely asynchronous, that is one-way communication and as such lack the following:

- a. Instant feedback
- b. Collaborative learning among students
- c. Interaction with the faculty on grey areas.

The Use of Microfilm and Microfiche in Distance Education

Microfilm and microfiche are two types of archival products that can store documents and photographs. Libraries often use these products to archive newspapers. Microfilm and microfiche are viewable through microfilm machines that can turn the negative image on the film to a positive image. The machine also magnifies the document to make it readable. They offer proven advantages in the management, storage, and retrieval of information, as well as significant cost advantages [11]. Microfilm is a long strip of film wound onto a reel, just like film for a camera. The microfilm is then feed into a microfilm reader and the person viewing it can scroll through the images. Microfiche provides the same storage of documents in a different format. Microfiche comes on flat sheets of photographic film. A single sheet can store numerous images. Both are available as positive or negative images, but it is more common to see negatives. Both forms also provide images 25 times smaller than the original [11].

The use of microfilm and microfiche has tremendously assisted in the teaching of subjects like health care, biology, computer science and mathematics among others. Their use made it possible to store a lot of photographic illustrations on films that can be easily moved around. Microscopic objects that would have required the use of microscope were captured on microfiche. A major setback in their use is the need for

reading machine that costs hundreds of dollars. Distance learners may not afford to buy this. Dissemination of lectures through the use of microfiche and microfilm is also asynchronous and as such suffers the same setback with radio and television.

INTERNET-BASED VIRTUAL CLASSROOM

Instructional media in distance education evolved from print, to instructional television, to current interactive technologies. According to [12], in the late 1950's and early 1960's, television production technology was largely confined to studios and live broadcasts, in which master teachers conducted widely-broadcast classes. Unfortunately, teachers who were expert in the subject matter were not necessarily the best and most captivating television talent, nor were the dull "talking head" medium the best production method for holding the interest of the audience. In the early 1970's, the emphasis turned from bringing master teachers into the classroom to taking children out of the classroom into the outside world. This had the negative effect of relegating television to the position of enrichment, which was not perceived as really related to school work. This trend was reversed later in the 1970's, as professionally designed and produced television series introduced students to new subject matter that was not being currently taught, yet was considered to be an important complement to the classroom curriculum. Then, in the 1980's, the pendulum swung back to the basics. The most recent trend has been one of multiculturalism, humanities, and world affairs.

Currently, the most popular media are computer-based communication including electronic mail (E-mail), bulletin board systems (BBSs), and Internet; telephone-based audio conferencing; and videoconferencing with 1- or 2-way video and 2-way audio via broadcast, cable, telephone, fiber optics, satellite, microwave, closed-circuit or low power television. Audio graphic teleconferencing using slow scan or compressed video and FAX is a low-cost solution for transmitting visuals as well as audio [3].

The Use of Computer and the Internet in Teaching and Learning

There are three general approaches to the instructional use of computers and the Internet, namely:

- a. Learning about computers and the Internet, in which technological literacy is the end goal;

- b. Learning with computers and the Internet, in which the technology facilitates learning across the curriculum; and
- c. Learning through computers and the Internet, integrating technological skills development with curriculum applications [13].

Learning about computers and the Internet focuses on developing technological literacy. It typically includes:

- Fundamentals: basic terms, concepts and operations
- Use of the keyboard and mouse
- Use of productivity tools such as word processing, spreadsheets, data base and graphics programs
- Use of research and collaboration tools such as search engines and email
- Basic skills in using programming and authoring applications such as Logo or HyperStudio
- Developing an awareness of the social impact of technological change [14].

Learning with the technology means focusing on how the technology can be the means to learning ends across the curriculum. It includes:

- Presentation, demonstration, and the manipulation of data using productivity tools
- Use of curriculum-specific applications types such as educational games, drill and practice, tutorials, simulations, visualizations and graphical representations of abstract concepts, virtual laboratories, musical composition, and expert systems
- Use of resources on CD-ROM and online information such as encyclopedia, interactive maps and atlases, electronic journals and other references.

Technological literacy is required for learning with technologies to be possible, implying a two-step process in which students learn about the technologies before they can actually use them to learn. However, there have been attempts to integrate the two approaches.

