INTERACTIVE MULTIMEDIA TECHNOLOGY IN DISTANCE EDUCATION

SANJAY L. MAHAJAN and ASHWIN SONONE
Continuing Education, Yashwant Chavan Maharashtra Open University, Nashik, India

Abstract: *This paper discusses the nature and status of interactive multimedia technologies in Open Universities. In distance education, technologies are used primarily to improve the effectiveness of teaching and learning, to individually tailor instruction, and to provide specialized and variety of innovative programmes, which are generally either not taught or are difficult to be taught through the conventional system of teaching-learning. Increased interactivity of the programs permits greater communication, and may lead to increased motivation, creativity and independence among learners. Insufficient cooperation and coordination between technology experts and curriculum developers, educational policy makers, technical support staff, faculty and students can however hamper effectiveness of interactive instruction. Resistance to innovation can be a major barrier to implementation of interactive technologies. Planning and implementation of educational technologies should start from a clear educational need or goal; to improve the quality of on-campus instruction, to supplement a program, and to increase access. Different technologies suit different purposes. A combination of technologies is usually most appropriate. The choice of technology should be based on factors such as educational form, education field, characteristics of learning audience, and local conditions. As large computer systems become available more widely and international communications costs decrease, open electronic universities will offer a variety of distance programs via global communication networks. The current exponential expansion of international networks for scientific, technological and educational communication in India shows that such advances may be available sooner than expected.*

Technology and Distance Education

Education and training determine a country's prospect for economic competitiveness. Many developing countries have already taken the initiative to push educational programmes, often in accordance with the recommendations of the Jomtien Conference on Education for All, and to seek integration of modern communication technologies. Education via radio, TV, telephone or Internet has become a viable complement to conventional education and training at all levels by reaching out to isolated groups in developing countries and regions. Moreover, as the world moves towards information-based society, the importance of distance education will become more visible.

The digital revolution is driving major changes in the way education is being delivered. Sharp and continuous fall in the cost of storing, retrieving and transmitting

Indian Journal of Open Learning, 2002, 11(3), 347-355
ISSN 0971-2690, Printed in India, © Indira Gandhi National Open University

information offer possibilities of developing a sustainable system to meet increasing demand for life-long learning. So people will be able to study what they want, when they want, where they want, and in the language they prefer, and that too electronically. The leading financial agencies and institutions like IMF, WB, ADB, UNESCO, Com. Sec. can play a significant role in promoting, financing, and even creating electronic services, helping make the vision of quality education for all a reality.

Dynamic and constant changes in technology and information have forced a paradigm shift in education from being *terminal* to a *life-long* and on-going learning activity. Accelerating technological change requires continuing education for a worker to remain competitive in the labour market. Without continuous learning, workers will find their human capital rapidly depreciated, with a corresponding fall in the wages. This realisation has sunk deep and education is becoming an essential service to be available on demand, just like any other utility. While the relative price of conventional education is rising, the digital revolution has helped reduce the cost of transmitting information by 50 percent every 18 months progressively. This wave is now driving major changes in the way education is delivered. At the heart of this change is the convergence of image, sound, books, and computer networks into digital multimedia. This is making the world's knowledge base accessible anywhere on the planet through satellites, coaxial cable or fibre optic cable through newer techniques to pump large amounts of information down the 'last mile'. Even the book 'is being rapidly transformed into an electronic learning tool that utilizes sound, images, and motion in addition to a printed text'. Online educational 'communities' now provide on demand and customized education to subscribers. Electronic distance education (EDE) coupled with the multimedia technologies is no longer science fiction. The marketplace for many educational services will be global with better quality at lower costs than conventional education today. 'Computer, television, cable, satellite, laser, fiber-optic, and microchip technologies (will) combine to create a vast interactive communications and information network that can potentially give every person on earth access to every other person' (Barber 1992).

