ISSUE PAPER

The Use and Effect of Distance Education in Healthcare:

What Do We Know?

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Executive Summary

Since the 1960s, distance education has been used extensively around the world for the preservice and inservice training of medical and allied health students and professionals. In several instances, such professionals have demonstrated improved knowledge scores and performance in the workplace upon completing distance education programs, but overall, there are few evaluation studies of education programs, distance or otherwise, that use rigorous and objective evaluation methodologies.

In the following paper, the Quality Assurance (QA) Project reviews the current body of published and unpublished research on the use and effect of distance education in healthcare. Special focus is made on its implementation in developing country setting, studies that use objective evaluation methodologies, and on areas of research around the topic that the QA Project feels should be addressed.

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September 2001 ■ Volume No.2 ■ Issue 2

Recommended citation
Knebel, E. 2001. The use and effect of distance education in healthcare: What do we know?* Operations Research Issue Paper *2(2). Bethesda, MD: Published for the U.S. Agency for International Development (USAID) by the Quality Assurance Project.

The QA Project
The Quality Assurance Project is funded by the U.S. Agency for International Development (USAID), under Contract Number HRN-C-00-96-90013. The project serves countries eligible for USAID Missions and Bureaus, and agencies and nongovernmental organizations that cooperate with USAID. The project team, which consists of prime contractor Center for Human Services (CHS), Joint Commission Resources, Inc., and John Hopkins University (JHU), provides comprehensive, leading-edge technical expertise in the research, design, management, and implementation of quality assurance programs in developing countries. CHS is a nonprofit affiliate of University Research Co., LLC, and provides technical assistance in the design, management, improvement, and monitoring of health systems and service delivery in over 30 countries.

Operations Research Issue Paper
Operations Research Issue Papers present important background information about key subjects relevant to the QA Project's technical assistance. Each paper reviews current research (both published and unpublished, theoretical and operational) on a subject and makes recommendations for further research and productive lines of inquiry for the project's technical staff, external researchers, and health professionals.

Acknowledgements
Bart Burkhalter provided technical review of this paper; Donna Vincent Roa offered editorial guidance.

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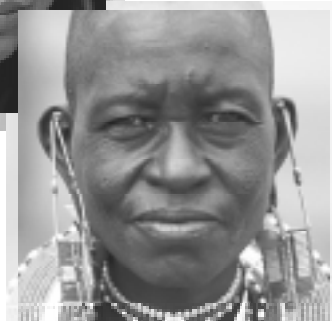


Introduction

There remains a critical lack of skilled health professionals in the developing world. Unfortunately, leaving home, family, and work to attend training courses in urban centers large enough to have training facilities or universities is not a viable option for many potential and currently practicing health professionals. As a response, the implementation of distance education programs to widen access to such students has grown steadily in the last two decades. From the University of South Africa to Indira Ghandi Open University (IGNOU) in India, there are now a plethora of preservice and post-graduate programs in health and medicine around the world.[1]

The QA Project is studying and implementing cost-effective intervention in international healthcare that improves the quality of healthcare delivery and overall health outcomes. The QA Project believes that education at a distance represents a potentially cost-effective approach for training preservice and inservice health workers in a variety of health topics. A review of the current body of quantitative and qualitative research on the implementation, costs, and effectiveness of distance education for healthcare providers appears on the following pages. Though largely undocumented, an attempt was made to include studies of the use of distance education in developing countries.

Definition and Characteristics of Distance Education

Distance education refers to teaching and learning situations in which the instructor and the learner or learners are geographically separated and therefore rely on electronic devices and or print materials for instructional delivery. Distance education programs require the enrollment with an educational institution which provides lesson materials prepared in a sequential and logical order for study by students on their own, and upon completion of each lesson, the assigned work is corrected, graded, commented, and guided by qualified instructors of facilitators (Willis 1993). This conception distinguishes distance education from (a) traditional or conventional instruction, in which all students are face-to-face with the instructor, (b) teach-yourself programs, in which students engage exclusively in independent private study, and (c) other uses of technology in education, such as independent computer-assisted instruction (Keegan 1986). In healthcare, it is important to stress that though continuing medical education (CME), medical software, or telemedicine are learning concepts/programs that involve a combination of self-study and the use of technology, this does not mean that they are necessarily distance education programs. Such activities would be considered as distance education programs only if an enrollment with a sponsoring institution and the provision of grades upon completion of lessons was evident.

Distance education includes distance teaching—the instructor's role in the process; and distance learning—the student's role in the process (Perraton 1992). The term "distance learning" is often interchanged with "distance education." However, distance learning is the result of distance education—institutions/instructors control educational delivery while the student is responsible for learning (Verduin and Clark 1991). Another term that has experienced some popularity is "distributed education." This term represents the trend to utilize a mix of delivery modes for optimal instruction and learning. Depending on the country of origin, distance education can also be described as: "external education," "off-campus study," "correspondence education," "independent study," "home study," and "open learning or education" (Keegan 1986).

Distance education programs may be described as "nontraditional," but not all nontraditional programs are distance education (Novotny 2000). Both might use supporting technology such as the Web and chat rooms, but note that the difference is the relative lack of physical space where teacher and class members come together. In the discussion of distance education in general and its role in health and medical education, certain terms are often encountered (see sidebar).

Acronyms

CBT ..... Computer-based training

CMI ..... Computer-mediated instruction

CME ..... Continuing medical education

IRI ..... Interactive radio instruction

ITV ..... Interactive television

QA ..... Quality assurance

WBT ..... Web-based training

Relevant Terms

These terms are used in the fields of distance education, computerized training, and health and medical training (Willis 1993; Dock and Helwig 1999; Kolshorn 1998; AMA 2000).

Asynchronous. A type of two-way communication that occurs with a time delay, allowing participants to respond at their own convenience. Literally not at the same time.

Audioconference. An electronic meeting in which participants in different locations use telephones or audioconferencing equipment to interactively communicate with each other in real time.

CBT (computer-based training). An interactive learning experience in which the computer provides most of the stimuli, the learner responds, the computer analyzes the responses and provides feedback to the learner.

CMI (computer-meditated instruction). Refers to (a) the use of computers by school staff to organize student data and make decisions or (b) activities involving computer evaluation of student test performance and guidance to appropriate instructional resources.

CME (continuing medical education). Educational activities that serve to maintain, develop, or increase the knowledge, skills, and professional performance and relationships a physician uses to provide services for patients, the public, or the profession.

Computer conferencing. An ongoing computer conversation via text with others in different locations. Conferencing can be done in "real time" or it can be "asynchronous."

Desktop videoconference. Videoconferencing on a personal computer equipped with an Internet connection, microphone, and video camera.

IRI (interactive radio instruction). An interactive lesson in which an external teaching element, delivered by a distant teacher through the medium of radio or audiocassette, is carefully integrated with classroom teacher and learners.

IVI (interactive video instruction). Combination of a videodisc (usually laserdisc) or videotape and computer system that permits user response and participation, allowing for direct exchanges between user and software or among people.

Synchronous. A type of two-way communication that occurs with virtually no time delay, allowing participants to respond in real time.

Teleconference. Simultaneous conference to multiple sites distributed via audio (phone or other audio). Satellite videoconferences and videoconferences using compressed video are sometimes referred to as "teleconferences."

Telemedicine. Use of telecommunications technology for medical diagnosis and patient care when the provider and client are separated by distance. Telemedicine includes pathology, radiology, and patient consultation from the distance.

Videoconference. A meeting, instructional session, or conversation between people at different locations relying on video technology as the primary communication link. Communication is 2-way audio with either 1-way or 2-way video.

WBT (Web-based training). A form of computer-based training in which the training material resides on web pages accessible through the World Wide Web. The terms "on-line courses" and "web-based instruction" are sometimes used interchangeably with WBT.

As with all types of education, the various distance education models are built around the central components of the instructional process: presentation of content; interaction with faculty, peers, and resources; practical application; and assessment. Each distance education model uses technologies in various ways to address some or all of these components.

Advantages and disadvantages of distance education

The chief advantages of distance education programs is that students can learn at their convenience thus accommodating work and personal life and that it can be accessed by those who do not live near or who cannot attend traditional training centers and universities. This is tempered, however, by some of the costs and personal motivation needed to complete programs.

