

Application of Interactive Technologies in Open and Distance Learning : An Overview

ABDUL W. KHAN and PATRICIA MCWILLIAMS

The Commonwealth of Learning, Canada

Introduction

Educational technologies and communication media are the key to the world of open and distance learning. Their effective application is dependent upon appropriate decisions and attention to a wide range of issues. One of the most important aspects is the integration of technology and media into the overall educational or learning process, a process which requires a shift in the way we view education and the roles of educators and media personnel. The use of technology and media in the learning environment must be planned and designed in such a way that it is transparent and unobtrusive to the learner. First and foremost, the media should be seen as the channel of communication or the medium of transmission. The message or the content of the communication or transmission remain the most critical component. The overall delivery system, one element of which may be the hardware, must be considered in the early stages of course design and development, as it will have an impact on other systems and the ultimate quality of the learning experience.

Modern technology has opened up new possibilities for educators. Most of us still feel dazzled and bewildered by the sheer volume of options and possibilities afforded by the emerging technologies. Terms like the 'information highway', virtual reality, and hypermedia, intrigue us and intimidate us and as educators we must rely on professionals in the field of technology to lead us through the maze of possibilities. Despite the wonders of technology and their use in education being expounded at length by the industry there is little research or evidence to suggest that these technologies have been embraced by the education community to the extent originally anticipated. Certainly in North America, there has been an explosion in the numbers of computers in schools in the past decade and literature reports some creative instructional uses being made of computers especially with the advent of the Internet system. However, when we examine other forms of educational technology and communication media, many of the reports would indicate that they are still principally used for administrative purposes rather than in support of the instructional process. For example, audio-conferencing systems linking education institutions with learning centres are often utilised more for communication between 'head-office' and local managers than connecting students with instructors. In Canada, there is a growing realisation that the promises of new technologies have not been realised by the distance education community nor have distance education practitioners provided leadership in innovative applications (Paul in Keough & Roberts, 1995). A World Bank published report says that despite the potential

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of educational technologies and the evidence of effectiveness and the existence of successful, sustained applications in many developing countries, educational technologies have not been as widely adopted as earlier anticipated (Lockheed, Middleton, Nettleton, 1991). They go on to suggest that there are several reasons to now reassess the use of educational technologies. These are:

- the quality of education in many countries is still dismal and access remains a significant issue;
- managerial capacity and technical infrastructure capacity has increased dramatically in many developing countries;
- much has been learned from pilot projects and research in the field; and
- there is greater acceptance by decision-makers of educational technology as a functional policy alternative. (Lockheed, Middleton & Nettleton, 1991).

What we need to examine is why technology and media are critical to distance education, what attributes may contribute to distance education, and some of the factors that must be taken into account when adopting and integrating media into distance education including the changing roles and responsibilities. Finally, we will look at existing barriers to expanded use of media in distance education and what the consequences of not eliminating these impediments are for the educational community and the learners.

New Paradigms in Learning

As we approach the 21st century, it is becoming increasingly clear that the ability to cope with rapid changes will become the primary measure of success, at both micro and macro levels. Change is occurring faster every day. Many societies have shifted from 'industrial' era to 'information' era, and others are fast moving in that direction.

Knowledge has doubled in the past seven years. The world has become a 'global village' and 'globalization' of economy and culture is now a living reality.

These changes have a major impact on education and training. Education and training are also undergoing a major change: the focus has shifted to learning rather than teaching. Some of the major changes are:

- from institutional based learning to far learning organisations with just in-time knowledge provisions;
- from fixed curricula to personalised curricula;
- from front ended education to life-like education; and
- from teaching to learning.

These changes are best summarised by Andy Reinhardt:

<i>Old Model</i>	<i>New Model</i>
Classroom Lecture	Individual Exploration
Passive Absorption	Apprenticeship
Individual Work	Team Learning
Omniscient Teacher	Teacher as Guide
Stable Content	Fast-changing Content
Homogeneity	Diversity

According to the new theory in education, teaching and learning is an interactive process which involves collaborative learning as well.

