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Addressing the Global Digital Divide and its Impact on Educational Opportunity

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Abstracts

This article examines the global digital divide, with tables of data that document the wide disparity between the world's information-rich and information-deprived. Its fundamental causes and ramifications for the world's poor are examined, with an emphasis upon how it affects educational opportunity. Critical challenges associated with addressing this problem are discussed, and some misguided past efforts to introduce instructional technology into developing regions are reviewed. Then, some potentially successful strategies for utilising educational technologies in developing settings are explored, including appropriate project design, funding issues, skill development programs for schools, new forms of distance education, and the establishment of tele-centres that can expand educational opportunities in a variety of ways.

Considérations sur la fracture numérique globale et son impact sur les possibilités d'éducation
Cet article examine la fracture numérique globale à l'aide de tableaux de données qui illustrent le large fossé qui sépare les pays riches en informations et ceux qui en sont dénumis. Les causes Fondamentales et les ramifications pour les « pauvres » sont examinées, l'accent étant mis sur la facon dont elles affectent les possibilités d'éducation. On étudie et discute les challenges critiques associés à ce problème ainsi que les efforts mal concus dans le passé pour introduire la technologie de l'éducation dans les pays en voie de développement. Ensuite, on explore des stratégies potentiellement réussies pour élever le niveau de la technologie dans l'éducation y compris des projets soigneusement planifiés, des suggestions pour le financement des programmes de développement des aptitudes, de nouvelles formes d'éducation à distance et la prolifération des centres de Téléenseignement qui peuvent offrir des communications, des formations et des occasions de développement.

Betrachtungen zur globalen digitalen Kluft und ihren Auswirkungen auf Bildungschancen
Dieser Artikel untersucht die globale digitale Kluft auf der Basis von Datentabellen, die die grosse Ungleichheit zwischen dem gut informierten Teil der Welt und jenem Teil der Welt ohne Zugang zu Informationen dokumentieren. Es werden die wesentlichen Gründe und ihre Auswirkungen auf die Armen dieser Welt untersucht, besondern hinsichtlich ihrer Chancen auf Bildung. Kritische Herausforderungen bei der Behebung dieses Problems werden besprochen und frühere fehlgeschlagene Versuche, Lerntechnologien in den Entwicklungsländern einzuführen, werden neu überdacht. Darüber hinaus werden potentiell erfolgreiche Strategien zur Verbesserung der Bildungstechnologie erörtert im Zusammenhang mit einer vorsichtigen Projektplanung, Möglichkeiten der Finanzierung und der Errichtung von Telezentren, die Kommunikations-, Trainings- und Weiterbildungsmöglichkeiten anbieten.

One of the world's most serious problems is the widening gap between rich and poor, wherein a small percentage of the global population enjoys unprecedented affluence amidst widespread global poverty that may actually be getting worse. One aspect of this disparity in wealth is the digital divide, the enormous differences in access to modern information and communications technology (ICT). Millions across Africa, Asia, and Latin America struggle daily to survive in dire poverty, while others in the industrialized world enjoy the conveniences provided by modern communications technologies, work in offices made more efficient and effective through the use of new technologies, and take advantage of new educational opportunities afforded by ICT.

One of the most unfortunate by-products of the digital divide is its negative impact on educational efforts throughout the developing world. Digital technologies provide exciting new opportunities for students in the industrialised world to obtain large amounts of current information on almost any topic, to communicate their

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thoughts in dynamic new ways, and to work more efficiently than ever before possible. Without access to the benefits of ICT, students in less developed countries may fall even further behind their peers in other nations.

Examining the divide

As the new millennium began, those who had accessed the Internet at some point represented only about 5% of the world's population (International Labour Organisation, 2001). Most of this information-privileged minority is found in the world's wealthiest nations. Table 1 demonstrates the percentages of Internet users world-wide by region, as of August 2001.