For faculty, teaching at a distance requires a large shift in what is normally performed from being just a teacher to being a combination facilitator, coach, and mentor. Last-minute preparation in isolation cannot happen since one needs to work with a team of professionals. Typically, teaching at a distance requires more time and faculty workload (Billings 1997). Cravener (1999) found in her review of 185 articles that having students at a distance increased faculty time demands when compared with the classroom courses. For example, in a graduate epidemiology course, administrators complained of the number of e-mails and feedback needed to make students feel less isolated and supported (Rose et al. 2000).

In distance education, the learner is usually isolated. The motivational factors arising from the contact and competition with other students are absent. The student also lacks the immediate support of a teacher who is present and able to motivate and, if necessary, give attention to actual needs and difficulties that crop up during study. Distant students and their teachers often have little in common in terms of background and day-to-day experiences and therefore, it takes longer for student-teacher rapport to develop. Without face-to-face contact distant students may feel ill at ease with their teacher as an "individual" and uncomfortable with their learning situation. In distance education settings, technology is typically the conduit through which information and communication flow. Until the teacher and students become comfortable with the technical delivery system, communication will be greatly inhibited.

Other advantages and disadvantages have been captured from numerous studies of distance education in diverse fields, including healthcare (see Table 1).

Models of delivery

Willis (1993) identifies three models to deliver a distance education program, each based on the needs of the learner, and the cultural and resource environment.

- **Distributed Classroom.** The experience is much like that of the classroom for both the instructor and the student as class sessions require students and faculty to regularly be in a particular place at a particular time. Interactive telecommunications technologies extend a classroom-based course from one location to a group of students at one or more other locations. The faculty and institution control the pace and place of instruction. All students have opportunity for verbal interaction during class with instructor and each other. On-site students have visual interaction with instructor and other students in class; off-site students may as well; depending upon technology used.
- **Independent Learning.** Students study at their own pace using a detailed syllabus and contact faculty using one or a combination of technologies. Students are provided course materials and access to a faculty member who provides guidance, answers questions, and evaluates their work. There is wide variation in the amount of student-initiated communication with the instructor. When e-mail and/or computer conferencing is available, interactive discussions can occur.
- **Open Learning + Class.** This model involves the mix of a printed guides and other media (such as videotape or computer disk) to allow students to study at their own pace, combined with occasional use of interactive telecommunications technologies or visits to specified locations for group meetings with a facilitator/instructor among all enrolled students. Such sessions are frequently used for problem solving.

Choice of media

There are four main categories of media used to bridge the distance between instructor and student: audio, video, electronic communication, and print (Chitanda 1990).[2]

Table 1 ■ Advantages and Disadvantages of Distance Education

Advantages		Disadvantages	
Convenience	Ability to participate in learning activities at the learners' convenience, at work or at home.	**Team approach**	Need a team of technical and pedagogical experts to develop course and content.
Accessible	Students in rural areas can learn without incurring lengthy transportation costs. Women in traditional societies can learn at home.	**Faculty workload**	Need new teaching methods to offer same content; Typing comments or corrections makes grading slower. No chance for improvisation. Students need more support than in traditional courses. Volume of communications increase.
Cost savings	Can be realized by decreasing learning time for students and saving travel time and expenses to send faculty or students to remote sites. School buildings are not required.	**Cultural differences**	Wider attendance means difficulty in addressing curriculum to different segments of learners.
Just-in-time	Access to more material for wider audience. Access to training means workers can immediately apply knowledge and skills to the job.	**New technology**	Must teach students e-mail, computer skills, and networking. User guides have to be developed.
Computer proficiency	Those that use computers in distance education programs often gain high computer proficiency.	**Lack of visual and nonverbal cues**	Written communications are more structured and formal than verbal. Isolation and alienation is an issue.
Instructional quality	A team of professionals often crafts distance education programs. Many programs go through extensive quality control.	**Higher room for error**	The increased number of people on the development team needs heightened coordination.
Teamwork	Distance learners tend to support each other more and develop strong networks.	**Over reliance on technology**	Often depends on control of institution. Service failures, power losses, malfunctioning of computers or audiocassette players.
Inexpensive	Cost saving increase over time as up-front development costs are absorbed and more students enroll.	**Expense of technology**	Programs that rely on satellites and/or computers cost a great deal.
		High degree of motivation	Dropout rates are very high due to the high degree of self-directedness required to finish.

Source: Cravener 1999; Long and Kiplinger 1999; Novotny 2000; Perraton 2000a

- **Audio.** Instructional audio tools include the telephone, audio conferencing, short-wave radio, and broadcast radio alone or coupled with tapes. Audiographic teleconferences allow pictures, graphics, and text to accompany telephone conversations.
- **Video.** Instructional video tools include still images such as slides, pre-produced moving images (e.g., film, videotape), and real-time moving images combined with audio conferencing (one-way or two-way video with two-way audio). Motion and visuals can be combined in a single format so that complex or abstract concepts can be illustrated through visual simulation.
- **Electronic communication.** Instructional electronic tools include computer applications that facilitate the delivery of instruction. Examples include electronic mail, fax, real-time computer conferencing, computer-meditated instruction and Web-based applications. Computer teleconferences such as electronic mail and electronic bulletin boards permit anonymous, as well as highly personalized interactions between individuals and groups.
- **Print.** Various print formats include: textbooks, study guides, workbooks, course syllabi, and case studies.

Prerequisites to successful implementation

A distance education program requires many upfront inputs, costs, and systems in place before implementation can begin. A systems framework as seen in Figure 1 is a useful way to conceptualize the required inputs and processes needed to execute an effective distance education program. As seen in the figure, such inputs in place will lead to successful implementation, which in turn leads to positive educational practices that promote learning, which in turn leads to desired learning and performance outcomes.

Experts in the field suggest, based on lessons learned, that distance education programs are only successful if they at least exhibit the following (Keegan 1990; Kinyanjui 1998):

- Limited regular contact between instructor and student
- A mix of media to transmit course content
- Some provision for two-way communication in the educational/instructional process
- People receiving instruction individually or in very small groups, rather than in large groups
- Organized study groups that meet regularly
- Timely and constructive feedback on assignments
- Access to succinct learning materials
- Photocopying facilities and lab for experiments
- Guidance and counseling
- Problem solving on administrative and practical work arrangements
- Facilities for production of materials
- Record keeping and management systems
- Assessment, evaluation, and accredititation systems

Common costs associated within each system for the delivery of distance education programs include (Threlkeld and Brzoska 1994):

- **Technology.** Hardware (e.g., audiocassette recorders, videotape players, cameras) and software (e.g., computer programs)
- **Transmission.** The on-going expense of leasing transmission access (e.g., radio station, satellite, microwave), maintenance, repairing, and updating equipment
- **Infrastructure.** The foundational network and infrastructure located at the originating and receiving sites
- **Production.** Technical and personnel support required to develop and adapt teaching materials
- **Support.** Miscellaneous expenses needed to ensure the system works successfully including administrative costs
- **Registration.** Advising/counseling, local support costs, facilities, and overhead costs
- **Personnel.** To staff all functions previously described

Distance Education in Healthcare

Distance education has been used to deliver health and medical training since the 1960s. Though objectives have ranged from teaching specific topics to premedical students, such as health services administration to training nurses in tuberculosis management, most of the experience to date in health and medical education at a distance has been confined to a limited area of health education and training. In order to meet the diversified and emerging needs of health workers, some feel that the programs and courses have to go beyond medical graduates to include a wide variety of need-based functional areas ranging from simple awareness programs to more complicated skill-oriented courses on epidemiology and health economics (Dutta 1996).

