http://www.icde.org.
iCDL (International Centre for Distance Learning). (1999). International Centre for Distance Learning [on-line]. Available: http://www-icdl.open.ac.uk.
Kato, H., (1997). Distance Education in Japan [on-line]. Available: http://www.chubu.ac.jp/inst/professors/webdoc12.htm.
Kinneman, G. (1997). Familiar themes: Future trends for computers in education. *Technology and Learning, 18*(1), 34.
Larson, M.R., & Bruning, R. (1996). Participant perceptions of a collaborative satellite-based mathematics course. *The American Journal of Distance Education, 10*(1). 6–22.
Laws, R. (2000). alt.education.distance FAQ [on-line]. Available: http://www.faqs.org/faqs/education/distance-ed-faq.
Lintz, M., & Tognotti, S. (1995). Distance education on the WWW. *Distance Education on the WWW* [on-line]. Available: http://tecfa.unige.ch/lintz/staf14/staf14+ST/projet.html.
Maddux, C.D., & Johnson, D.L. (September/October, 1997). The World Wide Web: History, cultural context, and a manual for developers of educational information-based Web sites. *Educational Technology,* 5–12.
Marchessou, F. (1999). From instructional technology (IT) to open and distance learning (ODL): A brief overview of educational technology in Western Europe, *Educational Technology Research and Development, 47*(1), 113–123.
Monbusho. (Japanese Ministry of Education). (1999). Efforts to Address Informatization, Efforts in the Field of Education, [on-line]. Available: http://www.monbu.go.jp/aramashi/1999eng/e10/e10-2.htm.
NCET. (1996). Desktop Video Conferencing [on-line]. Available: http://www.ncet.org.uk/gensheets/desktop-vc/vcintro.html.
NIME (National Institute of Multimedia Education). (2000). NIME at a Glance, Our Focus, [on-line]. Available: http://www.nime.ac.jp/index-e.html.
OSCAIL, The National Distance Education Centre (1999). OSCAIL, The National Distance Education Centre [on-line]. Available: http://www.dcu.ie/ncec/conten.html.
OTE (Observatory of Technology for Education in Europe). (1994). Observatory of Technology for Education in Europe [on-line]. Available: http://tecfa.unige.ch/tognotti/ote.html.
Potashank, M., & Capper, J. (1998). Distance education: Growth and diversity, Finance & Development [on-line]. Available: http://www.worldbank.org/fandd/english/0398/articles/0110398.htm.
Schneider, E.L., Glass, S., & Henke, M. (1997). Distance learning in gerontology: The future is here. *Generations, 21*(3), 46–49.
UNED (Universidad Nacional de Educatión a Distancia). (2000). Universidad Nacional de Educatión a Distancia [on-line]. Available: http://www.uned.es.
University of Texas. (1998). Distance education: A primer. [on-line]. Available: http://www.utexas.edu/cc/cit/de/deprimer.html.
Virkus, S. (2000). Distance education as a new possibility for librarians in Estonia [on-line]. Available: http://www.shef.ac.uk/is/publications/infres/paper20.html.
Webopedia. (March, 1998a). What is the Internet? *Guide to Cyberspace 6.1.* [on-line]. Available: http://www.eit.com/goodies/www.guide/guide.03.html.
Webopedia. (March, 1998b). Videoconferencing. *PC Webopedia Definition and Links.* [on-line]. Available: http://www.pcwebopedia.com/videoconferencing.htm.

## Wireless Technologies: A Knowledge Opportunity in Developing Countries

*by Robert Hayden, Rod Rientjes, Wendi Ryder, and Ross Wall*

□ Visualize a United States Peace Corps volunteer named Shem, equipped with the customary supplies for visiting the area, including his new cellular phone, as he enters a remote village in West Africa. Previous assessments of the area have shown that the crop production is much lower than it should be for an area such as this one that has fertile soil, good weather, and a long growing season. Shem, utilizing his agricultural training, concludes that the irrigation system needs a change. Realizing that such a change by the local farmers could potentially affect the productivity of the entire region, he outlines a plan to upgrade the irrigation system. He then uses his cellular phone to send his plan via e-mail to regional headquarters, nearly 350 miles to the north. Within a few hours, he checks his e-mail, finds valuable feedback on his plan, and immediately begins work on the system. This imaginary setting represents ways in which a knowledge opportunity can be delivered via wireless technology to developing countries around the world.