The global percentages of those who connect online from Africa and the Middle East are minuscule, and Latin America's percentage is very small. North Americans constitute over one-third of users, and Europeans more than one-quarter. Most of the rest are found in Asia. However, a few prosperous centres of Asian business activity account for a very high percentage of this total. This digital divide within Asia itself is clearly demonstrated by the figures reported by the World Bank in Table 2. The categories reported are for personal computers per 1,000 people, telephone lines per 1,000 people, and Internet hosts per 10,000 people.

Table 1 *Global Internet utilization*

Region of the World	Internet Users (millions)	Global Users
Africa	4.2	0.8%
Asia and the Pacific	144.0	28.0%
Europe	154.6	30.1%
Middle East	4.6	0.9%
Canada and the USA	180.7	35.2%
Latin America	*25.3*	*4.9%*
World Total	**513.4**	**100%**

Nua Ltd. (August 2001). Internet Users World-wide
www.nua.com/surveys how_many_online/index.html

Table 2 *ICT indicators in Asia*

Country	PCs/1000	Phones/1000	Internet /10,000
Cambodia	–	2	0
KoreaPDR (No.)	–	47	–
Hong Kong, China	254	558	120
Indonesia	8	27	1
Japan	237	503	133
Republic of Korea (So.)	157	433	40
LaoPDR	–	6	0
Malaysia	59	198	21
Myanmar	–	5	0
Peoples' Rep. of China	9	70	0
Philippines	15	37	1
Singapore	458	524	208
Taipei, China	159	524	141
Thailand	22	84	3
Vietnam	6	26	0

World Bank (2001) *World Development Indicators Database*, Washington, DC: World Bank.

The world's largest continent is a microcosm of the global digital divide. Japan, South Korea, Taiwan, Hong Kong and Singapore have attained high levels of ICT access. But small impoverished nations like Cambodia, Vietnam, Laos, Myanmar, and North Korea have negligible levels of ICT activity. Within large countries like the People's Republic of China (PRC) and Indonesia, ICT is mainly available in a few urban centres. In other developing areas, like Africa, the Middle East, and Latin America, the same digital divide exists between a few major urban centres and the rest of the region, with small privileged minorities connected, while the masses across the region are almost completely without access to telecommunications services.

The divide within

Yet another digital divide exists within every nation, between an affluent minority and the rest of the population. The very limited ICT resources of the least developed countries are concentrated in the hands of a very few, so that ICT access for the vast majority is extremely limited or non-existent. Among Nepal's wealthiest 20% of the population, 11% had telephone access, but among those in the next quintile (60–79th percentile), who are economically better off than most of the population, less than 1% did. For the rest, there was no phone access whatsoever (World Bank, 2000). This aspect of the digital divide needs to be addressed just as seriously as do the aforementioned gaps in ICT development between industrialized and non-industrialized nations. Table 3 shows what tiny percentages of the population in most Asian countries have accessed the Internet. In fact, in two-thirds of these Asian nations, less than 1% of the population has ever used the Internet.

Table 3 *Internet users in Asia*

Country	# of Users	% of Population
Bangladesh	30,000	<1
Bhutan	500	<1
Hong Kong, China	3,460,000	48
India	4,500,000	<1
Indonesia	400,000	<1
Japan	38,640,000	30
Kazakhstan	70,000	<1
Kyrgyzstan	10,000	<1
LaoPDR	2,000	<1
Malaysia	1,500,000	7
Mongolia	3,000	<1
Myanmar	500	<1
Nepal	35,000	<1
Pakistan	1,200,000	<1
Peoples' Republic of China	16,900,000	1
Philippines	500,000	<1
Republic of Korea	16,400,000	35
Singapore	1,850,000	45
Sri Lanka	65,000	<1
Taipei, China	6,400,000	29
Thailand	1,000,000	2
Turkmenistan	2,000	<1
Uzbekistan	7,500	<1
Vietnam	100,000	<1

Nua Ltd. (2001). Internet Users World-wide
www.nua.com/surveys/how_many_online/asia.html

In fact, developing countries are even further behind the industrialized areas of the world in their access to ICT than they are in terms of overall economic activity. For example, a typical member of the Organisation for Economic Co-operation and Development (OECD) has about eleven times the per capita income of a South Asian country, but it has 40 times as many computers, 146 times as many mobile phones, and over 1000 times as many Internet hosts (Rodriguez and Wilson, 2000). The developed world has about a phone for every two people, whereas there are only 1.5 phones for every 100 people in the developing world (International Telecommunications Union, 1999a). Less than 5% of the computers that are connected to the Internet are in developing countries (International Telecommunications Union, 1999b). Unfortunately, this digital divide is also growing. An Index of Technological Progress calculated from many different measures of ICT-infusion, showed that growth in developing countries was 18% from 1994–1999, but was 23% for the developed countries (Rodriguez and Wilson, 2000).

