Digital Divide: The News Is Not All Bad
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Abstract

For education in the United States, the term Digital Divide refers to differences in quality and richness of information technology and communication services that are available to students, teachers, and schools in rich and not-so-rich communities. This variation in quality has clear implications for the quality of education that students receive, which will affect their productivity as citizens and the quality of life that they will lead.

The educational opportunities using traditional methods and older technologies are, never the less, available to all young people. The difficulty faced is that newer technologies replace older technologies and usually require change to well establish methods. In the United States, the largest expense and effort goes to this clash between old and new ways of doing things. The best telecommunication infrastructure, for example, might not be deployed because abandoning an older infrastructure may have major social, economic or political implications. Although technological development is extremely rapid, its adaptation to better serve education to overcome the Digital Divide is relatively slow.

For much of the rest of the world, the Digital Divide separates those who have access and those who do not have access to technology. In developing countries, the divide could make it impossible for a portion of the population to acquire adequate education to participate in the global economy. Many governments recognize this problem and have begun to put in place infrastructure, systems, and services that will serve education. Infrastructure and systems are costly but the cost is rapidly decreasing. The provision of associated services, including content provision, is by far the most difficult and expensive.

The developing countries have several advantages. First, the infrastructures that are being built could take advantage of the latest in technology and avoid the massive cost of supporting multiple competing technologies. Second, the systems developed to support students and teachers could be open systems allowing for a multiplicity of vendors and...
organizations, including local businesses, to provide enhancement and support. Third, the content and services created at considerable cost in the developed countries could be made available over the Internet at no cost or at a fraction of the actual cost.

In this presentation we will argue that, although the Digital Divide between the developed and developing nations is real, proper policies adopted by governments and international economic development organizations could provide developing nations with the opportunity to more easily overcome the Digital Divide.

Introduction

The Digital Divide not only separates the rich from the poor, replicating the existing divide between those attuned to the computer age and those not, along lines of class, wealth, and ethnicity, but it also erects a new hurdle for the poor: in an age where economic development is increasingly characterized by the centrality of knowledge and education in general and science and technology in particular, the poor are once again left out by inadequate education systems and deprived of the skills that would improve their economic prospects.

Two technologies will dominate the future of information processing and telecommunication. The Internet has become the primary means for sharing information. The computer, in all its forms, has become the source for organizing and presenting content. The developed counties are the primary beneficiaries of the Internet and the networked computer systems. But we will present a more upbeat argument today, one that finds that the proper approach to using new technologies in education could reduce costs substantially and make a difference to effective education. We base our argument partially on a four-year old technology project in the Chicago area.

The good news is that knowledge is a public good. Thomas Jefferson once said: "He who receives an idea from me, receives instruction himself without lessening mine; as he who lights his taper at mine, receives light without darkening mine." Of course some information used in formation of knowledge are not pure public goods, and are protected by intellectual property rights. But in general knowledge has many characteristics associated with a public good, and if we can improve transfer of knowledge to the developing world, with all the externalities associated with it, the world as a whole would benefit.

International development agencies have launched a number of admirable initiatives to transfer knowledge about development to those who need it most. The World Bank has brought together, through the "Global Development Gateway," the private sector, international agencies, governments and non-governmental organizations -- into a Web portal on development issues. This "Global Development Network" fosters collaborative work among research institutes, policy makers and donors to encourage capacity building. The "Global Knowledge Partnership" is an evolving, informal partnership of public, private and non-governmental organizations in both developing and developed countries, for sharing information, experiences and resources to promote broad access to knowledge and information as tools for sustainable development.
The point to be made about technology is that technological infrastructure and systems are costly, of course, but that their costs are rapidly decreasing. They represent a much lower cost than building physical infrastructure, such as roads or power lines. The associated services, including the creation of content, remain by far the most difficult and expensive.