Distance education programs are more challenging to implement when the topic of interest is specific clinical procedures. These skills can be gained through role-plays followed by practice with clients after learners complete knowledge through distance education or interspersed throughout training (Long and Kiplinger 1999). Adding video materials has been one option in tackling this limitation. However, this does not mitigate the need for supervision of technical procedures once students have received training (Lejarraga et al. 1998). In one study, registered nurses experienced with nonclinical

Figure 1 ■ Systems Framework for Distance Education in Healthcare

Inputs Before Implementation →	Implementation →	Positive Educational Practices →	Outcomes
Technology and Media Accessible and reliable infrastructure Use of hardware/software promotes productive use of time Fax, phone, mail system, photocopier A mix of media to transmit course content Some provision for two-way communication in the educational/instructional process **Instutional Policy and Regulation** Roles and function of distance education unit identified Clear linkages between distance education and other education systems established Accreditation, certification, licensure processes defined Official organizational support Systems for enrolling learners, tracking progress, grading, etc. Lobby government to ensure relevance and acceptance of distance education **Materials** Instructional design based on learning objectives and audience needs Field testing, production, printing, and distribution guidelines Place to store and inventory materials **Funding** Secured funding from local sources or donor funds Guidelines for student payment and cost recovery Collect funds and budget for future sustainability **Staff** Administrative, instructors, instructional designers, testers, technology experts, graphic designer Guidelines for delegation of powers and accountability	**Faculty Support** Faculty development and training Orientation to technology Ongoing technical support Workload recognition Rewards **Student Support** Information Orientation to technology Ongoing technical support Learning resources based on needs Student services such as registration, library, assessment Timely distribution of materials Adequate and informative supervision Practice in clinical environment Continuous evaluation Timely and constructive feedback on assignments	Active learning Time on task Feedback Student-faculty interaction Interaction and collaboration with peers Respect for diversity High expectations	Knowledge Recruitment, retention, graduation Access Convenience Connectedness Performance in and preparation for real-world work Computer tool proficiency Professional practice socialization Satisfaction Completion rates Graduation rate Cost Improvement in health services

Source: Mwakilasa 1992; Kinyanjui 1998; Billings 2000; Novotny 2000

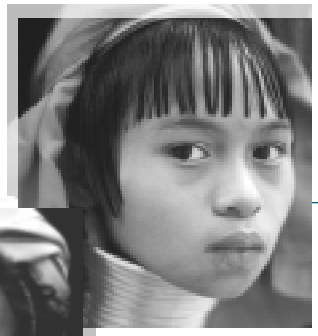
distance courses found the workload heavier and more challenging to complete when taking their first clinical distance course (Blakeley and Curran-Smith 1998).

Since the health sciences deal with life and death and therefore are more skill-oriented, rather than more knowledge-based, it is felt that providing basic beginning or early training in the field of health may not be feasible through distance education. Some feel that distance education is most appropriate for inservice training of health personnel (Dutta 1996).

Historical development

Distance education in healthcare evolved much like it did in other industries—as a way to offer accessible training to students in rural areas, as a way for students to complete their course of study without suffering the loss of salary due to relocation or negative impact on family life, and as a way to offer quality education to the masses (Ludlow 1994).

The limited resources to develop traditional education has probably been most instrumental in expanding distance education in developing countries. Attending university or obtaining additional continuing education is simply not possible using existing traditional institutions due to overcrowding, poor funding, high costs, poor infrastructures, and low capacity to take in any more students. Governments in developing countries are primarily interested in distance education as a cheaper way to offer education to the demanding masses (Perraton 2000b).



Distance education has also particularly evolved as a way to increase access to rural health providers or students. In speaking about the paucity of health educational options available in Argentina, one doctor said, "Like the rest of Latin America, some 50 to 60 percent of everything that happens is in the capital city. The rest of the country lives in the shadow of the capital (Robinson 2000)." This would describe the state of many lower- to middle-income countries' health training environments. Distance education is meant to address the mass of people living outside such capital cities. Similarly, distance education has also been seen as a way to stem the tide of brain drain of foreign-education health professionals. Distance education can also offer education to women who would normally not be allowed to attend school due to cultural reasons or childcare obligations.

Relevance of distance education to quality assurance in healthcare

A philosophical basis for today's quality movement is that quality organization should institute a continuous program of education and retraining that gives workers a share in the philosophy and goals of the organization, an understanding of their jobs, and specific procedures to do their jobs correctly. Among the many options for improving quality, evaluation of learning achievement when training is completed will improve quality (Gitlow et al. 1989).

Having well-trained and competent workers is a goal of any quality organization, but traditional training or conventional education has several limitations. For example, training often disrupts trainees' work for extended periods of time, especially training that is held offsite. It is also possible that the knowledge and skills acquired during training may not be applicable to the trainee's work. In addition, training sites often do not reflect the true work situation in the field. In such situations, training can actually result in a decrease rather than increase in the level of quality (Bradley et al. 1998).

Health organizations are looking for alternative training approaches that address such basic tenets of quality in healthcare as continuity, effectiveness, and technical competence (DiPrete Brown et al. 1998). Distance education, when used as training for healthcare workers, addresses the issues of continuity; by opening the way to training health workers at preferred times and locations, thereby minimizing or eliminating interruption of healthcare delivery. Distance education programs used at a learner's own pace reduce instructional time for some trainees. When soundly designed, distance education addresses effectiveness and technical competence with its embedded assessment of performance.

Training is an integral component of a quality assurance (QA) effort. Frequently, considerable time is involved in QA up-front training. The process often requires a change of such magnitude that it necessitates training in planning for quality and applying quality principles, tools, and techniques; forming and developing teams; and identifying the components of healthcare that are to be monitored and evaluated even before the actual QA effort begins. Teaching QA at a distance holds promise—one recent course on quality management was developed in Spain for primary healthcare physicians (Saturno 1999), and the QA Project has developed the Quality Assurance Kit CD-ROM, which was be delivered as part of a supported distance education program.

Studies of Distance Education in Healthcare

The studies discussed in this section were selected because they had one or all of the following characteristics:

- The population of interest comprised medical, public health, nursing, or allied health students (working toward a diploma or baccalaureate) or health providers in practice or training
- The intervention under research met the appropriate criteria of being a distance education program
- The outcomes assessed were either a combination of overall achievement as measured by posttest, retention, attitude toward distance education, cost-effectiveness, time to learn, performance of skills, and/or competence of trainees
- The intervention took place in a developing country healthcare setting

This review is not an exhaustive analysis, but rather a sampling of most of the last twenty years of research on distance education in healthcare. A drawback of the analysis is a lack of study comparability and external validity of results and the publication-selection bias among the studies. The wide range of research designs, intent of interventions, sample sizes and variability, settings and populations, and criteria for outcome measures makes objective comparisons impossible. Many studies have sample, selection, and overall methodological biases that make them questionable for discussion. An effort was made to concentrate on studies not possessing such biases or those taking place in developing countries.

Comparison studies

"Is the distance education course going to be as good as the traditional course?" is one of the first questions asked of any distance educator. As traditional training is ubiquitous and considered the standard to which other educational models must compare, both kinds of training approaches are continuously researched and compared. Numerous studies in healthcare show that distance education programs, regardless of the technology used to deliver the program, are equally effective, and occasionally more effective, than traditional training programs in measures such as exam scores and on-the-job performance (Storey et al. 1999; Billings 2000; Leasure 2000; Umble 2000; Capper 1990).

In a study comparing traditional and distance education programs for diarrhea case management in Guatemala, Flores et al. (1998) found the distance education program students scored significantly higher in assessment and diagnosis and scored about the same in counseling. The level of the performance of those completing the course, however, remained below an adequate level for good public health in several indicators. Leading researchers recommended that the course be complemented with other educational options. This echoes similar findings, which demonstrate that training is not the only answer for the acquisition of skills, regardless of how it is delivered.

Even if both programs are found to be equally effective in knowledge or performance measures, traditional training tends to be favored. Parkinson and Parkinson (1989) found in the comparison of a group using ITV and a group receiving a traditional lecture course that though all other outcomes were equal, satisfaction was less favorable among ITV users than traditional. Lewis et al. (1998) found the same results comparing an IVI program and traditional training of family medicine residents. Edwards et al. (1999) found the same comparing audio conferencing and traditional. When giving the opportunity, most students will opt for the traditional lecture approach.

Factors related to satisfaction

When compared to similar educational experiences in the on-campus classroom, many distance education students report general levels of satisfaction and indicate they would take distance education courses again (Billings 2000). This largely depends on the characteristics of students taking the course and organizational and infrastructure factors around the delivery of the course.