The critical issue of cost

Not only is technology in short supply within developing countries, but the costs for Internet service are often significantly higher than they would be in an industrialized country. In terms of percentage of annual per capita income, Table 4 illustrates how the monthly fees for Internet connectivity in poor countries are prohibitively expensive for most of the population.

Figure 1 also demonstrates how levels of Internet utilization are inversely related to the cost of service, in selected countries around the world. Using per capita comparisons, column one ranks eight nations from highest to lowest level of Internet use, and column two ranks the same countries' Internet service from most expensive to least costly. It is clear that in countries where utilisation levels are lower, corresponding costs for connectivity are higher.

Of course, high costs discourage online access, so this situation is yet another critical aspect of the digital divide problem. Until the costs for Internet service can be reduced in poor countries, levels of online access are not likely to increase very significantly. However, at the moment, the telecommunications services of most developing countries are monopolistic, outmoded, inefficient organizations that provide low levels of service at rates they themselves can establish rather arbitrarily. Deregulation and privatization of telecommunications sectors are very much needed throughout the developing world, to introduce competitive pricing and more efficient models of providing service (International Telecommunications Union,1999b).

Table 4 *Cost of Internet connectivity*

Country	Monthly Charge ($US)	% of Annual Income per Capita
Sierra Leone	50	118%
Uganda	92	107%
Ethiopia	32	77%
Mozambique	29	70%
Guinea	65	45%
Senegal	24	18%
Mexico	94	15%
Turkey	65	13%
Japan	50	3%
Finland	33	2%
USA	29	1%
Australia	24	1%

International Telecommunications Union (1999). *World Telecommunications Development Report.* Geneva, Switzerland: ITU Publishing.

Number of Internet Users	Cost of Online Access
1. Sweden	1. Philippines
2. Canada	2. India
3. Japan	3. Indonesia
4. Malaysia	4. Poland
5. Poland	5. Russia
6. Russia	6. Japan
7. Philippines	7. Sweden
8. Indonesia	8. Malaysia
9. India	9. Canada

Figure 1 *Internet utilization levels and cost of online access (per capita)*
International Labour Organisation (2001). *Life at Work in the Information Economy*, World Employment Report, Geneva, Switzerland: ILO Publishing.

Causes of the divide

The global digital divide problem is a complex phenomenon. When the Global Information Infrastructure Commission surveyed individuals around the world from the private sector as to what they felt were the basic causes of the digital divide, seven factors were identified (see Table 5).

These responses reflect the multifaceted nature of this problem. One set of issues is highly endemic and therefore perhaps the most resistant to change. It involves the culture of many traditional societies, which may oppose the adoption of new technologies whose influences may be perceived as antithetical to their ways of thinking and behaving. Likewise, for these ethic groups, language can serve as a major barrier, making it difficult for them to take advantage of resources available through ICT, which are mainly in English or some other widely spoken language. Of course, some might argue that these groups should be allowed to stay isolated, on the far side of the digital divide, in that the potential effects of globalization brought via modern telecommunications may do them more harm than good (Friedman, 2000).

Poverty is certainly a fundamental factor in the digital divide, and with sufficient funding, other impediments, like weak infrastructure, can be addressed. Underdeveloped telecommunications infrastructures limit ICT access, and their expansion and improvement will open up opportunities for the information-deprived. But other issues may

Table 5 *Obstacles to addressing the digital divide*

Critical Factors	Percentage of Total Responses
Culture	11%
Language	12%
Poverty	17%
Infrastructure	19%
Bureaucracy	14%
Corruption	11%
Protectionism	13%

Global Information Infrastructure Commission Survey (2001) www.giic.org/#survey

interfere with the upgrading of infrastructure and the effective introduction of ICT. An inefficient and corrupt bureaucracy can slow progress and divert much needed funds. Government regulations can make the telecommunications environment so restrictive that reform is discouraged. Potential funders and investors can be deterred by these circumstances, which unfortunately characterize the political systems of many developing countries.