Advances in communication and information technologies are at the heart of these changes. Speaking on education of the future, Buckminster Fuller said that “Education is going to be number one amongst the great world industries, within which will flourish an educational machine technology that will provide tools such as the individually selected and articulated two-way TV and an inter-continently networked documentaries call up system operative on any home two-way TV set.” (cited in Thorvaldson, 1980)

Philosophers and visionaries, like McLuhan and Leonard (cited in Thorvaldson, 1980), foresaw that “the student of the future will truly be an explorer, a researcher, a huntsman who ranges through the new educational world of electrical circuitry and heightened human interaction just as the tribal huntsman ranged the wilds.” They pointed out that the main “works” of the future is education, and that people will not so much “earn a living as learn a living”. A final comment portrays a future that has been more than realised during the 25 years since it was penned:

“The world communication net, the all-involved linkage of electrical circuitry, will grow and become more sensitive. It will also develop new modes of feedback so that communication can become dialogue rather than monologue. It will breach the wall between “in” and “out” of school. It will join all people everywhere. When this has happened, we may realise that our place of learning is the world itself, the entire planet we live on. The little red schoolhouse is already well on its way towards becoming the little round schoolhouse. Some day, all of us will spend our lives in our school, the world.”

Convergence between information and communication technologies has resulted in considerably enhanced capacity to transfer data, voice and vision, at an enormous speed. Bates (1995) has outlined the following developments in communication and information technologies with implications for learning:

- integration of television, telecommunication and computers, through digitisation and compression techniques;
- reduced costs, and more flexible uses/applications of telecommunications, through developments such as ISDN/fibre optics/cellular radios;
- miniaturisation (tiny cameras, microphones, small high resolution display screens);

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- increased portability, through use of radio communication and miniaturisation;
- increased processing power, through new micro-chip development and advanced software techniques; and
- more powerful and user-friendly commands and software tools, making it much easier for users to create and communicate their own materials.

These developments will have far-reaching impacts on the way people learn. The learner will increasingly be free to choose what, where and when he/she learns and from what source. One of the most important features of the emerging technologies is their improved capacity to facilitate learning.

Technologies for Interaction

The plethora of technology and media must be examined in more detail. There is no taxonomy or easy way of categorising and thereby describing technology and media. For our purposes, we have chosen to restrict our discussion to those media which provide for some form of two-way interaction and communication between the instructional base and the learner. Other media, although often used in education, is of less direct relevance to our discussion of open and distance learning whose main concern must be mediating the distance which separates the learner and the instructor. Thus we are most concerned with those technologies which facilitate two-way person-to-person dialogue as opposed to the learner interacting with textual materials i.e. print, hypermedia CD-ROM, videocassettes. (even although these latter are often termed interactive technologies, Schwier & Misanchuk, 1993). We have arbitrarily decided to speak of three types of delivery or carrier systems:

- broadcasting
- telecommunications, and
- computer-based.

Often we see these forms combined in what is often referred to as mixed-media or multi-media. In the first category of broadcasting the most common forms are radio and television, although television for instruction is also used in a narrow-cast system via satellite. Telecommunication systems most commonly support teleconferencing using voice, image and data (audio, video and computer) components singly or in combination. Computers which are networked or connected together provide a platform to support communication as evidenced in computer mediated communication in effect computer conferencing.

So why are we as distance educators so preoccupied with these technologies? As educators we are often the sole advocate for the learner in the negotiation with the decision-makers of our own institutions and provide the interface with the technology industry; an industry that often has quite a different motivation from that of us as educators. As such it is incumbent upon us to examine technologies from the perspective of their additive values to the overall learning environment. Distance education and its associated technologies allow us to increase access to education, 'democratise' education,