The developing countries have several advantages. First, the infrastructures that might be built can take advantage of the latest in technology and avoid the massive costs of innovation, development and early deployment of applications, as well as the costs of supporting multiple competing technologies. Second, the systems that provide services to students and teachers could be open systems allowing for a multiplicity of vendors and organizations, including local businesses, to provide support. Third, the content and services created at considerable cost in the developed countries could be made available over the Internet at no cost or at a fraction of the actual cost. In our experience in Chicago, we have found that the only technology training required for teachers is the ability to use a Web browser. The tools used in Chicago are designed to support the well-understood and established activities of teachers, while allowing experimentation and innovation.

**The Chicago Experience**

The present technology support model in the Chicago area schools, as is the case elsewhere in the United States, is based on a number of PCs connected to a local area network that is connected to the Internet. In this model the schools have the burden of supporting all of these technologies. In addition, most applications used by teachers and students are locally supported. Finally, the content is typically created locally. In spite of substantial funding for technology, this model is too expensive to be sustainable; the result is that technology only marginally impacts education.

Four years ago, a team at Northwestern University began a project, with private support, to find a better model to provide technology support to schools. The Collaboratory Project now serves some two hundred schools and over one thousand teachers in Chicago and its suburbs. It allows teachers and students to collaborate on projects of interest across the region. It helps support established curricular activities in novel ways. It provides simple to use but sophisticated tools to teachers and students. The only technology needed at the schools is a device that can run a Web browser. All servers, software, tools and contents are run, maintained and kept at Northwestern University.

The project provides a number of collaboration communities that meet teachers' interest. Three examples of these collaborative communities are:

- **Internet Book Club** - Teachers can share projects and assign materials to read and share book reviews, stories, essays and poems written by their students. They can also search a database of projects done by other teachers, adopt and modify them or propose collaboration.
- **The Science Connection** - Science teachers have available resources for science projects and can develop projects with other teachers across the Internet. Learning by doing science is
supported. Teachers can ask questions from volunteer practicing scientists.

- The Music Connection -- Music teachers develop music composition projects. Students exchange music compositions as MIDI files and play and discuss those compositions with other students or teachers. Professional composers and music education faculty at the University participate in discussion and review of compositions.

An example of an easy to use tool is the Survey Studio, which enables teachers to create surveys, collect data, analyze and present data. This tool keeps track of surveys designed by teachers and allows teachers to share survey instruments or collaborate with other teachers to jointly perform surveys. The Collaboratory integrated communication services including messaging, conferencing, discussion forums, invitations, instant messaging and calendars.

Further description of the Collaboratory Project is provided at collaboratory.nunet.net/.

A System and Services Model

Copying the historical system and services model in the United States or other developed countries may not be the best approach for most developing countries. The successful model must be inexpensive to develop and sustain. It must not depend on the availability of massive technological support. And it must not further burden schools and teachers with a new set of issues.

We believe the Collaboratory Project may have lessons for the development of a right model for supporting teachers and schools in the developing countries. The elements of this model are:

- Building a national education network as a virtual high-speed network on the national network infrastructure. The cost of developing such a network will be low if the network technology is designed with convergence of voice, video and data in mind. The cost of the education network will be low because a single real network is maintained for supporting commerce, communication, entertainment and education.

- Mass-produced, simple devices to browse the Internet are coming to market at rapid rates and are far cheaper than PCs. They require very little maintenance and no local software or technical support.

- Limiting computing to one or more major data centers that host all applications, run servers, and provide on line support to all schools from a remote location. This eliminates the massive and redundant on-going cost that schools will otherwise face.

- Making available specialized intuitive tools to bring value to teachers. Thereby, making it possible to eliminate the need for training teachers or students. At the same time, allowing easy sharing of contents generated and managed by these tools.

- Mechanisms created by International organizations to borrow and
Situation in East Asia

What we have said is applicable to all developing countries. We believe that there are specific institutional features in East Asia, derived from decades of "catching up" to the West, that can be utilized for technological "leapfrogging."