Educational Opportunity: Addressing the digital divide problem in education is a huge challenge. ICT is expensive, while school budgets are generally quite limited. Finding funding for instructional technology is very difficult. Remote rural settings may still lack electrification and telecommunications services or may experience problems, like surges in electrical lines that can damage hardware or low bandwidth connections that make Internet access tediously slow. Finally, telecommunications service may be prohibitively expensive for most of the population (see Table 4).

Finding hardware and software at affordable prices is yet another challenge. Third world schools often purchase used equipment or rely on donated hardware that may be of limited functionality. Likewise, most of the high quality software available comes with a significant price tag, beyond the means of many schools in the developing world.

Another major problem is the lack of technical expertise available in this context.. Finding the technical support to set up systems and repair equipment that malfunctions can be extremely problematic. School administrators and teachers with little experience with technology need some guidance as to how to work with the equipment and how to integrate its use into the curriculum. Student skills with technology will be minimal, so developing their proficiency with ICT will be a challenge (Castro, 1998).

Misguided Methods: In many cases, past projects that tried to bring instructional technologies into the school systems of developing countries were ultimately unsuccessful. Some very poor countries became even further indebted with the considerable costs of technology-based projects that failed to improve their educational systems in any significant way. Consequently, many involved in development work became wary of experimenting with educational technology. Here are some examples of strategies for introducing ICT into poor nations that have generally failed to produce positive results.

One common mistake has been to be overly ambitious and overly optimistic about what technology can accomplish. For example, some projects tried using broadcasting on a large scale to rapidly expand educational systems, only to experience a variety of problems. Teachers were averse to this approach, students soon lost interest once the novelty waned, technical difficulties interfered with the learning process, project management was inept or corrupt, and cost overruns ran up the national debt (Tiene and Futagami,1987). Any effort to expand or improve schools with technology needs to be carefully planned, has to secure the support of all key participants, and must be managed in a cost-efficient manner.

Despite these negative experiences in the past, today many instructional technologists still see ICT as powerful catalyst for change. They advocate bringing the very latest technologies into developing countries to help them quickly 'leapfrog' over certain stages of development that might have taken decades in industrialized nations (Inglesias, 2000). New wireless systems are sometimes seen as a way to avoid the labour and expense associated with installing and maintaining wired telecommunications systems. Optical disks can replace books and alleviate the need for publishing enterprises. Virtual universities can substitute for building new college campuses.

But while new developments in ICT can be effective for certain applications, the wholesale adoption of new technologies will be extremely difficult for developing countries. High tech solutions cannot readily be implemented in societies with little previous exposure to technology and committing to technology as a solution can backfire. It is advisable for developing countries to look carefully before they attempt to leapfrog.

On the Bleeding Edge: Another classic mistake in adopting instructional technologies is to become infatuated with owning the very latest technology. Many school administrators cannot resist purchasing the most sophisticated hardware available (Cawthera, 2002). As a result, fewer units can be obtained for the school than if less expensive models had been selected instead. Unfortunately, many of the advanced features of such systems may be little used by the average student. In addition, brand new equipment may not run older software or interface with older peripherals. In trying to be on the 'cutting edge', many have found themselves instead on what is sometimes called the 'bleeding edge'.

Many school administrators focus too heavily upon equipment acquisition, failing to understand that hardware purchase is only the *first step* in developing a successful school technology program. Software acquisition or

licensure is another very important consideration. Management of technology resources and technical support are also critical factors. Finally, if teachers are not effectively trained to work with technology, utilization levels in laboratories and classrooms will remain low. Many schools have seen their investments in hardware largely wasted, with the machines sitting unused for the most part.