Student characteristics

Focusing her attention to undergraduate distance education programs in nursing, Billings (1987) developed a model accounting for 44 percent of variance in correspondence course progress. She found that a student likely to make progress towards course completion is one who intends to complete the course in three months, who submits the first lesson within 40 days of receiving it, has a high SAT and GPA, has completed other correspondence courses, receives family support, does not require the support of an employer, has high goals for completing the program, lives closer to the instructor who teaches the course, and enters the program with higher level of college preparation. This is obviously not generalizable to other settings, but it is interesting to note the difficulty for most students in meeting such criteria.

Carr et al. (1996) also found that distance education students were most successful when the amount of time set aside for studies was long, and whether or not the student had a 'study buddy.'

Findings such as these are echoed somewhat in studies of factors for success in distance education programs in other fields. Willingness to initiate calls to instructors for assistance, possessing a more serious attitude toward the courses, employment in a field where career advances can be readily achieved, and previous completion of a college degree are just some of the factors consistently found to related to success in distance education programs overall (Ross and Powell 1990; Bernt and Bugbee 1993).

Usually the motivation to finish a course is related to some notion of career advancement or certification leading to better employment. To explain the high acceptance of and voluntary payment for a pediatric distance education program in Argentina by pediatricians, both a lively interest of pediatricians in learning, and "perhaps the perception that their participation in the program would contribute to their curriculum vitae" were deemed as reasons for completion (Lejarraga 1998).

Infrastructure and organization

Much review and research has been conducted on the organizational factors related to progress or success in distance education programs. Acknowledged basic principles of good practice in learning programs, regardless of their mode of delivery, that lead to student learning and satisfaction include: active learning (case studies, database, problem based); time on task (students spend time actually learning instead of, for example, how to use the computer); collaboration with peers, especially small groups; interaction with faculty; rich and rapid feedback; and respect for diversity (Coldeway et al. 1980; Egan et al. 1991; Billings 1997, 2000). For inservice or postgraduate programs, it has been consistently found that the utilization of on-site facilitators who develop a personal rapport with students and who are familiar with equipment and other course materials increases student satisfaction with courses (Burge and Howard 1990). The extent to which most distance education programs respect these principles varies a great deal.

In their review of the lessons learned from decades of IRI programs, Dock and Helwig (1999) found that the following external and internal factors were present in successful IRI programs of the developing world.

External factors

- Appointment of consistent, high quality, caring leadership
- Financial security
- Political support
- Integration of program into the administrative and professional fabric of the education system
- Training of teachers and program facilitators

Internal factors

- Management
- Technical coordination
- Timely inputs
- Training, supervision, and nurturing
- Evaluation
- Long-range planning and budgeting

Based on his experience with a print-based independent study program for doctors in Tanzania, Ndeki (1995) recommends that a program should be flexible in its timing, as excessive clinical and administrative duties can cause serious delays in progress; and visits by tutors should be coordinated with other visits, i.e., immunization visits. Nyarango (1991) echoes the same based on a similar experience in Kenya, emphasizing supervision failures as key to the poor motivation of participants in distance education course for rural medical officers in Kenya. Other contributing factors to the failed course included the isolated nature of their work sites, the high volume of clinical work, low supervision during the course, and inadequate guidance on self-directed learning and time allocation.

Dissatisfaction of trainees usually stems from technological problems. One course for family practice residents consisted of presentations at remote locations using two-way interactive video. Assessing the differences in attitude of residents before and after the series of presentations, attitudes toward learning by interactive video declined. Interviews revealed that residents viewed technical problems with equipment to be tedious. Residents were also reluctant to ask questions, interact, and be visible on camera (Lewis et al. 1998). Cragg (1994) found similar mixed levels of student satisfaction. Nursing students were satisfied with the access and convenience of a distance education course on nursing delivered through computer conferencing, but frustrated with the technology, and distressed by the lack of connectedness to their faculty and classmates.

Resistance to distance-based education indicates that decision-makers are overly concerned about the quality of distance-based programs. They are concerned over the lack of note taking, listening, understanding, and memorizing, which they consider to be essential to effective learning (Kusnanto and Trisantoro 1998).

Much of the literature demonstrates that planners and educators of the developing world are very aware of the many subsystems and processes needed to host a distance education program, but just lack the resources to do so (Perraton 2000b).

Technology and media

Research indicates that the instructional format itself has little effect on student achievement as long as the delivery technology is appropriate to the content being offered and all participants have access to the same technology (Kolshom 1998). The choice of media in distance education, though it should be determined by learning needs and the environmental context, is often driven by fashion and the love of new technology. Radio dominated in the 60s, video in the 70s, and electronic communications in the 90s. There is little empirical evidence to make such shifts, but more a bias toward using the latest that technology has to offer (Halliwell 1987). Choice of technology should ideally depend on:

- Technology integration
- Organizational readiness
- Instructional design and development
- Economic development

Regardless of this, many programs, especially in the United States, heed the evolving state of technology and the demands of students for the latest available technology, regardless if the decision is empirically based. In a survey of 1,500 health workers, Chen et al. (1999) found that learning by satellite broadcasts (47.9%), followed by video-tape-based instruction (19.4%), professional meetings (16.1%), the Internet (8.3%), print-based instruction (2.2%), audio conferences (1.1%), and other or no preference (5.0%) were preferred ways of receiving distance-based courses. Health workers indicated a preference for learning provided through new technology or that offered greater flexibility reflecting the limiting work-time for pursuit of educational activities. A study conducted at the University of South Africa found that though audiocassette recordings were ten times more expensive than radio broadcasts; 90 percent of the students preferred cassette recordings to radio broadcasts (Shrestha 1997b).

Though currently out-of-fashion, IRI has been found by many researchers to be the most cost-effective tool to improve educational quality in the classroom. While estimates vary from place to place, most indicate the annual recurrent costs for

radio instruction are in the range of US $2 - US $3 per student (Dock and Helwig 1999). The primary advantage of radio is that it is relatively inexpensive per person reached—both the capital costs and running expenses of radio are lower when compared to the use of other media in education. The development of a larger audience for radio is stimulated by the large-scale manufacture and distribution of cheap batteries and battery-operated transistor radios. Radio is highly applicable to developing countries because it is often the only medium that reaches the entire country, and any lack of literacy poses no barrier to its use for education. One disadvantage is that there is usually no lasting record of the broadcast for the audience to review. To counteract this, some distance education projects make tape recorders and empty tapes available to target audiences (Chitanda 1990).

Computers can facilitate self-paced learning. giving immediate reinforcement and feedback. With integrated graphic, print, audio, and video capabilities, computers can effectively link various technologies. Interactive video and CD-ROM technologies can be incorporated into computer-based instructional units, lessons, and learning environments. However, computer networks are costly to develop. Although individual computers are relatively inexpensive and the computer hardware and software market is very competitive, it is still costly to develop instructional networks and purchase the system software to run them. Computer illiteracy still exists worldwide. Students must be highly motivated and proficient in computer operations before they can successfully function in a computer-based distance learning environment. A common problem cited in programs that rely on computers to deliver content is that more time is spent on getting students to learn the computer than on the actual content of the program (Cravener 1999).

Descriptions of trial-and-error experiences with new electronic technologies are common in the literature. Sear and Douglass (1998) implemented an Internet teleconference for real-time class instruction in a graduate health services administration program. Worried that some students had slow modems, they chose Internet conferencing software that would enable students to connect satisfactorily at a 14.4 modem speed. Only 19 students were able to connect satisfactorily, when additional students attempted to join the meeting, the session crashed as a result of limited bandwidth. As a result, Sear and Douglass opted to hold the rest of the class using chat room and whiteboard technology. Common frustrations cited in other studies have been associated with slow telecommunications hardware and software to access the bulletin board system and difficulty downloading files (Novotny 2000).

E-mail is an inexpensive option when compared to other electronic communications such as the Internet. E-mail works well using older modems with slower baud rates. Notably, even as early as 1989, a distance education e-mail course in epidemiology and medical statistics for health personnel in sites across Canada and one in Norway was successfully implemented (Ostbye 1989).

