

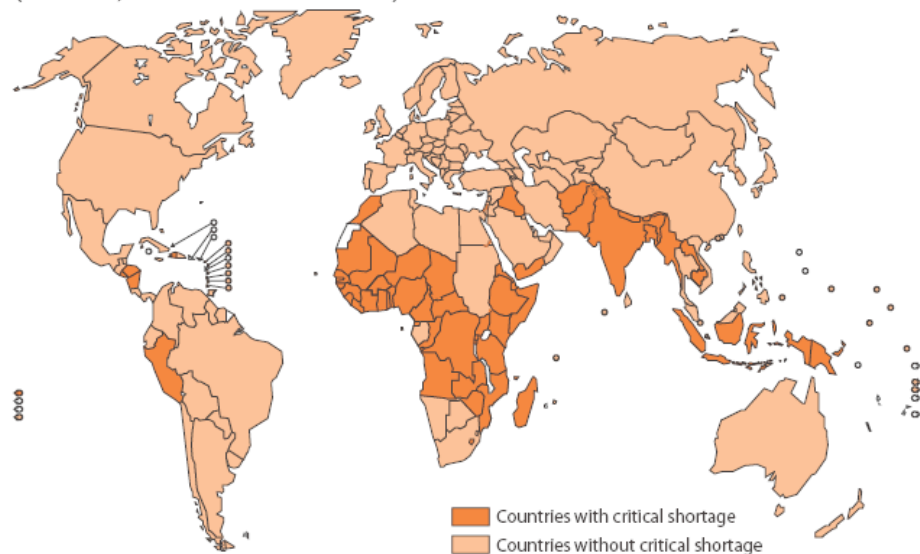
Using Digital Libraries and Web-Conferencing to Support Human Resources for Health
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As stated in the 2006 WHO *World Health Report*, “At the heart of each and every health system, the workforce is central to advancing health.... There is ample evidence that worker numbers and quality are positively associated with immunization coverage, outreach of primary care, and infant, child and maternal survival.” Medicines, facilities, and medical technology are only effective if there are trained health workers to use them. As importantly, cost-effective preventive services require adequate numbers of trained health workers who have the appropriate range of knowledge and skills.

There is currently a shortage of more than four million health workers in 57 developing countries, 63% of them in Africa. One quarter of physicians and one in 20 nurses trained in Africa currently work in the 30 most industrialized countries, those countries already containing 90% of the world’s health resources.

Throughout the world, health worker shortages are aggravated by skewed distributions within countries and by movements of health workers from rural-to-urban locations, from public-to-private settings, and to employment outside the health sector. In developing countries, the health worker crisis is further exacerbated by insufficient training, by limited opportunities for professional advancement, and by feelings of isolation from colleagues.

Countries with a critical shortage of health service providers (doctors, nurses and midwives)



Data source: World Health Organization. Global Atlas of the Health Workforce (<http://www.who.int/globalatlas/default.asp>).

Existing resources, practices, and policies are grossly insufficient to address the health workforce crisis. WHO estimates that more than 140,000 health workers need to be trained annually for the next 20 years just to meet minimum current needs. Unfortunately, the most optimistic estimates of training output for developing countries, such as those in sub-Saharan Africa, range from 10 to 30% of what is required. Therefore, in addition to providing immediate personal health care for those at risk of death and disability, long-term, sustainable improvements in global health can only be achieved by building health system capacity and, in particular, developing and expanding the health workforce.

In recognition of this critical need to expand the number of health workers globally, the World Health Assembly in May, 2006, passed resolution 59.23, “Rapid Scaling Up of Health Workforce Production.” This resolution includes the following statement:

2....(4) to encourage and support Member States in development of health-workforce planning teams and use of innovative approaches to teaching in developing countries, with state-of-the-art teaching materials and continuing education through the innovative use of information and communications technology....