Underestimating the significance of the teacher's role in any technology plan can be a critical error. In the past, there were attempts to produce 'teacher proof' technology, that would not depend upon a teacher to oversee its implementation. The instructor's level of interest, technical competence, or ingenuity in integrating the technology into the curriculum would thereby not be a critical issue. However, such approaches were largely unsuccessful. The most dynamic applications of ICT are those facilitated by a teacher who is prepared to take full advantage of its potential and able to apply technology in creative ways.

Sensible Strategies: Technology has too often been a solution in search of a problem. Or technology has been applied to problems it could not effectively address. As dynamic as many of the new forms of ICT can be, technology is no panacea for educational ills. It needs to address clearly defined problems and set appropriate, attainable objectives.

The scope and scale of a technology-based project should be reasonable. In fact, it usually makes sense to pilot test the approach with small groups before embarking upon the full scale effort. Ongoing evaluation can help address problems as they arise. Ultimately, sufficient scalability is critical to any project that hopes to make a significant impact. But growth needs to be carefully guided at a pace that allows for adjustments to specific circumstances and consideration of new developments that may impact implementation.

ICT projects that hope to address the digital divide need to control costs. Older technologies are likely to be less expensive and more widely available than newer forms of ICT. For example, radio has been a cost-effective instructional medium in many poor countries, especially in remote rural areas where it may be the only widely available technology. In fact, radio can be *more* effective than text materials for largely illiterate audiences. Likewise, television can be an effective medium, especially for the millions of urban poor whose TV sets receive local broadcasts. Older technologies have the advantage of being already familiar to users, so training may not be as significant an issue. In many cases, a 'multiple media' approach is probably the most effective way to approach the digital divide challenge.

Another strategy for maximizing investments in ICT is to use equipment round-the-clock. In many places, school computer laboratories have been opened in the evening for community use, as training facilities for those who wish to develop their technological literacy. Arranging for multi-purpose utilization can be an organizational challenge. But multi-user, multi-purpose projects are the best way to involve the most people in ICT-based activities and to thereby reap the maximum benefit from an investment in ICT.

Sources of Funding: Addressing the digital divide has a serious catch associated with it. How do you provide technology for poor people, to help them catch up, when ICT is so expensive that they cannot afford it? Probably the most critical challenge associated with the digital divide phenomenon is finding funding for projects. Support for projects can come from a variety of different sources, as indicated by members of the private sector on the aforementioned Global Information Infrastructure Commission survey (see Table 6).

One traditional source of funds is donors, including philanthropists, governments, or development organizations willing to give money or loan money, either interest-free or at very low rates. International assistance organisations have begun many technology-based projects over the decades. But sustainability is a major issue with most of these efforts. When the demonstration phase of the project ends or the 'seed money' is used up, many technology projects in developing countries have ceased operation. This 'soft money syndrome' has plagued development efforts for years. Many projects have ceased to function shortly after the departure of specialists from overseas who initiated them, because locals lacked the expertise to competently oversee their operation. Indigenous staff need to be trained to take charge of these projects, so that they are able to flourish and ultimately have some meaningful impact.

Another potentially significant source of financial support can be partnerships established with non-government organisations (NGOs) or enterprises in the private sector. Corporations share some common interests with educational institutions, especially at the university level, in terms of research, training, and even product testing. Many technology firms are interested in marketing themselves in the developing economies of the Third World. As a way to begin building contacts, corporations may be willing to donate equipment, provide software discounts, offer professional advice, etc. While multinationals can make for good partners because of their extensive resources, there are also some advantages to partnering with indigenous start-ups in the technology

Table 6 *Funding sources for addressing the digital divide*

Type of Source	Percentage of Total Responses
Philanthropy	12%
Government	19%
Foreign Aid	12%
Development Organisations	14%
Civil Society	13%
Non-Government Organisations	13%
Private Sector	18%

Global Information Infrastructure Commission Survey (2001)
www.giic.org/#survey

field. For example, in some places, local ICT firms provide training for fees in public school facilities on equipment they donated to the school, an arrangement that suits both parties (Anzalone, 2000).