One positive externality of using electronic communications in distance education programs is the increased computer skills gained by students. Bachman and Panzarine (1998) found that nurses in an Internet-delivered course, when compared to students at a similar stage of their nursing program, had more computer knowledge, reported greater computer skill, and used computers more. Students in several studies have also reported overcoming fear of computers, Internet, and E-mail. Researchers have found that this exposure to computers has assisted in the development of communication skills, critical thinking, clinical decision-making, and analysis of data sets (Novotny 2000).

Audio conferencing is comparatively inexpensive to install, operate, and maintain and uses available telephone technology and reaches many students. It does, however, place restrictions on the type of content that can be delivered in an oral format. Not a great deal of research is available on the use of audio conferencing in healthcare. There was a successful pilot program of four audio-teleconferences on optometry that was offered in 1993 to optometrists based in rural and regional areas of Australia. The program demonstrated audio-teleconferencing to be both a cost- and educationally-effective medium for the delivery of continuing education to a widely distributed audience (Wildsoet et al. 1996).

Video production is very time consuming and can be technically demanding; often requiring relatively sophisticated production facilities and equipment. Due to the expense, videos are often used to train large number of students, as in the case of the armed forces. Video is used mostly in medical and health training in refresher courses, such as for CPR, but not in distance education courses (Capper 1990).

In developing country settings, correspondence courses using print materials abound. Print can be used in any setting without the need for sophisticated presentation equipment. The portability of print is especially important for rural learners with

limited access to advanced technology. Print materials are typically learner-controlled. As a result, the student rapidly moves through redundant sections, while focusing on areas demanding additional attention. No instructional tool is less expensive to produce than print. However, numerous studies have shown that higher learner motivation is required to successfully complete print-based courses. Though instructional designers can attempt to offset the passive nature of print through the creation of stimulating activities, it still takes more motivation to read a book or work through a written exercise than it does to listen to a radio broadcast or participate in a computer conference (Willis 1993).

Although technology plays a key role in the delivery of distance education, educators must remain focused on instructional outcomes, not the technology of delivery. Typically, this systematic approach will result in a mix of media, each serving a specific purpose to meet the needs of the learner in a manner that is instructionally effective and economically prudent (Wagner 1992; Kolshom 1998).

Costs

In discussing the cost benefits of distance education, researchers laud such benefits as the economies of scale, and the lack of a need for full-time residence or attendance at a learning center over a period time. This contrasts with the tremendous opportunity costs involved in conventional training such as spending less time with family, taking time away from work, etc. (Perraton and Potashnik 1997).

In reality, the cost equation is rarely that simple. For example, in the university setting, although there may be a need for less in the way of buildings and campus infrastructure in implementing a distance education program, there will be a need for communication technology infrastructures, support networks, supplementary services for marketing, registration, library access, advising, and testing beyond the campus. Cost savings may be realized only when the number of students is over 100. Indeed, it is at the university level where you will find that distance education has economic advantages.

Researchers have produced a number of studies in higher education confirming that both developed and developing countries can produce graduates at one-third to two-thirds of the cost of doing so in a conventional institution (Perraton 1982, 1987). Such studies are informative, but often lack data on graduation or completion rates, thus costs per students can be compared, but not costs per graduate (Perraton 2000b). In most cases, distance education systems may have little chance of survival if their costs are higher than those of conventional education systems-most countries only support distance education as long as it is a cheaper alternative to traditional education (Shrestha 1997b).

In his analysis of costs of distance education programs in India, Datt (1994) found that most institutions in India have a negative and significant relationship with cost per student. He hypothesized that since costs at undergraduate level are generally much lower than those at the post-graduate level, undergraduate fees should support the post-graduate level. He also found that the cost of providing instruction to one student in a regular college is equivalent to the cost of providing instruction to 6.5 students in a distance education program. In his earlier study, Datt found that economical viability for a distance education program at a university meant having at least 10,000 students.

Cost effectiveness of a project is usually dependent on the following: the number of students, the sophistication of the media, the amount of face-to-face education in the program, the educational effectiveness, and the quality of administration and management of the program (Lockheed et al. 1991). The media alone can impact costs considerably. The production time per hour can be: lecture (2 – 10 hours), telephone (2 – 10 hours), audiotape and print (3 – 10 hours), broadcast TV (100 hours and technical time), computer-aided (200 hours and technical time), and interactive video (300 hours and technical time) (Rowntree 1992).

One innovative way to pay for a distance education program took place in Argentina where distance-based pediatrician education was funded by the pharmaceutical industry. Through a network of telecenter sites that linked ten Argentinean cities, doctors were required to obtain certificates for each unit passed in the course. Some questioned whether drug companies could effectively set the agenda for health education and drug use at the expense of appropriate public health policies. But course implementers did not see this as a threat since the universities and the governing bodies, not the drug companies, set the content of the courses for the various health professionals. Drug companies did, however, have marketing people at the telecenters to promote their products to the doctors (Robinson 2000).

In one evaluation of a radio-based correspondence course for healthcare providers in Kenya, 391 learners completed the course and the average cost per learner was approximately US$ 113. The report further suggests that since it took about 40 days to complete the course, the cost per head per day was thus approximately US$ 3 (Mwangi 1999). Using a model of open learning plus class (mail delivered modules graded by off-sight tutors coupled with regular meetings with tutors and other class participants), Flores et al. (1998) calculated that the average cost of a course on diarrhea case management in Latin America per initial participant was approximately US$ 60. Though this appears to be very low relative to the results achieved, there is no data on what the traditional course would have cost.

In an evaluation of an independent learning program for doctors in Tanzania, costs per student equaled US$ 341.46 or US$ 0.38 per person per zone being taken care of. Though the program was largely independent study by the participants, there were occasional visits by tutors to answer questions and offer support. While the travel of tutors adds to the cost of the course, it was recommended that such contact should be established in the program to provide moral and learner support (Ndeki et al. 1995).

For a distance education course based in Australia and offered to medical students in Zimbabwe, Ethiopia, and China via mailed print modules and technology-supported contact with the tutor, administrators calculated that the direct costs from the course (e.g., communication costs, tuition fees, residential workshop costs) were slightly lower than the cost of bringing international students to study full-time in Australia (e.g., tuition fees, living allowance). The administrators concluded that the primary saving of this program was not to the institution but to the home country since such students normally would have left their respective countries to attend training for extended periods of time (Treloar 1998).

There are only a few studies on time efficiency. When comparing an ITV course and a traditional lecture course, Parkinson and Parkinson (1989) found that 33.3 hours for traditional lecture and only 10 hours for ITV class resulted in nearly identical examination scores. Similarly, Ryan et al. (1999) found no significant differences in the amount of time to complete assignments between a traditional classroom and a Web-delivered course.

Culturally appropriate

As far as the concept of distance is concerned, there are multiple "distances" to be navigated in distance learning programs (Granger 1995).

- **Knowledge.** What do the learners actually know?
- **Prior skills.** What can they actually can do?
- **Language.** What is the level of their language ability?
- **Culture.** What is their cultural background?
- **Context.** What is the context that learners actually inhabit?
- **Learning patterns and styles.** What are their learning styles?
- **Learning goals and motivations.** What needs, interests, goals, and motivations the program assumes that learners have as opposed to the actual goals and motivations of learners?

Often in developing countries, local experts are not available to develop original programs in the language and culture of the people and thus, the majority of educational programs are either used intact from the host country or are superficially translated with very few adaptations to the local culture. When this is done, the results are often unsuccessful. There are many examples of programs from North America, Australia, Great Britain, and Europe that were purchased but never used in Africa and Asia because the material was not relevant in those countries. Because the appropriate design of instructional material is a critical element in its effectiveness, the issue of "who designs what and for whom" is central to any discussion of the economic, political, and cultural dangers that face distance educators using information technologies (McIsaac 1989). For example, the game-like style of many US software programs are not appreciated in countries like India and China where schools are very much focused on content and oriented towards examination (Shrestha 1997a).