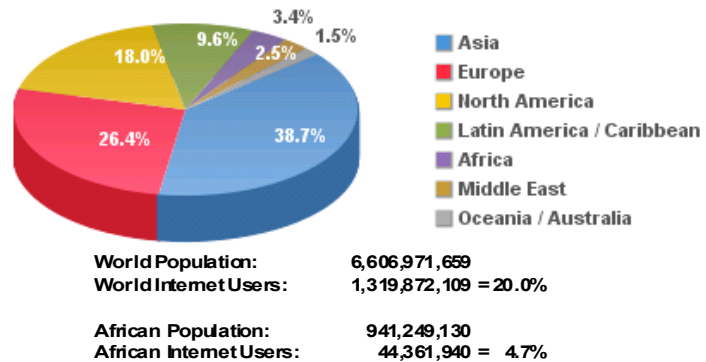
(Ninth plenary meeting, 27 May 2006 – Committee A, sixth report)

The Internet and Health Worker Training

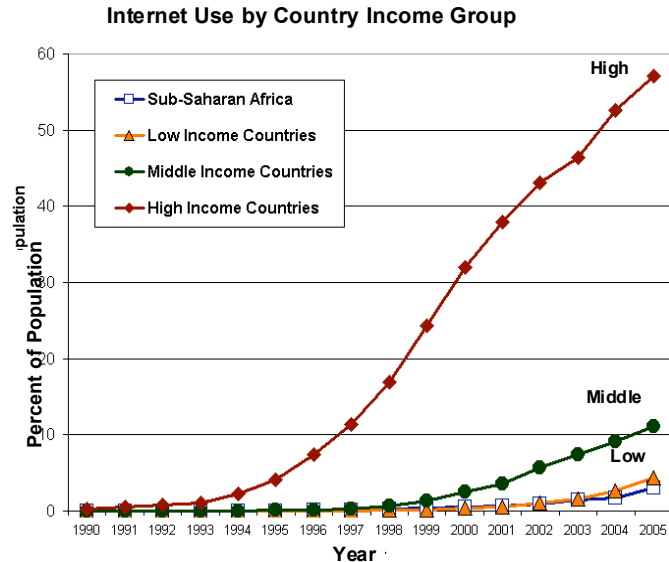
Health professionals and health educators in developed countries have come to expect rapid and widespread access to health information and health education resources as an everyday fact of life. Easy and relatively inexpensive access to the Internet, along with the rapid digitization of information, provide a wide range of formats for information delivery and exchange. These include email, internet searches, chat rooms, list-serves, voice-over-IP, video streaming, and web-conferencing, among others. Although this “information revolution” will continue to have a major impact on the dissemination of health information and health education in developed countries, the impact has been only marginal in most developing countries.

Although 20% of the world’s population uses the Internet, its use is far from being equally distributed among regions (see adjacent figure). In particular, the fact that less than 5% of the population of Africa has access to the Internet is highly relevant to addressing the critical shortages of health workers there.