Key roles for technology

What strategies might most effectively facilitate efforts to address the digital divide? One critical focus might be to involve the most critical players in the most influential sectors of the educational system. One example of this approach is the World Bank's Global Development Learning Network, which uses ICT in a variety of ways, both online and via teleconferencing, to provide workshops and seminars for those in positions of influence throughout the developing world

To enhance the role of ICT in developing education systems, the initial emphasis should probably be on higher education and secondary schools, especially technical schools, since these institutions will be directly involved in training the ICT specialists of the future. School administrators need to be made aware of ICT's potential, and dynamic teachers need to take leadership roles in helping their colleagues work with technology. Eventually, the focus can shift to earlier grade levels, so as to gradually develop basic technology skills throughout the entire school-aged population.

How can technology most effectively improve educational practice in developing parts of the world? One critical area to address might be school administration. Many schools in developing regions are poorly run. School principals in impoverished, rural schools could benefit from the availability of a computer to produce word processed documents, to calculate budgets and salaries on a spreadsheet, or to keep records in a database. Access to telecommunications services could allow administrators to email colleagues and share ideas. They could also benefit from Web-based resources on effective school management, curriculum development, and leadership skills.

ICT can also provide critical information resources desperately needed by teachers and students. Video can provide footage from around the world for students who may have never travelled outside their own villages. An electronic encyclopaedia on CD-ROM may have more information on it than many of the tiny school libraries in the developing world, and its pictures, sounds, and videos can help arouse interest in a wide variety of topics. Access to the World Wide Web would also have great potential, providing a huge source of information on nearly any subject imaginable. Originally developed at the World Bank, the WorldLinks program has facilitated Internet access for over five hundred secondary schools in developing countries, by helping fund equipment purchases, overseeing connectivity and training teachers (McGhee and Kozma, 2001).

Expanding educational systems

Technology-based distance education projects already play a crucial role in expanding educational opportunities throughout the developing world. The so-called 'mega-universities' generally modelled on the British Open University, deliver instruction via mailed materials, radio and television broadcasts, and now over the Internet, to

Table 7 *Mega-universities*

Country	Institution	Students	Graduates/yr.	Cost/credit($US)
China	China TV University	530,000	101,000	40
India	Indira Gandhi Open U.	242,000	9,250	35
Indonesia	Universitas Terbuka	353,000	28,000	15
Iran	Papayme Noor University	117,000	7,583	25
Korea	Korea National Open U.	210,578	11,000	5
South Africa	University of South Africa	130,000	10,000	50
Thailand	Sukhothai Thammathirat	216,800	12,583	30
Turkey	Anadolu University	577,000	26,321	10

Daniel, J (1996). *Mega-Universities and Knowledge Media: Technology Strategies for Higher Education*, London, UK: Kogan Page.

hundreds of thousands. In fact, eight of the world's ten largest universities systems are in developing nations (see Table 7).

Many teachers in developing countries are trained through distance education projects, there by addressing previously existing shortages in the teaching profession. In addition, DE has helped provided continuing in-service education for teachers, so that underqualified teachers can improve their techniques and upgrade their levels of certification (Wang, 2000). Distance education projects may also help provide secondary school education where few such schools exist. Even at the primary level, projects like the United States Agency for International Development's Interactive Radio Instruction help teach special subjects like English or science with broadcasts wherein students actually respond to prompts from the voice of a teacher, heard on the radio (Capper, 2001). With the ongoing proliferation of radios, televisions, and computers, greater numbers of students in developing countries will be able to take advantage of DE courses in the future.

Web courses are world-wide

In the past decade an exciting new way to learn at a distance has evolved: the online course. With the right computer connections, university students in developing countries can now take coursework from overseas institutions and can even obtain a degree, entirely online (see Figure 2). This new, expanded access to college

Africa	
African Virtual University (AVU)	www.avu.org
University of South Africa	www.unisa.ac.za
L'Université Virtuelle Francophone (UVF)	www.uvf.org
Asia	
Europe and Central Asia Virtual University	www.developmentgateway.org/subsites/EuroAsiaUniv
Online Education, Hong Kong	www.online.edu/about/index.html
Latin America	
Instituto de Tecnológico y de Estudios Superiores de Monterrey (ITESM), Mexico	www.ruv.itesm.mx
Facultdade Pitagoras, Brazil	www.pitagoras.combr

Figure 2 *Virtual universities in the developing world*

coursework may significantly benefit countries whose higher education systems can still only accommodate a small percentage of the population.