Koul (1995) suggests that developers of educational products needs to give up the "fallacy that all human beings, whatever their cultural base and local imperatives, 'learn' the same way, should learn the same things for the same purposes, using the same techniques and the same materials." It has also been suggested that the supplier countries/institutions should enter the developing world, study the market, and then modify their wares according to local needs with the help of the local industry and labor force (Koul 1995; Shrestha 1997a).

In the administration of country-to-country distance education programs, there have been many instances where group discussion and supervisor communication were of very poor quality due to a lack of common language. This meant that in-depth communication on professional issues was nearly impossible. The cultural minority in such classes can often have aggravated feelings of isolation. Logistically, the delivery of different courses raises issues like how to coordinate time zones and different academic calendars (McPhee 2000). One course was able to overcome such difficulties. The course, based in Australia delivered to Australian, Ethiopian, Zimbabwean, and Chinese health professionals, yielded no difference in completion rates and knowledge among the trainees (Treloar 1998).

Performance

Long-term performance studies in the field of distance education are rare. The effect of a respiratory rehabilitation distance education program on nurses' clinical skills in a rural Japanese hospital was examined using heavily biased self-reported data. Before the first videoconferencing session, 'always use' and 'sometime use' the new skills were rated by 67 percent of nurses, but after the second videoconferencing session 'always use' and 'sometimes use' were rated by 73 percent and 'never use' at 0 percent (Sawada et al. 2000).

Some studies avoid such bias by using measurements of performance made by trained objective observers. Flores et al. (1998)

considered a significant impact to be an increase in the prevalence of correct practices of at least 20 percentage points between pre-and post-course measurements relative to the control group. The level of performance of those completing the course as measured by the trained observers, substantially improved; yet, still remained below an adequate level for good public health in several indicators. The authors recommended that the course be complemented with other educational options. One program using open learning plus occasional face-to-face contact with tutors was used to train Moroccan health workers in family planning. Observed four months after the end of the course in the process of providing family planning counseling and infection prevention, the course participants obtained an average score of 15.4 points and 11.4 points respectively while the control group only obtained 8.5 points and 4.8 points respectively (Combary et al. 2000).

Socialization

One worry about distance education is the potential isolation felt by students. Many studies have shown, however, that students tend to form peer support groups and study groups, especially in online courses (Cragg 1994). Socialization and mentoring activities can be achieved by providing access to role models, peer support groups, cohort groups, and faculty mentoring through planned activities. For clinical practice experience, on-site faculty, faculty who travel to outreach sites, preceptors and monitored-cohort programs have been applied strategies (Block et al. 1999). Usually, new technologies are used to bridge any gap among students or between students and the instructor. This would include audio conferencing or discussions on the Internet. Faculty can promote interaction by having toll-free telephone numbers, scheduling Internet chats or face-to-face visits at outreach sites or sending out newsletters or information packets (Novotny 2000).

Gender

Little research has been done on the role of gender and distance education. One study assessed the impact of a graduate diploma of family medicine on the clinical practices, community activities, learning styles, and personal lives of its graduates. Male respondents felt that they treated a greater variety of conditions, had undertaken more procedural work, and had increased procedural confidence compared to female respondents, while the female respondents referred more. More male students than females indicated they preferred a reflective learning style. The clinical electives of the graduate diploma had the most significant impact on the clinical practices of full-time general practitioners who were predominantly male graduates (Piterman and McCall 2000).

An analysis of course materials used in distance education in India where women's access to and successful participation in distance education programs is affected by the male construction and ownership of knowledge and the invisibility of women in course materials. Though not in the health field, a study of the postgraduate diploma in higher education in one institution revealed that for example, in some courses there was reference only to male teachers and in the analysis of pictures, only pictures of male teachers were used (Ushadevi 1995).

Completion rates

Another important finding around the use of distance education is the study of completion rates. Correspondence courses and independent study modules have had historically high noncompletion rates. Even courses offered by the Internet can have similar completion rates to older form of print-based instruction. Surveys of existing distance university programs in the developing world have shown that successful completion rates for degree courses are often as little as 10 to 34 percent compared with the rates of 55 to 66 percent in conventional universities. Such dropout rates erode the economic advantage that comes from lower costs per student. Indeed, in the rare instances that costs are calculated, costs are all attributed to the graduates and not to those who dropped out. Completion rates seems to improve when the class is shorter rather than longer and if the class is postgraduate or inservice, either because the students are more mature learners or perhaps because of the lesser demand of short course as compared to a long one (Perraton 2000b). This supports the theory that distance education is better for training inservice health professionals in short-course modules rather than in a preservice degree mode.

Distance Education in Developing Country Settings

Barriers specific to the developing country setting include a lack of resources needed for meaningful development and sustenance of technology-based learning; a lack of infrastructures (which includes information and communication hardware systems) to support modern technologies in least developed and/or low-technology countries; and a lack of

recurrent funding necessary to acquire or develop appropriate software and courseware on a continuous basis, and maintain, service and replace the equipment (Shrestha 1997b). This leads to many problems including a lack of sufficiently trained personnel, delays in actual delivery of learning materials to students, insufficient levels of motivation of students, poor monitoring, lack of personnel for coordination and authoring of courses, and lack of incentives to deliver and complete the course (WHO 1990).

One case study in Pakistan illustrates what can go wrong. A lack of opportunity for question and answer session, no provision to make up missed classes; absence of teachers to advise students on the use of materials; lack of competition; lack of competent teachers; corruption and poor funding; low standards resulting in receipt of degrees without corresponding learning; lack of facilities for lab work in science and technical training; and lack of rights to duplicate costly foreign materials have all led to high dropout rates (Panhwar 1996).

Often, in reviews of distance education programs in the developing world, systematically organized learning needs assessments are continually absent. This type of assessment should be used to determine the type and level of courses and to validate the appropriateness of content and level of difficulty for the wide range of health workers, and to develop new distance education courses to meet identified needs (Mburu 1989)

Students in developing countries often complain about the length of time it takes for course materials to arrive after registration for a course. Once students complete the assignments, the waiting time for the assignments to arrive at the institution, be graded, and then return to the learner is often very long. In one example, 11 students stated that it took up to one month to receive course materials once they had registered for the course and the majority of the students stated that it took up to 2 months for receipt of their grades after submission of assignments (Mwangi 1999).

Students also frequently complain about the lack of formal recognition, usually by the government, of distance education. Continuing to explore formal recognition for distance education and related continuing education activities through affiliations with national and regional educational and training institutions is a frequent recommendation. This usually involves heavy promotion and publicity of distance education through student advocacy and the designation of personnel at key health institutions to inform potential participants of course offerings.

Some decision-makers have not welcomed the advent of distance education programs. They fear that distance education programs may become commercialized and that open access to higher education via distance education will produce a surplus of graduate health professionals. Decision-makers predict that such health professionals will become frustrated if they are not quickly absorbed into the work force. Potential students are also concerned that distance education program will not be given same status or prestige and respectability as traditional educational programs (WHO 1990). Distance education has had to overcome a stigma of being second class relative to other academic institutions. Often, poorly run institutions that act as 'diploma mills' damage the credibility of distance education. Panhwar (1996) cites in a review of distance education in Pakistan that prospective students suspect that competent teachers work at private institutes while poor teachers work in distance education institutions. This belief is shared in other countries as well.

As far as the dominance of print-based programs in developing countries, Khan (1994) cites educational conservatism, lack of manpower, educational imperialism, and lack of adequate cooperation among those who possess technology as a limiting factor in advancing beyond print.

An issue to be deliberated is the provision of student support services for health workers and professionals. While it has been shown that compulsory counseling and extended contact increase the effectiveness of distance education programs, the attractiveness of not needing to meet face-to-face is what led countries to institute distance education programs in the first place. The need for programs to have more compulsory built-in face-to-face components and work centers or practice centers with required instructional provisions elevates the costs that administrators are trying to avoid (Dutta et al. 1996). There are a host of additional services needed to run a successful educational program: academic advising, access to the bookstore, registration, bursar, financial aid services, learning assessment, career development, learning portfolio management, competency testing, access to library materials, etc. Most developing country educational institutions have difficulty providing these things for the traditional on-campus students and thus the provision is even more unlikely for the student at a distance.