control the cost of education and provide a quality of education that is otherwise often not possible through traditional means. The technologies should be viewed as the 'tools of the trade' rather than the driving force behind education. Unfortunately, it is often the case that decisions concerning adaptation of technology are made without adequate consideration of the educational ramifications or sufficient research. New technologies often appeal to decision makers as status symbols, they are seen to be 'sexy' and glitzy, and are purported to be the tangible evidence of progress and development. Analysing and choosing media has been the subject of many books and articles (see Bates, Laurillard) which outline the strengths and weaknesses of the various alternatives. Rarely do we as educators have the opportunity to make decisions purely on that basis. Factors such as cost, availability, local applicability etc. often become overriding concerns. It has been reiterated by a number of authors based on several research studies however, that no one media is superior and further that often a combination of media can be more effective. The latter is founded on the premise that due to the variety of preferred learning styles, learners can actually select that media which is most appropriate for their own style and circumstance. (Mason, 1994)

Learning is basically a process of communication between the learner and his universe. By definition, all communication is interactive (sent and received), or else it would not be communication. But the degree of interactivity varies considerably between different forms of communication.

Interactivity has always been regarded as an important element in learning. The Greeks considered learning to be an interactive and individualized process, making use of the Socratic method of defined objectives and structured questions and answers to achieve effective one-to-one learning. Most theories of learning suggest that for learning to be effective, it needs to be active. Interactive learning involves learner response to the learning material and feedback, which provides the learner with a knowledge of results.

Interactivity is regarded as being even more important in distance learning, in which the teacher and students are separated by distances large enough to require some form of mediating technologies – printed material, audio and video cassettes, radio, television, telephone, computer and teleconferencing. Distance learning technologies differ in the ways in which they simulate true interaction. The degree of sophistication with which technology does this depends on:

- how well it simulates the nature of the task to be learned;
- how thoroughly and accurately it structures and sequences the tasks entailed in acquiring the knowledge it is representing; and
- how readily it adapts to the student's approach to and progress in learning (corrects errors, selects a paper based on how much the student learns and the procedure the student uses in acquiring skills and knowledge).

While the above factors are important in determining the degree of interactivity with the learning material, there is yet another dimension of interactivity – social interactivity. The interaction between two or more people about the learning material is also an important aspect of interactivity.

Interactivity is often equated with “human touch” . Kevin Smith believes that because of greater human touch interactive technologies help massage the message. In a two by two matrix based in degree of interactivity and level of sophistication of technology, he places the technologies in different categories. This matrix is given below:

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While the above matrix is helpful in looking at different technologies from the point of view of interactivity and degree of sophistication, it is not meant to provide any suitable classification of technologies. The application of technologies is linked with the educational context in which it is being used and the manner in which it is being used.

Implications for Learning – Some Examples

The role of media in distance education is of fundamental importance as we attempt to find ways and means to bring together the learner and the teacher across time and distance and to facilitate the communication process. Media which are able to support and enhance the person-to-person communication both in real-time (synchronous) i.e. telephone conversions and delayed time (asynchronous) i.e. computer mediated communication are both useful tools for the distance educator. However, the intervention of media in the learning process has some inherent consequences for the learner, the instructor and the educational institution resulting in changing roles and responsibilities for all concerned. The form and type of communication must be planned and managed and viewed in the context of theories of learning and communication. Inserting technology or media into an existing learning process will not automatically improve the quality of instruction or of learning outcomes. Designing the overall learning environment to take account of the technology must be carefully considered and has a number of dimensions.

In designing for real-time communication and interaction there are several possibilities each of which has its proponents and detractors. Often the learning environment is an ‘extended classroom’ model whereby the technology is used to transmit what is simultaneously occurring in a traditional classroom to a remote site or sites. This is also referred to as ‘mediated classroom’ (Oliver in Willis) or the distributed classroom

(Garrison & Shale). Television is often the medium used in this transmission with an audio link between the remote and originating classroom to allow for communication between sites. Interactive televised instruction (ITI) using a closed or narrowcast network is a model widely adopted in North America and Australia e.g. HIT (Hawaiian Interactive Television) system. The TAFE (Tertiary and Further Education) system in South Australia uses a multi-point videoconferencing system to distribute the classroom, usually located on campus in Adelaide, to various receiving sites throughout the state. In this case a number of students are gathered in the receiving site and participate in the class. The two-way video transmission allows the instructor to view the remote students and provide comment and feedback. This has proved particularly effective for skill-based instruction and validation of performance levels. Site-to-site videoconferencing has also been used effectively in an extended classroom model allowing the remote classroom site and the instructor based classroom to maintain two-way visual and voice communication. So both the broadcasting and the telecommunication networks (audio and videoconferencing) contribute towards the use of televised instruction and can effectively be used in combination.