Training in all kinds of job skills is also now being provided on the World Wide Web. Thousands can develop new competencies and obtain certifications by means of Web-based courses. Large multinationals sponsor online training and certification programs in ICT skills. One successful such program is the Cisco Academy for networking-related training, which works with local partners to help recruit students and deliver its extensive online program of courses for network specialists (Anzalone, 2000).

Scores of new e-learning firms are being established around the world to furnish training but one real concern at this point is quality. Many new Web-based courses and programs have no accreditation, so there are few guarantees as to the quality of the instructional experience (Bollag, 2001). Also, much of the potential of online training will remain untapped until greater numbers are given access to the Internet. Here is yet another important reason why the global digital divide situation needs to be addressed.

The tele-centre approach

As documented at the beginning of this article, millions around the world remain without access to basic telecommunications services. These people have never even made a telephone call and probably would be amazed to see what is available on the World Wide Web. Scores of international assistance organizations are working on this problem, many of whom can be located at online clearinghouses like Global Knowledge and Development Gateway. The World Bank has established a fund called Info Dev to support innovative projects of all kinds that seek to address these communications problems and to provide sources of information and education for the information-deprived (Knight-Moore, 2000).

Hundreds of community 'tele-centres' have been established around the world by a variety of different organisations. A typical tele-centre might be equipped with telephones, a fax machine, a printer, a copier, and a computer with Internet access. Many rural professionals have used these services to share expertise in addressing local problems. Information available on the World Wide Web has also helped local professionals in a variety of fields, including health, agriculture, manufacturing, and education.

Some tele-centres have been designated as Community Learning Centres (CLCs), in that their primary purpose is to train locals in a variety of skills designed to help them improve their living conditions. Programs include development of literacy, training in numeracy skills, disease prevention practices, agricultural improvement, and other types of non-formal educational experiences. Through such tele-centres, basic education can be provided to those who received little or no schooling when they were younger.

A divide to be conquered

Some may feel that traditional cultures should be left in isolation, so that their value systems and customs remain undisturbed. However, most communities have appreciated modern conveniences given the opportunity to acquire them. Access to modern telecommunications and information resources can open up new opportunities and potentially improve millions of lives around the world. Some of the projects that have contributed significantly to addressing the digital divide, along with the organisations that have sponsored them, are listed in Figure 3.

Project	Internet Address
WorldLinks (World Bank)	www.worldbank.org/worldlinks
Global Development Learning Network (World Bank)	www.gdln.org
Global Knowledge	www.globalknowledge.org
Development Gateway	www. developmentgateway.org
Info Dev (World Bank)	www.infodev.org
Telecenters (Int'l. Development & Reconstruction Centre)	www.idrc.ca/telecentre
LearnLink (U.S. Agency for International Development)	www.aed.org

Figure 3 *Projects addressing the global digital divide*

It will take the efforts of scores of such organizations and hundreds of projects to gradually bring information and communications technologies to the vast regions of the world that have existed for centuries without exposure to modern technologies. There are no simple solutions to the digital divide problem. But probably the worst possible approach is to just ignore it, because it is only likely to get worse. For as long as millions remain without the technology to communicate effectively, obtain information they need, and become better educated, conditions of poverty will continue to prevail across most of the planet.

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Biographical note

Drew Tiene is a Professor of Instructional Technology at Kent State University in Ohio. His recent book entitled Exploring Current Issues in Educational Technology examines a series of important issues associated with how to most effectively use new technologies to improve instruction (www.mhhe.com/tiene). He has worked with instructional technology in a number of overseas settings, including Japan, the Philippines, Thailand, Hong Kong and China, and he recently completed a consulting assignment with the Asian Development Bank on the digital divide problem.

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