Collaboration

In light of resource and infrastructure difficulties faced in developing countries, collaboration is promoted. Many countries have similar health and educational needs and problems and their populations share similar geographical, socio-economic, and cultural features. The idea that universities or training institutes could pool resources for common good, and have shared delivery of distance education programs has started to take hold. This would ideally be done through joint training, information collection and exchange, joint research, and exchange of expertise (Mwakilasa 1992).

Institutional cultures are different in that there are different levels and types of knowledge taught, the kind of students sought, what pedagogies are deemed appropriate, and choices about the relative value of teaching and research. All of these elements constitute an institutional identity that needs to be understood and articulated when beginning a collaboration with a new partner. This is especially true when developing countries are dependent on outside institutions for funding and guidance in design and implementation. Dealing in another language and different assumptions about curriculum and pedagogy is difficult for the less advantaged institution. For successful collaborations, Moran and Mugridge (1993) have found that institutions must share the following: abiding commitment to improving educational opportunity; a disbandment of academic chauvinism; willingness to share resources; clear communication about assumptions, and ground rules before agreements are formalized. Barriers to collaboration include incompatible organizational structures and administrative processes, problems of inter-institutional communication, inadequate funding, lack of clarity in terms of an agreement, and an absence of real commitment on the part of one or more partners (Perraton 1993).

Access

Though distance education is often lauded as a way for providing access to education for women and rural inhabitants who would normally be unable to attend school or training, evidence shows that distance education systems mirror that of conventional education systems in that distance education programs around the globe still predominantly attract men, mainly men below the age of 30, and urban inhabitants. Where figures are available, large distance-based universities in India and China have on average only 20 – 30 percent rural students and approximately 30 percent female enrollment—the same as that of conventional universities (Perraton 2000b).

Research Issues

Research on the context of distance education, considering its purposes, outcomes, and relevance to major educational problems, has been relatively neglected as contrasted with research on its application (Perraton 2000a). Perraton and Potashnik (1997) found that studies can be classified into five research categories, with a majority of them being descriptive:

- **Description.** Descriptive accounts of courses and institutions discussing some combination of management, students, teaching methods and outcomes of a course or institution.
- **Audience studies.** Studies of the audiences for open and distance learning in which examination of the performance of students in relation to variables associated with the methods of study sometimes takes place.
- **Cost-effectiveness studies.** Studies on cost-effectiveness with a fair measure of commonality in the methodology used
- **Methodology.** Often descriptive, of the various methods used to teach, support and counsel open and distance-learning students
- **Social context.** Some recent work has been concerned to examine the social context of open and distance learning

When studies attempt to calculate effects on learning, the same basic research question is usually posed: "Is distance education as good as, or better than, traditional education?" Nearly a thousand studies have attempted to find out whether distance education differs from traditional modes of instruction when it comes to facilitating student success. This "significant difference" research has been equivocal since the majority of studies reported no significant differences between the distance and traditional modalities. Moore and Thompson (1990) reviewed much of the research from the 1980s and 1990s and concluded that distance education was considered effective when effectiveness was measured by the achievement of learning, by the attitudes of students and teachers, and by return on investment. However, that many research studies demonstrated weak designs, specifically in regard to control of the populations being compared or otherwise studied, the treatments being given, and the statistical techniques being applied.

Traditional-distance comparisons are premised on the implicit yet rarely mentioned assumption that traditional education is the ideal mode of educational delivery. However, there is no way to determine that one class method is better than another without first agreeing on the criteria for such a determination. What is traditional? What is distance education? are rarely defined in such studies (Saba 1998). By specifically defining what these terms mean (i.e., what materials, motives, or methods are employed), one's study is limited to a very narrow perspective. Clark (1989) decries the comparison of conventional education and computerized distance education employing the Internet or training CD-ROMs. Usually, in such studies a favored electronic media or design approach is carefully developed and then compared with a poorly produced and conceptualized traditional course.

Absent from most comparative research in distance education is a discussion of theoretical foundations of the field. Research questions are rarely posed within a theoretical framework or based on its fundamental concepts and constructs. Saba (2000) argues, "a theoretical discussion of research results would be helpful in making studies relevant to the work of other researchers, and possibly even to the practitioners in the field. Comparative researchers, however, have shown little or no interest in the theoretical literature of the field either before or after conducting their studies."

Critics of distance education studies note that most of studies do not use randomly selected subjects (Phipps and Merisotis 1999). Unfortunately, random selection is not practical. Students will self-select into courses based on reasons important to them, such as preferences for certain teachers, locations, or personal schedules. As Diaz (2000) notes, "randomizing subjects in a distance study may increase generalizability, but in practice many of the findings are not likely to be useful, unless one assumes that students who are randomly assigned are representative of those who self-select into a course."

Particular to the arena of public health, it is difficult to accurately compare distance education programs with traditional programs since there is no independent evaluation of most traditional programs to which to compare. Usually in the university setting, each instructor teaches his or her own class and does his or her own independent evaluation via classroom surveys. Though there might be knowledge tests, there is rarely a requirement when graduating from a public health program to demonstrate a core competency in public health skills or performance (Mosley 1998).

Research and Implementation Needs

What are the alternatives to comparison studies?

Because it is generally agreed that studies comparing distance and traditional education have design limitations and have been performed enough, other research designs have been offered and promoted. Component analysis is a research method that attempts to determine the contribution of each component in a system to the success of the whole or to the effect on another component. Because distance education programs are comprised of multiple components, this type of analysis has been recently promoted. Isolating, for example, tutoring, feedback, and pacing could be examined as components with respect to their overall contribution to the effect of a distance education program (Coldeway et al. 1980).

Simulation analysis, whereby one uses previous results and information to build a model that can then be tested in a simulated state to determine effect is another research option (Coldeway et al. 1980). For example, it would be possible to build a model from the results of a cost effectiveness study on distance education done in Benin and then extend that to various student population sizes in Togo or other countries in West Africa.

There are alternative ways of evaluating distance education programs apart from merely looking at test scores. Ample studies show that people can pass examinations, gain qualifications that attract formal recognition, etc. Questions remain, however about the efficiency of distance education. Efficiency measures include examination pass rates or dropout rates. Functioning of the learning material delivery system, efficiency and effectiveness of curricular implementation, quality of materials, and an existing certification process are all informative measures (WHO 1990).

A systems framework such as in Figure 1 is useful for conceptualizing outcomes and practices in distance education courses in healthcare. Such a framework is useful in forming research questions around not only outcomes, but also teaching and learning practices, quality of inputs, and academic standards. In contrast to the experimental method, systems as a method of inquiry allows researchers to collect data from various sources such as management and legislation, and to study their ramifications on instruction and learning outcomes, as well as several other systems variables (Saba 2000).

What is the long-term impact?

Few studies demonstrate how distance education is adequately meeting the needs that led students to enroll. Many studies show students reporting their satisfaction with the course, but there is a lack of tracer studies to demonstrate how many of those students achieve their ambition in terms of jobs, status, or impact on quality of healthcare (Perraton 2000b).

What is the impact on cognition?

Questions regarding the development of higher-order cognitive skills, such as critical thinking and clinical decision making, through distance education remain largely unanswered (Edwards et al. 1999). Instruction aimed at improving students' ability to access and apply knowledge is more likely if it (a) provides learners with opportunities that help them to establish meaningful relationships between new and prior knowledge, (b) induces them to apply strategies for organizing and processing information, and (c) assists them in discovering concepts and relationships (Capper 1990). Research on how such distance education programs can be improved to do this is needed.

Which student characteristics favor distance education?

Thompson (1998) has noted that the dynamic nature of the individual learner and the field of distance education as a whole make it unlikely that a "generic" profile of the distance learner can be established. Research indicates that student-learning styles are continually changing, significantly shifting from year to year and even from the beginning of the term to the end. Diaz and Cartnal (1999) confirmed this by demonstrating that online students display widely differing learning style profiles and other characteristics.