**World Internet Users
December 2007**

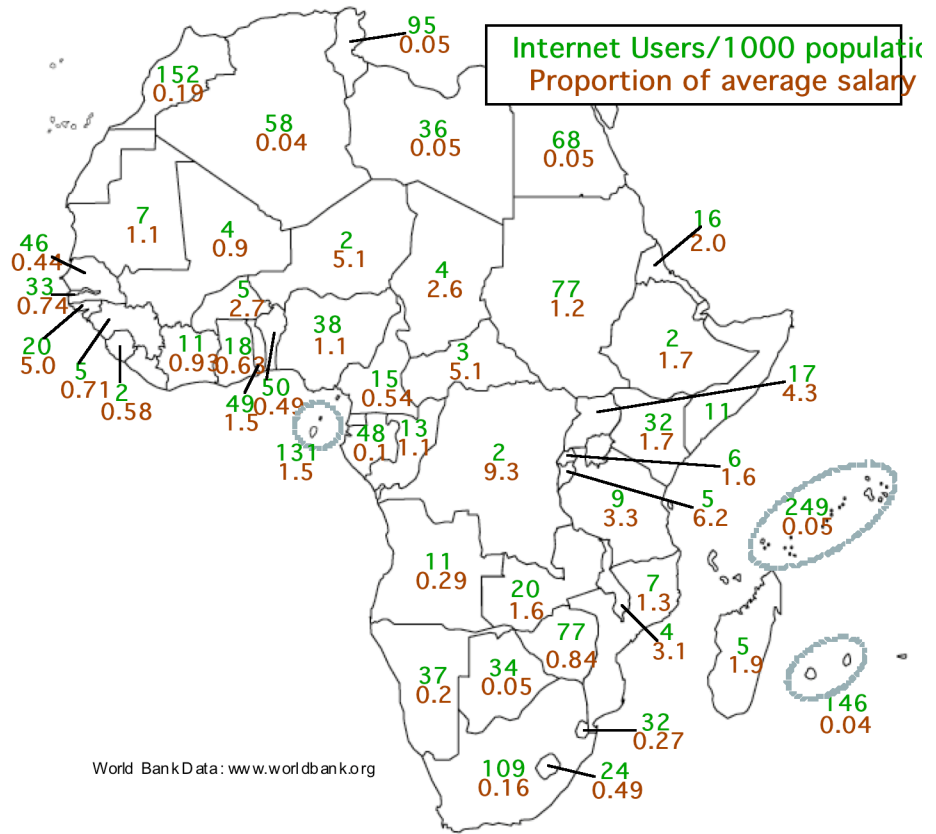


Income level is a major determinate of how much access any country has to the Internet. The adjacent figure indicates the significant disparities between high-, middle-, and low-income groups of countries. As of 2005, the percent of Internet users ranged from 57.1% in high-income countries to 11.1% in middle-income countries to 4.4% in low-income countries. For the group of sub-Saharan African countries, only 3.0% of the population was reported to use the internet. A recent World Bank report analyzed Internet diffusion across 199 countries over 14 years. All available data and evidence indicate that Internet use in low-income countries is not likely to undergo dramatic increases in the near future. According to the recent World Bank report, “A simplified simulation indicates it would take low-income countries more than 50 years to close the digital divide.”



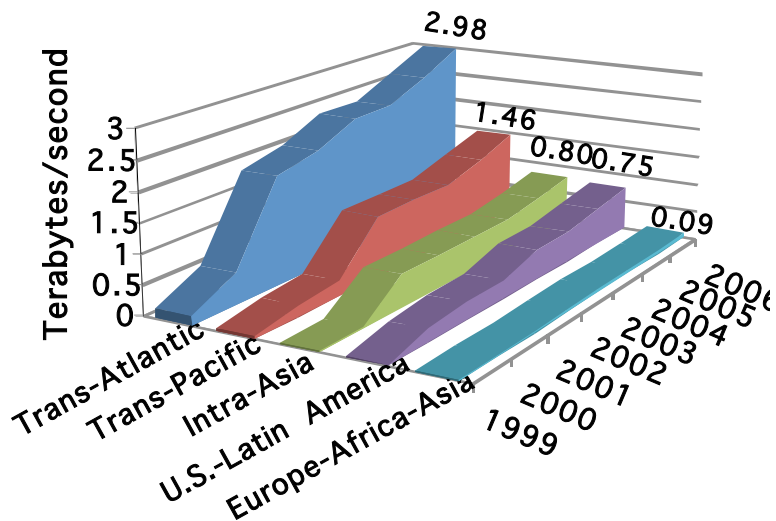
Even with great international pressure and the recognition of the value of Internet access for economic development, there are still significant obstacles. There continues to be the great promise that access to the Internet will help countries to “leapfrog” forward and catch up with more developed countries. But, despite significant efforts and investments, there is little evidence that this is occurring, or is likely to occur, to any significant degree. According to recent analyses, only a few, wealthier countries have had any success in leapfrogging the classic pattern of diffusing new technology.

Even where the Internet exists in developing countries, it is usually extremely expensive. The adjacent figure shows the number of Internet users along with average cost of an internet connection for most of the countries in Africa. The data in the figure indicate that the northern-most and southern-most countries tend to have more Internet users and obtain their connections at lower relative costs. Also, in general, some coastal countries, particularly on the west coast of Africa, have somewhat greater access and relatively lower costs. This pattern is easily explained by the fact that these countries are in closer proximity to the submarine cables that carry the Internet around the world.