Broadcast telecourses have also found favour in various developed countries and have been transmitted via educational channels on the cable networks as we see with such agencies as the Open Learning Agency (BC) and TV Ontario in Canada. The weakness of this model has been in the lack of real-time interaction between the instructor and the student requiring other forms of student support systems to be put into place.

A further possibility is to create a new environment which makes the best use of a variety of instructional strategies designed in such a way so as to consider the attributes of all of the components including the media. An experiment in the far north of Canada combined interactive televised instruction and broadcast. Using the Television Northern Canada broadcast channel, twenty-five hours of instruction over a ten-day period were delivered live to the viewing audience. In addition, special receiving sites were established in seven remote communities where groups of students gathered, with a trained facilitator, to participate in the management training course. These students were engaged in group activities at each site, viewed the on-air portion and interacted with the instructor in the studio through the fax machine or the telephone. Thus learners had the ability to ask questions, seek clarifications, respond to directed verbal and written questions and assignments.

Successful use of audioconferencing for instructional purposes often relies on the pre-produced courseware materials to transmit the content or body of knowledge and uses the conferencing portion for interaction, elaboration, and feedback (Burge & Roberts).

Both of these possibilities are based on the notion of real-time interaction and therefore restrict the learner in terms of time and location of learning. Asynchronous communication on the other hand provides more flexibility for the learner allowing them to plan both the content and timing of their intervention as we see through computer-conferencing models.

Interactive Technology for Distance Learning

Over a period of 6,000 years the written word replaced the spoken word as the primary source of knowledge for human beings. Eventually the technology of the printing press gave the masses access to knowledge previously available only to a scholarly few. So, from the first new age of education, general literacy came not from writing itself but from the technology that made information accessible. Books made possible both quantitative and qualitative advancements in learning and formal education. In the past 100 years, we find the invention of telephone, radio, television and computer, each making new stages in the evolution of information and communication technologies. These recent developments collectively and cumulatively define the latest of the information revolution.

Modern information and communication technologies, especially with the merging of the telecommunications and computers, are revolutionising the quantity, complexity and speed of information being produced, stored, processed and transmitted. This development has created enormous potential for the use of interactive technologies in open and distance learning.

In theory, any act of communication involves a certain degree of interactivity but the degree of interactivity varies considerably from one medium to another. A wide variety of descriptions are used to characterise educational media. For the purpose of this paper we have selected the following media for further discussion:

Interactivity in real time:

- Two-way video and audio (video conferencing)
- One-way video, two-way audio (interactive televised instruction)
- Two-way audio and graphics (audio graphic teleconferencing)
- Two-way audio (telephone and radio talkback)
- One-way audio (radio broadcasting)
- One-way video (television)

Interactivity with recorded message not in real time:

- Computer conferencing
- Voice mail
- Facsimile

Video Conferencing

Advances in digital and compression technology have made videoconferencing an alternative tool for education, training and business.

Videoconferencing involves two-way transmission of voice and moving image between two or more sites. Each site is equipped for both receiving and transmitting of video

and associated audio, to enable the instructor or presenter to see and hear the participants at the remote site or sites. Several modes of transmission are employed in videoconferencing but the two most common modes are "full motion" video or "broadband" video, and "compressed" video. Full motion video conferencing requires a full television channel (the equivalent of about 12000 telephone lines) for each site that transmits a video signal. Compressed video enables interactive conferencing with as few as two or as many as 24 digital telephone lines.

In recent years, compressed video conferencing has become one of the attractive tools for distance education and training in the developed countries. Several factors have contributed to the growing use of video conferencing in distance education. These are: standardisation of compressed imaging algorithms, lower equipment costs, and economic telecommunications tariffs.