Current distance education literature supports the thesis that modern digital and telecommunication technologies can deliver information and impart knowledge equal to and, if used efficiently, even better than traditional means. The new electronic technologies such as CD-ROM interactive disks, computer bulletin boards, and multimedia hyper-text available over the Internet using the Mosaic interface and the World Wide Web can provide students with far greater involvement in the process of learning and allow them to exercise far greater control over their learning than is possible in many traditional learning environments. Integration of multiple-media creates a new rich learning environment awash with a possibility of and clear potential to increase student involvement in the learning process.

Expansion through conventional means is slow and unable to meet contemporary educational needs and demands. Conventional methods are not cost-effective for specialized courses but technology offers a potential solution. Students using computer-based educational technologies and communication systems during their

studies are better prepared for future jobs in competitive information-based industrial environments. Interactive educational technologies improve the effectiveness of DE in two ways:

1. They directly improve the quality of teaching and learning by integrating several educational media, improving structure and organization of materials by increasing interactivity and a higher degree of communication between students and teachers.

2. They help to overcome the cost and/or distance barriers and therefore add a variety of new possibilities to conventional educational methods: they furnish access to remote databases, update the knowledge pool, supplement laboratory work by modeling, simulations and expert systems, provide rapid feedback, and enhance counseling and evaluation.

Multimedia and telecommunication-based interactive technologies are used to increase the effectiveness of education especially when a very high level of expertise is required. The most rapidly developing application fields include medical education, specialized vocational & technical training, and individually-tailored business courses. Telecommunication-based interactive technologies can use and redesign, high quality and effective educational materials. They help save instructor's as well as student's travel time and transaction costs while expanding access to new students. In on-campus courses, interactive technologies can be used as efficient individualized learning tools in large classes. Typical examples of such use are found in business, management, vocational courses and social sciences courses.

Convergence between multimedia and communication technologies has resulted in considerably enhanced capacity to transfer data, voice, and vision at an enormous speed. It has outlined the following developments in multimedia technology (Bates, 1995):

- Integration of television, telecommunication and computers through digitization and compression techniques.
- Reduced costs and more flexible user applications of telecommunication, through developments such as ISDN/fiber optics/internet/satellite technology.
- Increased portability through use of radio communication and miniaturization.
- Increased processing power, through new microchip development and advanced software.

Educational Technologies in Distance Education

Typical educational technologies and distance education include computer-conferencing, audio-conferencing, audio graphics, and video-conferencing (one-way television with audio return, two-way television). Romiszowski (1998) opined the fourth generation of distance education combines synchronous use of two-way student-teacher and student-student communication. The main users of the third generation and the leading developers of the fourth generation DE technologies are

industrialized countries with strong technological and telecommunication backgrounds, especially the USA, Canada, Western Europe and Japan. Educational institutions in a number of developing countries still fall in the first or second generation of distance teaching based primarily on printed materials, radio and/or television lectures, and occasionally electronically stored media – audio, video and computer programs. Youth in industrial countries are used to a variety of entertainment technologies (video and computer games, karaoke, comedy TV channels, etc.). Students and professors involved in interacti· e on-campus or DE classes feel positive about their teaching-learning experiences.

Distance education technologies and media, applied in the industrial model of distance learning, have several advantages:

- they use pre-designed, accurate and effective learning materials, especially designed for independent study;
- they do not depend on an individual teacher and can therefore be applied in colleges, which lack qualified teachers;
- they are cost-effective with large student population;
- the distance education material can be shared between countries speaking the same language.
- the audio graphics are valuable for-small groups of students (e.g. elective subjects, specialized graduate studies, geographical remoteness, small island countries), individually tailored instruction (academically very capable students, physically handicapped students, home-bound or migrant students), in-service education (teacher training, on-the job industrial education, continuous education in computers and hi-tech equipment).

Using telecommunications in education is often perceived as being expensive when compared to either face-to-face education or print based correspondence education.

Choice of Media Technologies

Multimedia Technologies are constantly changing and we need keep track of the advent of new digital and cyberspace technologies like Telecommunications Networks, Media Business Incubators ,Computer-based and Assisted Instruction Video cassettes, CD and CD-Rom Technologies, Email and Facsimile Technology, Internet and Web-based Communication, Electronic Commerce and Funds Transfer, Cable and Web Box TV, Interactive TV, Internet and TV Combinations.