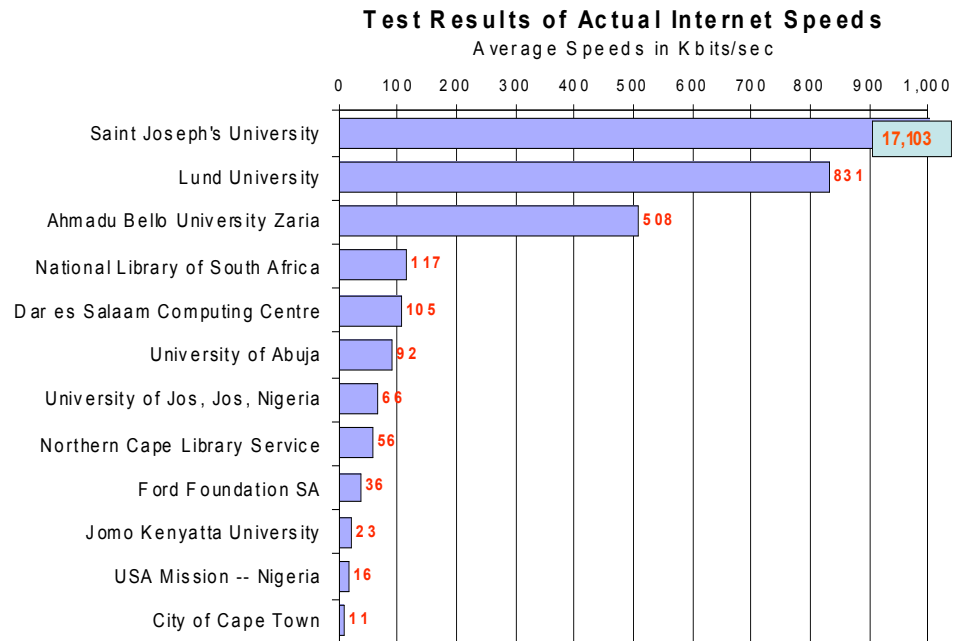
The capacities of the submarine Internet cables that provide information exchange with Africa are hundreds of times less than capacities in other regions of the world. In 2005, the cables between the US/Canada and Europe had a capacity of 668,757 megabits/second (Mbps) compared to only 2,364 Mbps between the US/Canada and Africa and 4,159 Mbps between Europe and Africa. By comparison, the capacity of the cables between the US/Canada and Asia was 307,318 Mbps. Between US/Canada and Latin America the capacity was 100,943 Mbps. Submarine Internet cable capacity has not changed significantly in the last several years, although there are some efforts underway to increase cable capacity, including capacity to Africa. However, once the cable capacity is increased, there will be the need to develop the land-based infrastructure for provision and distribution of Internet services. According to a World Bank Institute survey, the state of ICT infrastructure in African universities can be summed up as “too little, too expensive, and poorly managed.” The survey report goes on to say that “the average African university has bandwidth capacity equivalent to a broadband

Submarine Internet Cable Ca



residential connection available in Europe, [and] pays 50 times more for their bandwidth than their educational counterparts in the rest of the world.”

Given the current state of Internet technology, it is not surprising that service in sub-Saharan Africa, where it is available, is often slow and unreliable. This is especially the case in non-costal interior countries. The figure on the right shows the results of tests of actual Internet connection speeds at a number of institutions, many in sub-Saharan Africa. These results indicate the actual, connection speeds as experienced when downloading a document file. In all cases, these measured speeds are substantially less than the connection speeds that the institutions think they are purchasing from the Internet service provider. This is true in nearly all countries, but is a much bigger factor in sub-Saharan Africa.