Advances in technology allows several configurations of compressed video conferencing – from permanent installations to roll about systems to desktop video conferencing systems. Although, there is loss of quality owing to high compression, compressed video conferencing can be used effectively for high interactivity in tutorials, seminars, and committee meetings. It is appropriate for widely dispersed study centres.

Compressed video conferencing is useful when limited motion is needed for applications such as: to show case study material; to conduct role plays; to demonstrate interview techniques; and to present information requiring high quality graphics or limited movement.

Effective use of video conferencing requires training in not only the use of technology but also in the instructional techniques appropriate for video conferencing. Advance preparation is required to develop the material to be presented. Instructors will need to develop facilitation skills to moderate the discussion and encourage maximum instruction. A number of organisations in Australia and Canada are now using video conferencing in distance education.

Television Talkback

This system employs one-way video with two-way audio and is associated generally with narrowcast and broadcast communication; there is simultaneous participation by a large number of sites. Participation or interactivity is, of course, at a lower level, being confined to audio only inputs from the receiver sites. Such input may be through audio conferencing telephone connections by means of a privately owned bridge or telephone connections made as required on a site by site basis.

An instructor using a television talkback system needs to acquire a few additional skills. These include skills in encouraging greater interactivity; skills in preparation of materials for presentation and knowledge of a television studio, its equipment and the technical staff.

Audio Teleconferencing

Audio teleconferencing is an interactive communication device which links individuals or groups located at different sites. It consists of these technical components: telephone

set or group audio conference terminals, telephone network and bridging device through which the telephones are linked.

Since audio teleconferencing is based entirely on two-way voice communication, lesson planning becomes one of the most important skills in the effective use of this technology. The effectiveness of audio teleconferencing depends on the careful planning of activities before, during and after the conference session. This helps students participate in the conference more actively and ensures a certain degree of sound interaction and group activities which is particularly important in distance learning environments.

Research studies have shown that audio conferencing is an effective, efficient and acceptable learning tool for a wide variety of cognitive skills. The fact that audio teleconferencing uses low cost and user friendly equipment, it is particularly attractive for distance education programmes in developing countries. In recent years, a number of countries (India, Malaysia, Kenya, Guyana, St. Lucia, Solomon Island) have acquired audio teleconferencing systems for distance education.

Audiographic Conferencing

An audiographic conferencing consists of the same components as an audio teleconference: a telephone or group conference unit, standard dial-up telephone lines and a bridging device. In addition, each site has a standard computer and modem. The main feature of audiographic teleconferencing is the shared screen which allows the students to interact with the instructor not only through voice communication but also through on-line graphics in real time. Because of the added component of graphics, it helps enhance learner interaction and thus makes the process of learning more effective.

To use audiographic conferencing effectively the instructor has to plan his lessons well in advance. The system allows the instructor to prepare the learning material in advance which can be saved on computer disc and copied to sites. Using the on-line commands the instructor can bring the required material onto all the screens. The learners can alter the graphic at their end and interact through voice and graphics. The system allows other peripherals such as document scanner, camera, VCR or camcorder to be added depending upon the complexity of the software.

Telephone and Radio Talkback

Telephone has been used for tutorials and other student support activities by many open and distance learning systems. It requires nothing more than a standard telephone for both the student and tutor and a telephone network. It is flexible and more personalised than other group-based interactive technologies. With the decreasing telecommunication costs it is also an economical tool for students.

Radio talkback has been used quite effectively, in Australia and Alaska, as an interactive tool for distance learning.

Designing for Interaction

Interaction is the key to successful distance education. Broadly speaking interaction is

possible to design into all aspects of distance education including print materials as considered in Holmberg's guided didactic conversation and the notion of simulated communication with the pre-produced course materials (Holmberg in bates, 1990). But what are the considerations for interaction when we look to the media supporting two-way persons-to-person communication? Indeed, why interaction at all?