The purpose of this article is to look at current knowledge transfer technologies that allow for a more efficient use of the digital world and to

determine how these wireless technologies may be used more effectively to transmit vital knowledge to third-world countries. It is hoped that preliminary findings will lead to a better understanding of how wireless technologies potentially may be configured to reach an even greater number of learners in developing countries than are being reached now. This understanding may be accomplished as answers are developed to the following questions:

1. With current telecommunications technology, is it really possible to reach anyone anywhere in the world who is willing to tap into the digital world?
2. Is it likely that each individual residing in a third-world country will be able to receive knowledge using wireless technology in the very near future?
3. Is it feasible to exchange knowledge with third-world citizens by piggybacking onto the medical community technology infrastructure already in place?

## Can We Really Reach Anyone in the World?

Prior to telecommunication as we know it today, many financially enabled students from developing countries traveled abroad to gain a university education. Some returned to their native countries to try to improve the knowledge base at home. Later, governments and private entities funded some of those who were without sufficient means to travel abroad to study yet who demonstrated academic competency. As the returning students began to fill positions of leadership in the social, educational, economical, and political realms of their respective societies, a need to increase educational opportunities for the masses grew. Efforts were made by these new leaders to localize their training by setting up in-country schools, however again the percentage of those affected was seldom above 10% of the college-aged population. To address this apparent need, third-world educators and educational leaders from the first world countries began to examine ways to deliver an educational experience to developing countries, concluding that a greater number of potential learners could be reached through distance education technologies. Winthrop Carty, Senior Development Officer for New Programs and Technology Initiatives, stated, "We are now witnessing a convergence of interest between the U.S. university community and the educational needs of students in developing countries" (2000).

Many systems for distance education have evolved in response to this need. Some systems use an "asynchronous" delivery model while others systems use "synchronous" delivery models. Examples of an asynchronous delivery model are found in paper-based correspondence courses that are delivered through postal services. Delivery models that are considered synchronous are found in audio links. In addition, opportunities to learn are delivered through real-time audio and delayed slow-scan television. Synchronous deliveries also are seen in real-time audio and television. As these systems have developed, it has been the more economically advantaged citizens around the world who have benefited for the most part. Thus the first question arises: With current telecommunications technology, is it really possible to reach anyone anywhere in the world who is willing to tap into the digital world?

## Will Third-World Residents Be Able to Use Wireless Technology?

Historically the North American Indians used smoke signals to communicate at a distance. Other ancient societies likewise developed ways of communication, which seem primitive to us now, however were actually quite ingenious. The universal human desire to communicate and transfer knowledge eventually evolved into the development of such media as radio and television, which were initially intended to deliver educational opportunities to listeners and viewers. In addition, the telephone is a well-known communication device that has evolved from a wire construction base to one of the major applications of wireless technology. Producers of radio and television programs bring together and deliver asynchronous educational opportunities over the airways or through cables and trust that the listener and viewer will be tuned

in. Telephone technology, however, provides synchronous interaction wherein two or more individuals engage in a real-time exchange. As these more advanced means of communication have evolved, more progressive societies have benefited directly. Devices are developed, infrastructures are installed, and a knowledge opportunity exchange is the result. The economic stability and political atmosphere of many nations have largely determined the extent of their success in exposing their citizenry to a level of communication adequate to keep pace with that of first-world countries.

It could reasonably be assumed here that an increase in the number of students in third-world countries, as may be the desire of the third-world leaders, would not possibly be realized because of the infrastructure installation dilemma of developing countries. This is a real obstacle to making such learning available in these countries. Several problems arise when contemplating the installation of an information infrastructure in third-world nations. A few of the most apparent difficulties are limited budgets, primitive and unreliable telecommunications and power systems, and the scarcity of trained personnel. So what is the solution? Though in reality there may not be a single solution, Clayton R. Wright suggests that:

> Wireless technology is a solution. As many developing countries have discovered, there is no need to install expensive telephone infrastructures. Cellular phones represent a major technology leap. Where there was once no communications infrastructure, almost overnight a highly advanced system is in place. With the arrival of wireless technologies, the potential to move communication beyond economical borders and develop [irrigation systems] has become a reality. (Wright, 1997)

The "instant infrastructure" potential of wireless technology contrasts dramatically with worldwide communications delivery efforts of the past. During the mainframe data storage years, many educators were frustrated because of an inability to send data at high rates of speed. This apparent bottleneck negated the idea that knowledge opportunities could be effectively delivered via technology to third-world countries. And although radio has been used in these countries to deliver various kinds of educational materials, a significant level of knowledge transfer has not been realized. In addition, the overwhelming cost associated with hardwiring the third-world countries may be another reason why only the affluent and gifted have the opportunity to pursue educational options.