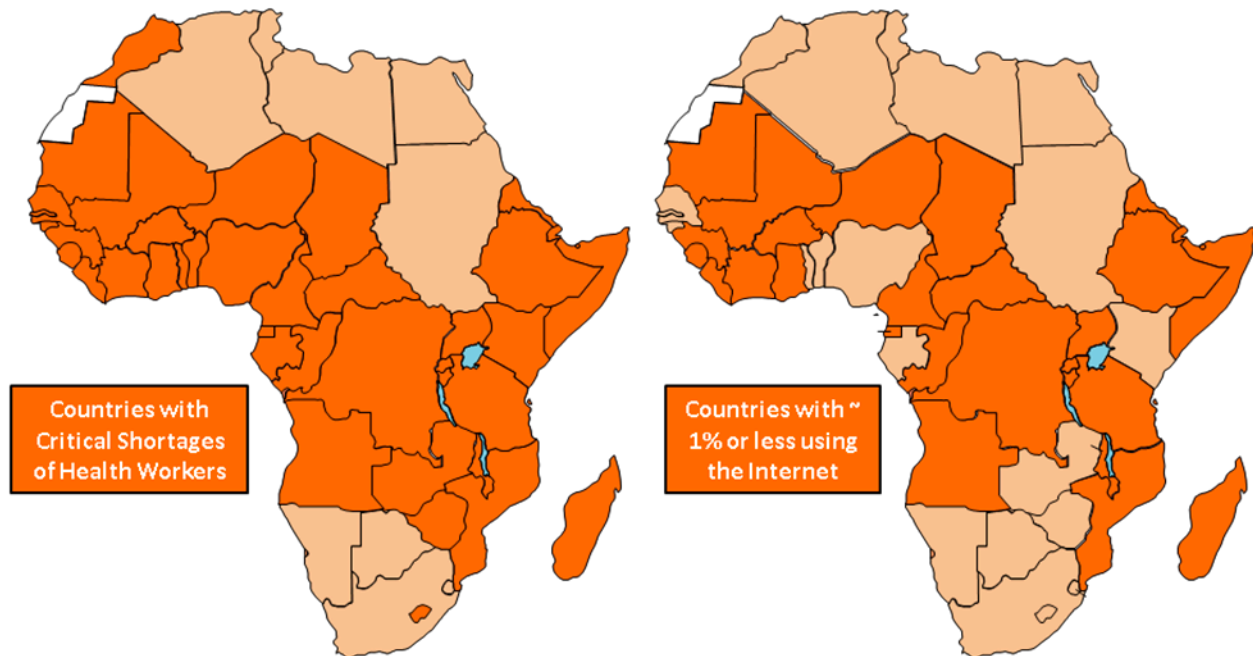
Reliability tests, in which various Internet servers are repeatedly contacted (pinged), indicate the following about Internet connections in sub-Saharan Africa: (1) they very rarely function twenty-four hours each day, seven days a week; (2) most struggle to deliver service six hours daily; (3) there are frequent lapses of a day or more and occasional lapses of a week or more; and (4) failures of external connections account for 70% of the connection problems.

Human Resources for Health – Information Communications Technology (HRH-ICT) Paradox.

The available information makes it clear that Internet access in sub-Saharan Africa can be characterized as: extremely limited, excessively costly, and highly unreliable, where it is available. Furthermore, the history of the development of the Internet and the lack of infrastructure to support Internet technology, including sub-marine cables, indicate that current conditions are not likely to change dramatically in the near future. As stated earlier, it will take decades to close the “digital divide” in low-income countries.

If we juxtapose a figure indicating the African countries with the most critical shortages of health workers with a figure indicating the African countries in which 1% or less of the population has access to the Internet, we arrive at what can best be described as the “Human Resources for Health – Information Communications Technology (HRH-ICT) Paradox.”

Simply stated: “Countries with the most critical needs for health workers tend to be those countries that have the least access to information resources via the Internet.”



For many agencies and organizations in developed countries, providing health information and educational resources using the Internet has become the standard approach. This makes it difficult for many people to envision circumstances or institutions where there is not instant and unlimited access to the world’s health knowledge. As is clear from the above discussion, circumstances “on the ground” are much different in most developing countries, especially in those countries that are the most information-poor. Complying with the World Health Assembly resolution for Rapid Scaling Up of Health Workforce Production “*through the innovative use of information and communications technology*” necessitates partnerships and methods which are based on current realities rather than on an Internet-centric view of how health information and health education should be delivered. It seems certain that wasted effort and disappointment will result if we assume that the information infrastructure that exists in developed countries of the “north” (Europe and the US) currently does, or soon will, exist in developing countries in the “south”. Unquestionably, it is true that the “Internet is coming” to places like sub-Saharan Africa. But its arrival will take time and significant investments while the need to provide health information and health education is urgent.

Training Health Workers: Alternatives and Opportunities

For several years, the College of Public Health at the University of Iowa has been developing the concept of a Global Health Campus with the goal of using information and communications technology to disseminate critically needed health information and to train health workers where they are most needed, in developing countries. The general guideline has been to focus on information and communications technology that is the most appropriate for each institution and situation.