Gayekwad (1992) defined multimedia as a class of computer-driven interactive communication system which create, store, transmit, and retrieve textual, graphic, and auditory networks of information. Today, multimedia usually means computer-supported integration and manipulation of at least three of the following media: text (ordinary text, tables, dictionaries, indexes, help facilities), data (statistics, tables, charts, graphs, spreadsheets), audio (human voice, sound effects, music), graphics (drawings, prints, maps, computer generated images, artwork, architectural drawings), still pictures (photographic images, transparencies, negatives, video still images), animation (film or computer generated figures), and moving pictures (moving video). DVI (Digital Video Interactive) programs are generally used in DE for technical training and obtaining information. For example, in Saudi Arabia and

Egypt DVI kiosks are placed in school lobbies to provide information on health practices, such as AIDS-related behavior and illegal drugs.

Impact of Multimedia Technology

It is a common misconception that face-to-face classroom instruction can be videotaped and distributed to produce multimedia-based Electronic Distance Education (EDE) courses. The fact is that it takes considerable time and effort as well as expertise to design and develop quality multimedia EDE. Once developed, however, the course materials may be used again and again. Thus, in the long run, despite the initial investment in time and money, EDE is very cost-effective. In order to make them more effective, EDE courses should be designed in such a way that they provide greater teacher-student and student-student interaction. To be more attractive to the adult population, course content should be relevant and challenging and transmitted visuals should be of high quality. Certain concepts from traditional classroom learning that are absent in conventional distance learning mode can be accommodated with computer communications. It is felt that distance education must adapt new technology tailored to individual learner within the Indian environment. However, the technology should be cost-effective, interactive and innovative.

During the last 20 years, the Open University system in India has shown substantial growth, both quantitative and qualitative. At present there are eleven open universities in the country, including the Indira Gandhi National Open University (IGNOU). IGNOU is the fastest growing education system in the world, with over one million students, 78 programmes comprising over 854 courses (2003). It is the largest single university in the world.

Various packages such as 'INFORLINE' for general information, 'ADVICELINE' for advice to students, 'CHOICELINE' for choice of subjects, 'LIBLINE' for library holdings and 'EXAMLINE' for date-sheet of term-end examinations and related information, if developed, shall help march towards excellence in learner support. These packages can be made available to the distance learner at university home pages on the web site initially for the assignments and later for the term end examinations. Traditional examination system may be replaced through online computer assessment system.

A success story of satellite use in HE is the National Technological University (NTU), a consortium of about 30 American engineering institutions, and a blend of distance education, corporate education, and continuing education. NTU offers graduate courses leading to the M.Sc. degree in various branches of technology and applied science (Computer engineering, Computer science, Electrical engineering, Engineering management, Manufacturing systems engineering, Materials science, Management of technology, and Aerospace). Students can also take non-credit short courses to update their professional knowledge or to become familiar with related disciplines. In addition to instructional interactive television, the satellite network provides for instantaneous communication between professors and students, exchange of data, homework assignments and other instructional materials. Exchange of documents is possible by two systems: by Space Text (a video tape

controller board converts data into TV signals, which are transmitted by a satellite, converted back to data at a receiving site, and stored on the computer or video tape), or by facsimile technology.

Wells (1992) collected data on 216 educational networks based on computer-mediated technologies from all over the world. Among them, more than 90 operate in the USA, about 30 in Canada, 45 in Europe and 7 in Australia. Some education computer networks exist in Asia, and a few in Africa and Latin America. In Europe, the Open University (UK) pioneered the use of computer conferencing in mass distance education. The use of computer conferencing system CoSy on the course DT2000, an introduction to information technology, was started in 1988 with about 1500 students and 65 tutors The course combined different software packages for word processing, database management, spreadsheet analysis and communications.