Learning through computers and the Internet combines learning about them with learning with them. It involves learning the technological skills "just-in-time" or when the learner needs to learn them as he or she engages in a curriculum-related activity. For example, secondary school students who must present a report on the impact on their community of an increase in the price of oil for an Economics class may start doing research online, using spreadsheet and database programs to help organize and analyze the data they have collected, as well using a word processing application to prepare their written report.

Teleconferencing in Distance Education

Interactive electronic communication amongst people geographically separated at two or more different places is referred to as teleconferencing. There are four types of teleconferencing based on the nature and extent of interactivity and the sophistication of the technology [15]:

- 1) Audio conferencing;
- 2) Audio-graphic conferencing,
- 3) Videoconferencing; and
- 4) Web-based conferencing

Audio conferencing involves the live (real-time) exchange of voice messages over a telephone network. When low-bandwidth text and still images such as graphs, diagrams or pictures can also be exchanged along with voice messages, then this type of conferencing is called audio graphic. Non-moving visuals are added using a computer keyboard or by drawing/writing on a graphics tablet or whiteboard.

Videoconferencing allows the exchange not just of voice and graphics but also of moving images. Videoconferencing technology does not use telephone lines but either a satellite link/connection or television network (broadcast/cable).

Web-based conferencing, as the name implies, involves the transmission of text, and graphic, audio and visual media via the Internet; it requires the use of a computer with a browser and communication can be both synchronous and asynchronous.

Teleconferencing is used in both formal and non-formal learning contexts to facilitate teacher-learner and learner-learner discussions, as well as to access experts and other resource persons remotely. In open and distance learning, teleconferencing is a useful tool for providing direct instruction and learner support, minimizing learner isolation. For instance, an audiographic teleconferencing network between Tianjin Medical University in China and four outlying Tianjin municipalities was piloted in 1999 as part of a multi-year collaboration between Tianjin Medical University and the University of Ottawa School of Nursing funded by the Canadian International Development Agency. The audiographic teleconferencing network aims to provide continuing education and academic upgrading to nurses in parts of Tianjin municipality where access to nursing education has been extremely limited (Edward N, 2000). Other higher education institutions using teleconferencing in their online learning programs include the Open University of the United Kingdom, Unitar (Universiti Tun Abdul Ruzak) in Malaysia, Open

University of Hong Kong, and Indira Gandhi National Open University.

At the University of Twente, in the Netherlands, an advanced level course about tele-learning developed and taught by Dr Betty Collis, consists of some face-to-face meetings as well as extensive use of the Web for resource material, collaborative activities and discussion. Collis in [16] identified four basic patterns of communication in the learning environment:

- a. telling - which in the asynchronous mode has traditionally been the printed text, but increasingly is taking on a new form in hypertext Web pages, although many conventional linear texts, articles, reports and original works are also available on the Internet.
- b. asking - which can take place through text messages via email or computer conference, through real time text chat systems, or through any of the audio systems.
- c. responding - which also is supported in delayed time through asynchronous systems, and much more immediately through synchronous systems.
- d. discussion - or collaborative work amongst small groups of students, which can take place over an extended time period through computer conferencing, or for much shorter periods via audiographics.

The use of ICT and teleconferencing [17] has made it possible to either deliver educational materials in asynchronous or synchronous mode. The review of the two approaches is as follows:

Asynchronous Delivery

The asynchronous media have four crucial advantages:

- a. Flexibility - access to the teaching material (e.g. on the Web, or computer conference discussions) can take place at any time (24 hours of the day, 7 days a week) and from many locations.
- b. Time to reflect - rather than having to react immediately, asynchronous systems allow the learner time to mull over ideas, check references, refer back to previous messages and take any amount of time to prepare a comment.
- c. Situated learning - because the technology allows access from home and work, the learner can easily integrate the ideas being discussed on the course with the working environment, or access resources on the Internet as required on the job.

- d. Cost-effective technology - text based asynchronous systems require little bandwidth and low end computers to operate, thus access, particularly global access is more equable.