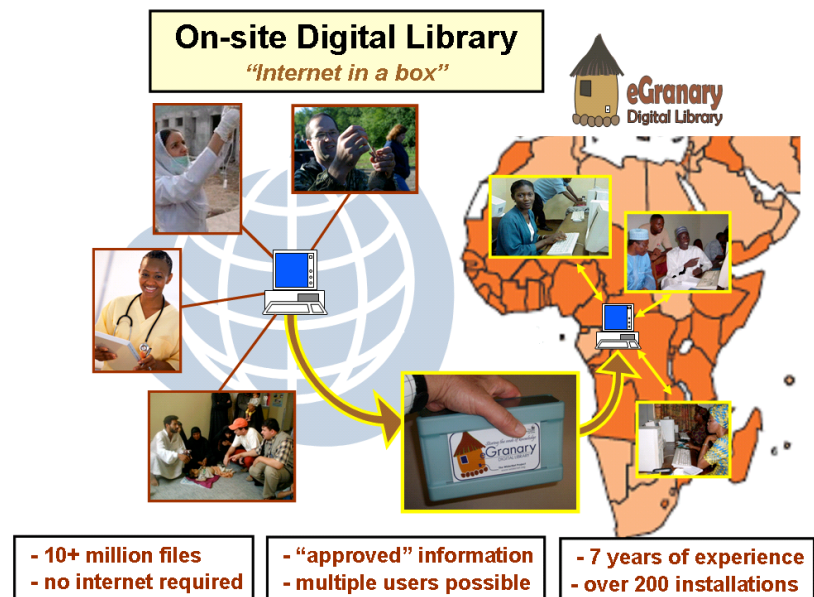
The overall scheme of the Global Health Campus Initiative is to establish a Network of Education & Resource Centers that can serve as the information infrastructure or “backbone” for supporting the provision of information and education on the full range of health topics in an efficient, cost-effective,

collaborative manner. The characteristics that have guided the formation of the network are that it needs to be country-led, scalable, sustainable, based on international cooperation, and supportable through multiple partners and mechanisms. It also needs to make maximum use of information and communications technologies that have been proven to work in developing countries.

An Education & Resource Center (ERC) is an entity that can take many forms, adapting to a number of settings and circumstances as determined by local resources and needs. However, the core components are envisioned to be the same in each ERC: (1) an on-site (eGranary “internet in a box”) digital library, providing multiple users with instantaneous access to millions of documents and educational materials; and (2), where feasible, on-line, real-time connections to outside resources by means of low-bandwidth web-conferencing. The figure below lists some of the important features of these two proven technologies, making them especially suitable, at this time, for use in developing countries.

On-site Digital Libraries

The eGranary digital library is a collection of more than ten million electronic files, including copies of websites, textbooks, journals, multimedia presentations, and a whole array of resource materials on a wide range of topics. These materials have been gathered from thousands of credible sources and organizations, including materials provided by more than 800 authors and publishers who have contributed copyrighted material to this collection. All of this information is easily searchable and is contained on a computer disc drive that is physically delivered to institutions in developing countries that have no internet connection, or, at best, have a very limited and/or expensive connection. EGranary digital library resources are immediately available twenty-four hours a day, every day of the year, at virtually no cost to the user. The digital library can take many physical forms, ranging from a simple single-user (USB-compatible) disc drive to a server-based version that provides a local area network connection for hundreds of information seekers. The library materials can be updated using a number of methods, with monthly deliveries via CD as the most common method. The value of the eGranary digital library is best described in the words of its users.



"eGranary Digital Library has been a great bridge in the digital divide for us in the University of Jos in Nigeria. It has served the purpose of bringing the Internet to our doorsteps. We've had problems with bandwidth cost, paying about \$6,000 monthly for a bandwidth of 128/64. We've had to put other expenses on hold in order to pay for bandwidth that is not very reliable."

--Dr. Stephen Akintunde, Librarian, University of Jos, Nigeria

"I want to thank you for this great initiative which, from the African perspective, is a real godsend."

--Professor Peter John Opio, Kampala International University, Uganda

“The eGranary Digital Library has helped our students and lecturers in accessing academic materials which were not easily accessible due to limited bandwidth. It has become part and parcel of our e-learning platform.”