Since student characteristics are in constant flux, the usual requirements for broad generalization in research may need to be abandoned in favor of a model that continuously monitors student characteristics and determines which characteristics facilitate favorable outcomes. This student- and learning-centered approach to research would likely influence educational practice by increasing faculty sensitivity to the individual learner and by preparing them to facilitate distant education. Studies that focus on comparing student characteristics, evaluating overall student success, and profiling successful (and non-successful) students might better help attain more successful students. Research questions should change from "Which method is better?" to "What student characteristics facilitate success within a particular modality?" and "Can certain characteristics be altered to improve student success?" The model used by Billings (1987) in her study could be applied in a variety of settings.

What are appropriate regulation systems?

Given globalization, how can we establish systems of governance and regulation that will protect individuals with imperfect information who are seeking to enroll in courses available at a distance? Perraton (2000a) recommends drawing from political science in order to generate the research questions about governance to help answer this question.

Other regulatory issues which need to be addressed include those surrounding legal concerns when licensed professional education crosses state or country lines, political and administrative issues that may involve multiple educational institutions, and questions related to accreditation by appropriate agencies (Mullins et al. 1998).

Indeed, a common complaint in distance education course evaluations of developing countries is the lack of certification or reward upon completing a course and thus an important means of motivating trainees to master materials and skills is often lost. More research needs to be done on distance education standards and on processes that support successful evaluation of performance and knowledge of students at a distance (Wachira et al. 1999).

How can the socialization process be improved?

Reinert et Fryback (1997) question whether if specials plans are not made to insure communication between students and faculty, will only facts and figures be transmitted and not the equally important beliefs, ethics, and ideals to produce a professional health provider. It may be discovered that it is cost effective to teach classes with advanced technolgy, but an exposure to ethics and other professional ideals may be lost in the process of communicating at a distance. The authors argue for a better understanding of the professional socialization process to insure the best use of distance education programs.

What is the ideal mix of technology?

Further research should focus on the possible disadvantage that the lack of visual cues for the tutor may cause, specifically to group functioning and the problem-based learning process (Edwards et al. 1999).

Can training in quality assurance be offered at a distance?

The QA Project has created the Quality Assurance Theories and Tools CD-ROM (QA Kit), a multimedia training and reference program on quality assurance for health providers in developing countries. Among the research questions that we plan to address when testing the QA Kit are:

- How much facilitation and student-to-student contact will be required in using the QA Kit in a distance education program?
- Which aspects of quality assurance are most appropriately delivered via computer as opposed to other media?
- How can the QA Kit be effectively implemented in a resource-strained environment?

Conclusion

At the inservice level in both the developed and developing world, distance education courses in healthcare are here to stay. No longer maligned as the inferior alternative to traditional training, distance education programs are in demand by the busy inservice professional. Though the research is plagued by biases, enough experiences have shown that health professionals successfully pass short courses related to their current employment. However, such experiences in the developing world remain isolated and have not been sustained or replicated over the long-term.

At the preservice level, however, desires for socialization with peers and the prestige of going to a "real" university still dominate. As long as distance education has lower prestige and is

Table 2 ■ Selected Studies on Distance Education

Author	Target Group	Country	Target Area *(Focus of Study)*	Intervention	Statistically Significant Difference	Other Findings
Parkinson and Parkinson 1989	Nursing students	United States	Pathophysiology (perception, knowledge)	Comparison of two groups: (a) IVI distance education (n=30), and (b) traditional campus lecture (n=48)	Instructor's effectiveness, organizational presentation, student motivation, objective clarification, learning promotion, and objective satisfaction were less favorable among Group A than Group B.	No difference in the mean of examination scores between the classes.
Flores et al. 1998	Doctors and nurses	Guatemala	Cholera and diarrheal disease (skill in assessment, diagnosis, counseling)	Pre- and posttest comparison of two groups: (a) print-based distance education (n=66), and (b) non–equivalent control (n=66)	The proportion of cases correctly assessed and diagnosed by Group A was significantly higher.	No significant difference in counseling.
Storey et al. 1999	Auxiliary health workers, health assistants, and assistant nurse midwives	Nepal	Reproductive health (knowledge, performance)	Cross-sectional, pre-, mid-, and post-observation of four groups: (a) nonintervention control, (b) traditional training workshop, (c) radio-based distance education program, and (d) traditional training workshop plus radio-based distance education program (n=240 observations per wave)		Though all scored significantly higher than A, no difference among the performances of B, C, and D.

Table 2 continued on next page

less efficient in terms of graduation rates, it will remain a poorer quality alternative to conventional education for those who could not afford to or failed to get in the conventional university system.

There is no question that distance education has positive effects on student learning. The benefits that health workers, no matter where they come from, will derive from any training modality will depend largely on good instructional design and an adequate infrastructure to support the program. More research should focus on the optimal delivery of distance education programs in a resource-strained environment to increase such benefits.

Before embarking on funding or starting your own distance education program, there are several questions to ask (Wagner 1992):

- Do you want to get involved with distance education because there is an expressed or demonstrated need?
- Are there cost savings expected from the establishment of a distance education system in your organization?
- Who benefits from such a program?
- Can your organization support the technical system requirements?
- Do you have the infrastructure in place?
- What kind of user support do you have to operate smoothly (texts, manuals, library resources, database resources, support personnel, instructional design support, etc.)?
- Will there be preliminary training?
- What incentives will be in place for students to finish a course?
- Have you given yourself enough time to develop a technology integration plan suited to your organization?
- Do you have enough money?

Table 2 ■ (continued)

Author	Target Group	Country	Target Area *(Focus of Study)*	Intervention	Statistically Significant Difference	Other Findings
Lewis et al. 1998	Family practice residents	United States	Family medicine (attitude, knowledge)	Quasi-experimental, non–equivalent control group design comparing two groups: (a) IVI distance education (n=87), and (b) onsite instructor (n=46)	Declines in five measures for attitude for Group A.	No difference in knowledge.
Maetz et al. 1998	Nurses and public health professionals	United States	Tuberculosis (knowledge)	Before and after study of intervention group (n=2,359)	Mean pretest and posttest score of all were 80.8% and 91.8% respectively.	Only 2.2% of the completers failed to score a grade of 70% or more on the posttest.
Treloar 1998	Various health professionals	Based in Australia delivered to Australia, Ethiopia, Zimbabwe, and China	Various health science curriculum (completion rate and knowledge)	Prospective comparison of three groups: (a) international distance education students (n=18), (b) Australian distance education students (n=114), and (c) part-time on-campus students in Australia (n=92)		No difference in completion rates and knowledge.
McCosker et al. 1999	Rural health workers	Australia	Violence against women (knowledge, attitude)	Before and after study of intervention group using print and audio-based course (n=60)	Post-course knowledge and attitude significantly increased.	
Combary 2000	Nurses, nursing assistants, and midwives	Morocco	Family planning (knowledge, skill, satisfaction)	Knowledge and satisfaction: Before and after study of group using print-based distance education (n=38). Skill: Nonequivalent control group comparison of two groups four months after intervention: (a) print-based distance education (n=38), and (b) control (n=10)	Post-course knowledge scores significantly increased. A scored significantly higher than B in counseling and infection prevention.	No difference in record keeping. Satisfaction scores ranged from 62% to 85% on different measures.
Leasure et al. 2000	Nursing students	United States	Nursing research (knowledge)	Nonequivalent control group, posttest-only design comparing two groups: (a) Internet-based distance education course, and (b) traditional lecture		No significant difference in examination scores between the two groups.
Rose et al. 2000	Graduate nursing students	United States	Epidemiology (knowledge, satisfaction)	Comparison of two groups: group (a) online distance education (n=14), and (b) traditional campus lecture (n=38)		No significant difference in test scores and satisfaction.
Umble et al. 2000	Public health professionals	United States	Vaccine-preventable diseases (knowledge, agreement, self-efficacy, and adherence in practice)	Comparative time series design posttest with second posttest 3 months later comparing two groups: (a) satellite broadcast (n=116), and (b) traditional classroom (n=196)		Groups A and B significantly improved knowledge, agreement, self-efficacy, and adherence, but no difference between the groups.

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Endnotes

[1] Consult The Commonwealth of Learning at http://www.col.org/col.htm or the International Centre for Distance Learning at http://www-icdl.open.ac.uk/ for various past and present health and medicine distance education programs.

[2] For a more thorough review of the different types of media and their advantages and limitations, consult Long and Kiplinger 1999.