In sharp contrast to technologies requiring an extensive infrastructure, current developments in technology allow information to be exchanged at an unprecedented rate via wireless communication. Wireless means are rapidly seeping into every affluent realm of society and even beyond, leapfrogging over language, social, and ethnic barriers. Existing technology allows users to browse the Internet, receive e-mail, and send and receive wireless Web update and text messaging on their personal cellular phones. Enhanced mainframe computing as a central storage unit coupled with wireless technologies can enable knowledge to be sent to the gifted and the affluent as well as to average knowledge seekers. Wireless technology has the potential of breaking through economic, cultural, and political barriers worldwide to bring knowledge opportunities to the most isolated and economically bereft of communities.

As an example, graduating seniors at the Massachusetts Institute of Technology (MIT) have not only created but also successfully tested three minisatellites that possess the potential of moving massive amounts of wireless information. These satellites are called spheres; each is roughly the size of volleyball. "Rather than fly one large, expensive satellite, the idea is to network together several small ones, much like how computers progressed from large mainframes to networked PCs," says MIT Associate Professor David W. Miller. The application of interest is the capability of creating a telescope with higher resolution than the current Hubble. This is achieved by stringing multiple satellites across the sky outfitted with mirrors for refracting. Clearly then, current technological developments provide for a more complete wireless society that can handle the delivery of video and voice streaming over the next few years, hence yielding the potential to bridge economic boundaries and provide wireless communication to every person desiring knowledge opportunities, regardless of location or economic

status. Hence the second question: Is it likely that each individual residing in a third-world country will be able to receive knowledge using wireless technology in the very near future?

### Can We Piggyback on Medical Community Infrastructure?

Most importantly, and at the most basic level, what are the implications of wireless technologies for knowledge seekers in developing countries? Knowledge seekers in third-world countries will begin at the most basic level, where illiteracy can be overcome. Once younger knowledge seekers begin to see the importance in understanding, a more advanced learning can take place. Regardless of whether the knowledge opportunities are communicated in English or in the native tongue, there is a greater literacy potential through wireless technologies than through current hardwired infrastructures. In many instances a native-language format has been used successfully as a form of delivery for third-world medical assistance. For example, the World Association of Medical Editors (WAME) uses the World Wide Web to assist editors in developing countries and editors of small journals, who often face special obstacles such as difficulties obtaining high-quality manuscripts, lack of formal training in editing, limited finances, and limited access to publication expertise. Thus the third question arises: Is it feasible to exchange knowledge with third-world citizens by piggybacking onto the medical community technology infrastructure already in place?

Without having to hardwire developing countries, political leaders and educators can enhance knowledge opportunities through wireless communication technologies. Efforts by the various world communities can provide both the structure and the opportunity for knowledge sharing in developing countries. If literacy levels in reading, writing, computing, and telecommunications are raised, a confidence level will be born that will extend a renewed promise to all those who wish to communicate either synchronously or asynchronously with the world. □

Robert Hayden is a doctoral student in Instructional Technology at Utah State University. He is an assistant professor at Brigham Young University-Hawaii Campus and Department Head in Information Technology.

Rod Rientjes, Wendi Ryder, and Ross Wall are pursuing their master's degrees in Industrial Technology at Utah State University.

### References

Carty, W. (2000). [Accessed, April 19, 2001]. http://www.laspau.harvard.edu/aragon.htm.

Wright, C. (1997). Educational technology consulting in developing countries. *Techtrends,* January/February, 35–40.

## Participation in International Teleconferences and Discussions: Implicit Assumptions

*by Elizabeth Anderson, Jacques du Plessis, and Tom Nickel*

□ Interest in distance learning is strong all over the world. The debate underway in developing nations and technologically advanced countries alike concerns the role distance learning programs should play in the increasingly complex task of educating a nation.

In the United States, the question can be explored directly through thousands of projects in industry, as well as in the universities. For developing nations, this kind of hands-on learning about new instructional delivery methods often is not a convenient option. The telecommunications infrastructure may not be in place to support it, or it may be prohibitively expensive to use. A measure known as *teledensity* (telephone lines per hundred people) tells the story—among developing countries the teledensity is 1.5, in Europe it is 45, and in the United States it is 65 (Ivala, 1999).

Until direct access is cheap and simple, strategic planning for institutions is much more difficult and demands greater creativity. In higher education, dialogue with peers who have easier access to technology can ever replace direct experience, but it still might play a useful role in planning for distance education in developing