--Nyaga Gacheru, Jomo Kenyatta University of Agriculture & Technology, Kenya

“The idea is simply GREAT! We are trying to promote it in Bangladesh, especially in educational institutions providing higher studies in remote areas.”

--Mr. Mizanur Munna, Positive Bangladesh Initiatives

"I've been showing off the eGranary at several places in Haiti.... Thanks for your wonderful efforts on behalf of people in undeveloped places."

--Sister Marie Vittetoe, Milot, Haiti

On-line Web-conferencing

Over the last three years, the University of Iowa has invested considerable resources in the capability to do live web-conferencing over slow and less reliable internet connections, providing interactive communications to locations that were previously thought to be unreachable. This web-conferencing capability makes the maximum educational use of whatever limited, and usually expensive, connectivity that an institution in any developing country might have.

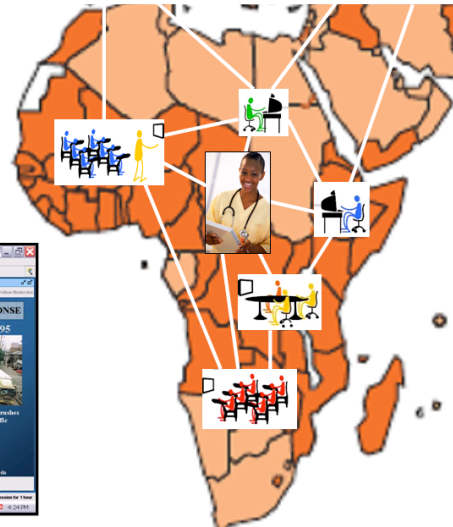
In addition to conducting traditional lectures and meetings with multiple participants in many countries, this system can support patient consultations, including live video images and a limited set of medical information and diagnostic test results.

Currently, the University of Iowa has the capacity to handle as many as 100 simultaneous connections (configured into any number of groupings) anywhere in the world where there is at least a minimally functioning internet connection. In 2007, this system supported over 1,500 hours of connection time for more than 900 web-conference participants in 57 different countries, most of them low-income countries.

For example, the Education & Resource Center at Aga Khan University in Nairobi, Kenya, is supporting and expanding the training of nurses and midwives. It is a combined effort of the World Health Organization, the Aga Khan Development Network, Nottingham University in England, the Czech Republic Ministry of Education, the University of Iowa, and other partners. Both students and faculty at this Center are using the eGranary digital library as a primary source of health information and educational resources. Additionally, they are using low-bandwidth web-conferencing capabilities in several of their programs. For example, in a recent 18-month period, the four Aga Khan University nursing programs in Kenya, Uganda, Tanzania, and Pakistan were routinely connected to each other, and to a total of 82 different Internet sites, for a total of 377 hours of connection time. A single connection

Low-bandwidth Web-conferencing

- High resolution graphics
- Two-way audio
- Video window capability
- Uses slower-speed internet
- Multi-site capability
- Recordable
- Interactive features & tools



site at any of the four institutions often included a classroom of nursing students who were participating in a lecture being provided by a nursing instructor in one of the other countries, with the opportunity for everyone to see, hear, and ask questions from any of the four sites. The faculty members at these institutions also frequently use the web-conferencing system for on-line planning and administrative meetings, with significant savings of time and money. The computer program that makes all of this possible is located at the University of Iowa with the signals are being routed half way around the world in real time.

As a second example, the WHO Knowledge Management for Public Health program, KM4PH, has been using the University of Iowa web-conferencing system since it was first introduced at a seminar in Geneva in May, 2005. Since then, under the leadership of Dr. Alena Petrakova, a globally dispersed group of Public Health professionals and institutions has conducted numerous web-conference sessions ranging from monthly presentations, which have originated from five different continents, to a three-part Global Forum on World Health Day in 2006. In total, 653 distinct Internet sites from over 50 developing countries have connected to KM4PH web-conference sessions over a recent 18-month period.

Additionally, these sessions have stimulated a number of constituent groups to begin conducting their own web-conference sessions on a regular basis. These groups include the World Federation of Public Health Associations, the World Dental Federation, the U.S. National Institutes of Health Fogarty International Center, the American Public Health Association, the Canadian Public Health Association, the Afro-European Medical and Research Network, the Public Health Education Network in KwaZulu-Natal Southern Africa, and others. The KM4PH effort also introduced this particular form of low-bandwidth web-conferencing to the PAHO regional office, which used the University of Iowa system on a trial basis before deciding to pursue identical capabilities dedicated to their region.