Synchronous Delivery

There are four equally compelling advantages to synchronous systems:

- a. Motivation - synchronous systems focus the energy of the group, providing motivation to distance learners to keep up with their peers and continue with their studies.
- b. Tele-presence - real time interaction with its opportunity to convey tone helps to develop group cohesion and the sense of being part of a learning community.
- c. Good feedback - synchronous systems provide quick feedback on ideas and support consensus and decision making in group activities, both of which enliven distance education.
- d. Pacing - synchronous events encourage students to keep up-to-date with the course and provide a discipline to learning which helps people to prioritize their studies.

There are many distance teaching programs which are entirely asynchronous (for example, those using print plus computer conferencing, or those using the Web for both course delivery and interaction), and others which are (almost) entirely synchronous (for example, those using video conferencing for delivery and interaction). However, the trend is very much towards combining synchronous and asynchronous media in an attempt to capitalize on the evident benefits of both modes. One of the proposed approaches for implementation and solving the challenges of combining synchronous and asynchronous modes of e-learning delivery is documented in Obasa et al. [18].

DESIRABLE FEATURES OF A VIRTUAL CLASSROOM

A number of features considered as desirable in an integrated virtual classroom that are challenging in implementation have been identified. Notable amongst them are:

- a. Assignments: Assignments assist teachers to grade and give guidance on uploaded files and assignments created both on and off line. Issues like preventing late submission, allowing students to resubmit assignment for re-grading and receiving

email alerts when students add or update their submission can be addressed by the teacher.

- b. Chats: The Chat module is a useful way to get a different understanding of each other and the topic being discussed by allowing participants to have a real-time synchronous discussion via the web.
- c. Choices: Here a teacher asks a question and specifies a choice of multiple responses. This is useful as a quick poll for simulating thought about a topic being discussed; to allow the class to vote on a direction for the course; or to gather important research content.
- d. Forums: It is in forums that most discussion takes place. Forums can be structured in different ways, and can include peer rating of each posting. The postings can be viewed in a variety of formats, and can include attachments.
- e. Glossaries: A list of definitions similar to a dictionary can be created and maintained by participants. The entries in the glossary can be searched or browsed using different formats.
- f. Lessons: Lessons deliver contents in an interesting and flexible way consisting of a number of pages. The navigation through lessons can be straightforward or complex and each page normally ends with a multiple-choice question.
- g. Quizzes: Using this module teachers are able to design and set quiz tests, consisting of multiple choices, true, false and short answer questions and more. Each attempt is automatically scored, and the teacher can decide whether to give feedback or to show correct answers.
- h. Wiki: A wiki is a web page that anyone can add to or edit. This enables documents to be collectively authored and sustains collaborative learning. Old versions are not deleted and may be available for restoring if needed.
- i. Blog: A blog is an activity of peer assessment containing a huge array of options. This will allow participants to assess each other's projects including prototype projects, in a number of ways.
- j. White board: The Whiteboard is used to present slides. It is the main presentation window which and also can be used as a work area where one and other session attendees can display images, write or draw.
- k. Audio feature: The Audio feature allows one to participate in conversations during a classroom session via Voice over Internet Protocol (VoIP) using a microphone and speakers (or headset).

1. Video feature: Transmission and receipt of video broadcasts with others in a classroom session can be accomplished using the video feature.

CHALLENGES IN IMPLEMENTING VIRTUAL CLASSROOM

There are other challenges faced by the design, implementation and use of Virtual classroom not explicitly observed above. These includes amongst others:

1. Designing a virtual classroom is an enormous task that requires a lot of resources and time.
2. Recognition given to certificates acquired through distance learning is still very low.
3. Lack of adequate fund for researches on e-learning and virtual classroom based technologies
4. Huge spending on construction of classrooms that will never be adequate for the ever-increasing population.
5. In order for distance learning via Internet or Virtual Classrooms to be firmly established, the following infrastructures must be enhanced:
 - a. Electricity
 - b. Internet connectivity
 - c. Problem of bandwidth
 - d. Wireless networks

CONCLUSION

In this review, a number of issues relating to the design and implementation of Virtual Classroom has been examined. It is proposed that blending asynchronous platform with synchronous platform would give a real time virtual classroom that mimics the traditional face-to-face classroom.

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CONFLICT OF INTEREST

Nil

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