There is a time-honored argument in economic development literature that points to the "Advantages of Backwardness." Alexander Gerschenkron famously argued that when nations lack developmental pre-requisites, they need "substitutes," most often in the form of inventive institutions.

The greatest economic success story of the second half of the twentieth century was the East Asian exploitation of its "advantages of backwardness," as governments mobilized societies along specific developmental goals. Facing the Digital Divide, some of the same governments have risen to the occasion, energizing their populace to catch up with the West in information technology and education. Often governments have been at the center of national campaigns.

The late Chinese premier, Deng Xiao Ping once said, "It does not matter whether the cat is black or white, so long as it catches mice." For countries with a long tradition of state-directed industrialization, the IT-based catching-up is likely to be state-generated. For countries without such traditions, and with a great deal of budget constraints, the campaign is likely to take a different form---say, a reliance on foreign partners.

In the East Asian "developmental states," governments are cognizant that they have a role to play in education, and they seek to encourage the kind of creativity and risk-taking that the entrepreneurship requires. They want to create the institutions that facilitate ideas being brought into fruition, and a regulatory and tax environment that rewards this kind of activity.

The state-led model is exemplified by the policies undertaken in Japan, South Korea, Singapore and Malaysia, and of course they bear the birthmarks of the past developmental policies. Japan has a comprehensive policy toward the so-called "knowledge-emergent society," for which its IT Strategy Council recommends national strategies, with the goal being to secure world competitive leadership in the 21st century.

Interestingly, Japanese policy for IT and education is being devised in tandem with fiscal policies designed to reflate Japan. The former Prime Minister Obuchi had a special budgetary framework, where a total of Y120.6 billion was allocated for targeted science and technology oriented activities, called the Millennium Project.

Korea, which, like Japan, has had a long history of multiyear plans, came up with a six year strategic plan (1997-2002) for establishing infrastructure and encouraging the use of information and communication technology in education. The emphasis is on equipping all classrooms with a multimedia network system, providing computers, developing educational software, and implementing virtual education.
Singapore perhaps has the most sophisticated plan. Its "Master Plan for IT in Education" is geared toward enhancing linkages between the school and the world around it, and is more insistent than the plans in Japan and South Korea on the importance of creative thinking, lifelong learning, and social responsibility. In other words, "Asian Values" are taking on a new, creative hue reminiscent of teachings of John Dewey. "Thinking Schools, Learning Nation," is the government's vision for Singapore's education in the 21st century.

The Singaporeans want to copy the vaunted Japanese "learning" that takes place in companies and the shop floor, but where education is concerned, the Singaporeans favor the American approach. Malaysia, which is perhaps the only significant "developmental state" in Southeast Asia, has its "Vision 2020," "Multimedia Super Corridor," and "Smart Schools," even though some 1,200 schools in Malaysia still do not have electricity.

The People's Republic of China, on the other hand, does not have the tradition of these developmental states, nor does it have governmental resources for introducing information technology in education. So it relies on what Aya Yoshida has called "Joint Venture Model," where virtual universities are established by organizations in collaboration with overseas universities, and with the private sector. The size of China also militates against a large IT-based national plan.

Thailand, with its "IT Projects for National Development," falls in between the two models that we discussed, as does the Philippines.

**Conclusion**

We want to emphasize that the developmental experience of the last half-century in East Asia should provide a platform for the new strategy of technological leapfrogging in education. Policies adopted by governments could make a major difference in affordability of new technologies.

We believe there is much to learn from selected experiences gained elsewhere in the World, such as the Collaboratory Project, where technology is used to empower teachers; where teachers' burdens are reduced rather than increased; where schools need not become computing centers to use technology; and, where collaboration among students and teachers across a country or the world is routine.

Development agencies such as the World Bank or the Asian Development Bank will do well to invest in strategy development, technology architecture specification, educational planning guidelines, and dissemination of success stories.