In March, 2008, a KM4PH web-conference originated from the First Global Forum on Human Resources for Health in Kampala, Uganda. The two-hour session was attended by 15 Forum participants who engaged in discussions with others from 21 remote locations including the Philippines, India, Pakistan, and South Africa, to name just a few.

Education and Resource Center Network

In practice, an Education & Resource Center is most likely to be a location with 20 or more computer workstations connected to an eGranary-based local area network (LAN) that provides immediate, local access to millions of educational resources. If there is an Internet connection available, these same workstations can also provide web-conferencing connections to a vast array of courses, teachers, and consultants from any other location in the network, that is, any one of hundreds of other ERCs and partnering institutions. In some instances, such as in small remote locations, participants in the network might use an individual computer supported by a single-user eGranary digital library and, where possible, connect to other network members via web-conferencing. Our vision is that this Global Network will eventually include Education & Resource Centers at hundreds, and then thousands, of public health and health care training institutions.

Using these two technologies, every site that is part of this worldwide network will have access to the same up-to-date health-related materials as every other site. These combined capabilities allow for rapid, widespread distribution of local content that originates from any Center and any associated institution or organization, either in the “north” or the “south”, thus serving as a dissemination and “publishing” platform for new information and educational materials that would be otherwise unavailable. This network also provides the opportunity for real-time teaching and consulting among the Centers and for timely responses to unexpected events, such as disasters and disease outbreaks.

The combination of an on-site eGranary digital libraries and on-line web-conferencing provides many important attributes and advantages for disseminating health information and for training health workers. These attributes and advantages include, but are not limited to, the following:

- The network uses proven technologies and methods that can be implemented rapidly for an immediate impact at both new and existing institutions and schools. It builds on, not replaces, current resources and contributions by previous and current donors.
- Centers are country-led with distributed leadership.
- The network can provide opportunities for international cooperation to build capacity through twinning/partnering arrangements between institutions in developing and developed countries.
- The network can provide both technical and instructional support mechanisms including technology training, consultations on instructional design and curriculum development, and input from content and curriculum advisory groups.
- Because of its regular update mechanisms, the eGranary digital library can serve as a source of current, comprehensive health information. The update mechanisms also allow for rapid dissemination (“publishing”) of locally produced materials to other Centers in the global network.
- Centers can provide web-conferencing facilities with live multi-site communication and information exchange among Centers and with twinning/partnering institutions.
- Centers can interact on a topical basis (e.g., malaria, prenatal care, etc), on a professional specialty basis (e.g., nursing, dentistry, etc) and/or on a geographical basis (e.g. East or West Africa).
- The network provides for easy expansion to a wide range of health-related topics, as well as to professional organizations, governmental agencies, NGOs, etc.
- As part of a larger network of Centers, funding for one health-related topic or group is automatically “leveraged” by funders who are supporting other Centers in the network because of their interest in other topics. All information is distributed to all Centers and any Center in the network can connect by web-conferencing to any other Center(s) to share knowledge and expertise on any health topic.
- Being part of a larger network allows for more objective evaluations and more efficient research functions, as well as participation in the larger group’s efforts and experiences in planning for sustainability and continued support.

The feasibility and value of the proposed Education and Resource Center network have been clearly demonstrated through development work on both the digital library (over the past 7 years) and the internet-based web-conferencing system (over the past 3 years). More than 200 eGranary digital libraries are currently installed in developing countries. Likewise, as described above, the University of Iowa has been providing low-bandwidth web-conferencing to health-related institutions in more than 50 developing countries. Because of this extensive groundwork, expansion of the Global Education and Resource Center Network can proceed rapidly and efficiently to have an immediate impact on the need for more health workers in developing countries. The current partner organizations, and many others, are already actively participating in this initiative and have joined in numerous meetings, discussions, demonstrations, and trials to formulate and refine this effort “from the bottom up”. The Network now appears to have the important characteristics of being country-led, scalable, sustainable, based on international cooperation, and supportable through multiple partners and mechanisms.