The world's first electronic, peer-reviewed science journal, with completely searchable full-text and graphics, *The Online Journal of Current Clinical Trials*, was launched on July 1, 1992, as a joint venture of AAAS (American Association for the Advancement of Science), which developed the editorial content, and OCLC (Online Computer Library Center), provided interface and distribution on its international telecommunications network. Subscribers could access the journal via direct dial to OCLC or CompuServe host, via OCLC's network, and through the Internet.

Effectiveness of Interactive Technologies

Student's achievements in on-campus courses using computers and interactive technologies are better than those learning by traditional teaching methods. The main reasons for improved effectiveness are:

- the high quality and increased interactivity of the programs;
- better structure and compactness of teaching units or lectures;
- information is offered through integrated media and therefore is more easily comprehended by the multisensory human mind;
- learning process supports self-paced studies and research, a higher degree of communication between students and teachers, rapid feedback, and increased student independence.

Courses, which use interactive technologies, are often of higher quality than traditional instruction, especially because:

- the instructors prepare themselves better;
- classes can be taught (or the units are prepared) by different experts in specific fields;
- the knowledge pool can be updated regularly and students can access several sources and databases, and;
- it is possible to provide feedback.

Interactive technologies in on-campus or distance teaching help individualize instruction and tailor it to the needs of individual students (each student can choose the level of pace, sequence of topics, detail, and depth of knowledge he/she wants). In addition, technologies used in distance education allow instruction to take place at

a time and place convenient to the learner. This is especially important for employed, part-time and homebound students. The cost-effectiveness depends on the type of technology and on characteristics of the teaching-learning environment.

Electronic Classrooms in Open Universities

Currently, a variety of media are used in EDE. These include instructional television, audiographics, compressed video, computer conferencing, and audio/video conferencing. The new technologies entering EDE arena are all digital in nature (e.g. hypermedia, computer networks, integrated data systems, digital television).In future "virtual" classrooms and worldwide lecture halls will be the norm A virtual school will not exist as a physical entity with all the accompanying paraphernalia but it can perform all the functions and assume the responsibilities of a regular school.

An electronic classroom is an integrated multimedia interactive instructional delivery system, comprised of a large high-resolution video screen, a special user designed electronic platform with a central microcomputer for multimedia presentation, and a spectrum of different media equipment. The computers are networked with a classroom and connected to the university mainframe. In January 1993, the Western Illinois University opened a special classroom for visual presentations and electronic interactions in the College of Education, with advanced technologies for large-image video projections and interactive discussions (Barker and Harris, 1993).

Today, institutions structured only for traditional classroom instruction cannot hope to meet the new demands for education and training. To meet the special needs of lifelong learning in the information age, the focus of the National University Telecommunications Network (NUTN) has to be on new and emerging technologies in videoconferencing and distance education. NUTN offers assistance to educational institutions making the adaptations necessary to survive the information age.

Multimedia and ICT at a glance in India

ICT infrastructure & access	Year	
	1995	2000
Telephone mainlines Per 1,000 people	13	32
In largest city (per 1,000 people)	95	131
Waiting list (thousand)	2,277	3,681
Mobile phone (per 1,000 people)	0	4
Radio (per 1,000 people)	119	121
Television set (per 1,000 people)	61	78
Computers & the Internet		
Personal Computers Per 1,000 people	1.3	4.5
Installed in education (thousand)	23.6	238.7
Networked PCs (%)	37.3	45.1
Internet		
Users (thousand)	250	5,000
ICT expenditures		
Total ICT ($, millions)	7,250	19,662

Limitations of Interactive Multimedia Technologies

Interactive educational technologies need a high degree of technical expertise to work successfully. It is necessary to coordinate networking, maintenance, adaptations, hardware and software upgrading, and compatibility. If the technical expertise is not adequate, the system may fail. Even if the system is put in place successfully, lack of spare parts and accessories like toners, paper, floppy disks, components for hardware and software upgrading, and insufficient/improper maintenance, may cause long functional interruptions, diminishing effectiveness. Geographical remoteness can add to maintenance problems in developing countries. Hardware and software suppliers tend to avoid providing regular repair and upgrading of services in such locations. Where such services are available, it may be at prohibitively high prices. Computer hardware and software become obsolete in a few years and therefore need constant upgrading. However, upgrading of only one system component may result in compatibility problems, and frustration driven from non-transferability of data files between the new and old versions.