Essentially, education of all forms, is dependent upon the communication process and interaction between the teacher and the learner. In the most traditional format it is the face-to-face transmission of knowledge from the teacher to the student often in a lecture mode, the discourse following and the feedback process through questioning strategies and other means that provides this type of interaction. The importance of technology to distance education is to facilitate this same type of discourse and feedback in spite of the barriers of distance. The question becomes one of deciding between the replication of the traditional educational experience as in the mediated classroom model or the creation of a new set of interaction dynamics or a combination of the two approaches.

The concept of the negotiation of meaning process (Garrison & Shale) as being the most essential component of the communication exchange is one which requires consideration in the design of the learning environment and the application of the technologies. Negotiation of meaning thereby requires a shift in our thinking about the roles of the learner and the instructor. The learner in this instance becomes much more active in receiving and initiating dialogue, is empowered to direct the course of their learning with a view to developing a rapport with their peers (fellow learners) and the instructor/tutor figure all of which is mediated by the technologies employed. Such interaction and communication is also one of the most important elements in achieving and sustaining learner motivation and ensuring successful completion of the learning objectives. A system where there exists, if required, constant learner support and monitoring of progress is a major factor in reducing attrition rates in distance education. The instructor on the other hand becomes the facilitator (Mason, 1994), the coach and mentor rather than the guru or fountain of knowledge. This role is much more focused on nurturing, supporting the efforts of enquiry, motivation, monitoring progress and validating learning. This revolution in the relationship between teacher and learner is most notable in the power shift which is negotiated to support the reciprocal respect. (Hedberg & Steele, Thompson et al). The instructor's ability to effectively stimulate and sustain dialogue and interaction is a critical factor in successful use of both asynchronous and synchronous communications. However, interaction does not just happen – it must be deliberately planned and encouraged (see Burge & Roberts, Garrison & Shale, and Oliver in Willis) which is the responsibility of both the instructional designer and the instructor. What must be recalled is that whatever the technology it must be used in a way which exploit its best features and supports the interactive capabilities.

Barriers to expanded use of technology/consequences of inaction

Although there is some reason to be optimistic about the future of educational technology and its application in distance and open learning there still remain a number of barriers to growth and expansion in a significant way. Even in the developed or advanced countries many of the major distance education systems which are being designed and

implemented are experimental in nature and are dependent in the first instance upon large infusions of money from government coffers. Initial start-up costs for any distance learning system are high and actual costs of the technical infrastructure is often dependent upon the sophistication of the technology selected and the regulatory environment of the telecommunications authorities. Presently in Canada pressure is being put upon the telecommunications industry and its regulatory body (CRTC) to allow differential rates for education thereby reducing the operating costs of distance education systems and networks. This move will have a very positive impact on delivering educational institutions' costs, a saving which can hopefully be passed along to the learners. Certainly the business plans for such systems advocate the self-sustaining nature but it is perhaps too early to judge whether or not this is realistic and each will need to be assessed on its own merit. Governments and institutions around the globe make choices in directing their limited educational resources and often the lack of institutional support and adequate information about appropriate, cost-effective, sustainable educational technology applications have resulted in limiting the advancement of educational technology in many low and middle income countries (World Bank, 1995). Brown and Brown (in Willis, 1994) in their review of distance education around the globe point to two major deterrents to adoption of new and emerging technologies in education. The first is the still prevalent traditional view of educational delivery held by educators, administrators and politicians and the second is the lack of financial resources available to divert into alternative delivery systems.

It would be remiss not to recognise the present lack of available technical infrastructure of sufficient quality to support distance education on a wide-spread basis in many countries and regions of the world. Although here too one can be optimistic given the speed of growth and penetration in this sector we are still, in many instances, dealing with 'dirt roads in the age of the information highway' and we are driving on that road with tractors, not high performance sports cars of the 90s. In practical terms, it is extremely difficult to effectively deliver quality education using an audio-conferencing system when half of the receive sites are off-line due to technical difficulties at the local telco! A further important component to an efficient technical infrastructure is experienced and trained human resources, a commodity which often requires several years to develop adequately.