In an inadequate technological environment, implementation of interactive educational technologies are not feasible. Harsh climatic conditions (humidity, high temperatures, dust, hurricanes) may cause frequent telecommunication breakdowns and equipment damages.

An innovative application, such as interactive educational technology, requires a great degree of specialized expertise. If faculty is not qualified to use new educational tools, hardware sits idle. Several experts are of the opinion that nothing has crippled technology-based innovations in education so much as inadequate training of instructors. There has been some fear that technologies will replace teachers and automatically educate large number of students at low costs. Experience with interactive technologies shows that while they can substantially improve the effectiveness of teaching and learning, and even multiply the teaching effects, they cannot replace instructors. On the contrary, the effective use of interactive technologies requires more training, preparation and initial work for the faculty, along with increased commitment, flexibility, cooperativeness and readiness to deal with occasional technical problems.

Administrative structure may be a major obstacle to the adoption of interactive technology. Educational innovations, which use complex interactive technologies, may run into competition with existing practices and policies. Faculty may be reluctant to use interactive technologies for many reasons: ignorance about how interactive technologies can enhance teaching and learning; insufficient skills to use the hardware and software; inability to tailor a technology to the specific discipline and integrate it into course curriculum; lack of time for creation of new interactive technology-based teaching courses, or unwillingness to change the established traditional teaching style. Sometimes rigid bureaucratic procedures and lack of flexibility may make implementation of technological innovations difficult. The introduction of sophisticated educational technologies may arouse opposition from political, philosophical and religious leaders, or individual instructors, students and parents. Some people view computer-related technologies as having dehumanizing

effects, as repressing intellectual development of students, as a tool of introducing unwanted materialistic/technocratic thinking, as a way leading to unwanted dependencies on foreign resources, or as a opportunity for mental colonialism. Hardware and software characteristics, regardless the type of educational environment, equipment and software should be reliable, easy to operate (user-friendly), simple to learn, expandable, standardized, compatible for the success of such innovations.

Conclusion

The multimedia revolution has produced radical changes in delivery of distance education. Interactive networking is highly useful for optimization of resources but very difficult to operate in Indian context. This Networking should be extended initially to two-three open universities and DE institutes, which are located geographically nearby. Networking needs well thought out planning collaboration and sharing of resources and facilities.

References

Barker, PG and Giller, S (1992) Electronic Books, In Saunders, D and Race, P(eds) Developing and Measuring Competence Kogan Page, London.

Barker, B and Goodwin, R. (1992) Audiographics: Linking remote classrooms, The Computing Teacher, April.

Bates, A.W., (1995) Technology, Open Learning and Distance Education, London, Routledge

BMI-TechKnowledge Group (1999) Communication Technologies Handbook 1999, Johannesburg, South Africa.

Gayeski, D.M., (1992) Making Sense of Multimedia: Introduction to Special Educational technology, 9-13

Romizowski, A J (1988) The Selection and Use of Instructional Media Kogan Page, London.

Romizowski, A J (1988) Designing Instructional Systems Kogan Page, London.

Wells, R., (1992) The Use of Computer-mediated Communication for Distance Education: An International Review of Design, Teaching, and Institutional Issues, ACSDE Research Monograph Nr. 6, ED351 997, 80p.

Wells, R (1993) The Use of Computer-mediated Communication in Distance Education: Progress, Problems and Trends, in Davies, G and Samways, B (eds), Teleteaching, Amsterdam: North-Holland.

Website at: www.globalknowledge.org

Website at: http://gkaims.globalknowledge.org/

Website at: http://www.worldbank.com

Sanjay L. Mahajan is a Reader in Continuing Education, Yashwant Chavan Maharashtra Open University, Nashik, India.

Ashwin Sonone is a Lecturer in Continuing Education, Yashwant Chavan Maharashtra Open University, Nashik, India.