However, what is perhaps important to remember is that no single media is superior to another in their contribution to learning outcomes and that even simple technologies can be used effectively for learning purposes (UNESCO, 1995). There have been numerous media comparison studies undertaken over the past several years and the standard finding has been that the instructional media has little bearing on learner performance or attitudes (Threlkeld & Brzoska in Willis, 1994). No single formula or package can be considered 'most effective' for all institutions or all pre-existing conditions and decisions will need to take into account a variety of local factors. It is important however to remember that many of the technologies from the 'western' world have not been tested and evaluated outside the rather pristine environment for which they were originally intended and may often not be directly transferable due to climatic conditions, technical support, cultural appropriateness etc.

Technology may not be the solution to the problem! Many of the world's distance education disasters appear to be a direct result of assuming that a technological intervention or application was needed prior to determining the pedagogical concerns often as a result of a search for cost-effective delivery modality. Rather, a planned approach which considers the various technologies in view of learner needs, course content, learning environment and teachers' abilities will provide a solution that is founded on pedagogical principles and hopefully common sense. (Lockheed et al). It is in the consideration of the course content that the questions of instructional design come into play. As stated earlier, the content for the message is more important than the medium and the quality of the content or curriculum and materials design is paramount. The media cannot make a good course from badly prepared courseware nor a good teacher out of a mediocre teacher (Mason, 1994). The learning environment consists of all of the essential pieces which when combined contribute to a positive learning experience for the learner and reflects the local circumstances of the learner. Choosing for instance to use videocassettes may be inappropriate if the target group of learners reside in a community without power.

Lockheed and co-authors suggest that there are three imperatives which must be considered for the successful implementation of a technology-based solution to an education problem. The following are possible obstacles that need to be addressed and overcome:

- an appropriate technological environment
- an adequate planning and administrative capacity including staff training
- political will at all levels

In other words, distance education is very much a system whereby the various sub-systems are dependent upon each other and with each one's contribution to the whole needing to be considered in the overall development of the larger framework.

The Future

The advances in global distribution systems will extend the reach and capacity for education to be delivered to the learner wherever they may reside on the earth (Brown & Brown in Willis, 1994) The boundaries and barriers to outreach have been blurred by the new technologies resulting in the forging of new relationships and challenging educational institutions to create new paradigms for the provision of education in a manner which most completely addresses the realities of the learners. Those educators who take up the challenge will be at the forefront of a massive growth in global delivery systems using the new effective delivery systems now being made possible through the strides in development of telecommunication technology.

There is a danger lurking behind all of the euphoria concerning the marvels of technology in education that will need to be addressed at the highest policy levels. That issue is one directly related to equity. We, as distance educators, espouse the values of distance education as overcoming inequities and democratising education. However, in reality, by embracing new technologies we may be working against this laudable objective by

creating a further division between those which have access to technology and those who do not (Mason, 1994). This has been referred to as 'technological apartheid' and has the potential of widening the gap between the educated and undereducated (Garrison & Shale, 1990). This will be especially true when educational institutions begin to rely on more sophisticated and expensive media which is not widely available to the normal consumer. It is possible to address this dilemma through the judicious provision of access to technologies and media through community-based learning centres. Such centres can then go beyond the provision of student and tutorial support and become the modern 'technology' hub through which learners connect in real or delayed time with the instructional base. Often learning centres are used in this manner for groups concerning for participation in various types of conferencing. Learning centres will increasingly become multi-dimensional/functional facilities/units incorporating a wide range of services for the community as a whole serving a variety of educational and quasi-educational providers.

Much more research is needed to determine the extent of technological diffusion in the educational system generally and in particular in open and distance learning and those factors which have an impact on decisions related to the application of technology.

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[**Professor Abdul W. Khan** is Head of Media & **Ms. Patricia McWilliams** is Senior Training Specialist, *Correspondence*: The Commonwealth of Learning, 1285 West Broadway Suite-600 Vancouver, British Columbia, Canada-V6H 3X8. Fax: 604-775-8210. E-mail: info@col.org]