8.1

ISSUES AND CHALLENGES RELATED TO DIGITAL EQUITY

Paul Resta
University of Texas at Austin, Austin, TX, USA
Thérèse Laferrière
Laval University, Quebec, QC, Canada

Introduction

Digital equity is a source of concern for those who understand the power and role of the Internet and digital technologies in the emerging knowledge-based society (Castells, 2001; Compaine, 2001; Norris, 2001; Organisation for Economic Co-operation and Development (OECD), 2001; Selwyn, 2004; Tolbert et al., 2003; United Nations Development Program (UNDP), 2001). However, many people across the globe do not have access to the Internet and related technologies resulting in a new form of digital exclusion often thought of as a "digital divide." The global concern is reflected in the following statement by the World Summit on the Information Society (WSIS) of the United Nations Educational Scientific and Cultural Organization (UNESCO) in Tunisia in 2005: "*We underline* the importance of removing barriers to bridging the digital divide, particularly those that hinder the full achievement of the economic, social and cultural development of countries and the welfare of their people, in particular, in developing countries" (WSIS, 2005, p. 1, article 10).

The term digital divide refers to "situations in which there is a marked gap in access to or use of ICT devices" (Campbell, 2001, p. 1). Gorski (2005) indicates that a digital divide exists when group's access to digital technologies and resources differs along one or more dimensions of social, economic, cultural, or national identity. Individuals are subject to social exclusion depending on age, gender, differing abilities, income, education and skills, location, language, and culture (Sen, 1999). For Warschauer (2004), "digital solutions" do not come without consideration of the complex factors, resources, and interventions required for supporting social inclusion. In 2002, he suggested to replace the notion of the digital divide by the alternate concept of technology for social inclusion:

J. Voogt, G. Knezek (eds.) *International Handbook of Information Technology in Primary and Secondary Education, 765–778*.

> Meaningful access to ICT encompasses far more than merely providing computers and Internet connections. Rather, access to ICT is embedded in a complex array of factors encompassing physical, digital, human, and social resources and relationships. Content and language, literacy and education, and community and institutional structures must all be taken into account if meaningful access to new technologies is to be provided (p. 2).

As noted by Warschauer (2002) and Sciadas (2003), there are many variations and levels of access, and they suggested that those concerned should be thinking of a gradation instead of a divide between those who can use IT to access, adapt, and create knowledge and those who cannot. However, we chose to keep the term digital divide in the title of this section as it continues to focus scholars', citizens', and policy makers' attention on this critical social issue and its challenges (e.g., the Tunis Summit, WSIS, 2005). This introductory chapter provides a conceptual framework for understanding the major dimensions of digital equity and the issues and challenges related to each dimension. These issues and challenges are discussed in detail within each of the five chapters of the section.

Conceptual Framework

Digital equity (Solomon, 2002) is a social justice goal. Digital equity for social inclusion, or universal access (Alampay, 2006), is the impetus behind informed advocacy toward IT access and use. Moreover, the digital divide helps widen an even more alarming divide – the knowledge divide.In industrialized nations, the economic base is shifting from industry to information (Haddad and Draxler, 2002). Knowledge societies (Anderson, 2008; Bindé, 2005) are becoming the aspiration of both North and South countries. Institutions and citizens are faced with an exponential growth in basic and applied knowledge: the world knowledge base doubles every 2–3 years, with similar growth trends in information on the Internet. With an increasing flow of information, national economies grow more internationalized. There is a social demand for higher levels of education as technology is reducing the need for many types of unskilled or low-skilled workers (Haddad and Draxler, 2002).

Digital Equity for Social Inclusion

The growing efforts to move toward digital equity are fueled by the prospect that digital exclusion will add to social and economic exclusion of individual learners and citizens and, on the broader scene, whole populations. The main assumption here is that the access and use of the Internet and digital technologies are critical elements for individuals to participate and derive the benefits of a global knowledge society. A requisite for participation, however, is basic literacy. Literacy levels vary greatly across gender, nations, and the world. The fact that almost two-thirds of illiterates are women (Figure 1) limits womens' access to IT. Gender is a digital equity factor, and its manifestations and evolution are studied in scholarly works (Ono and Zavodny,

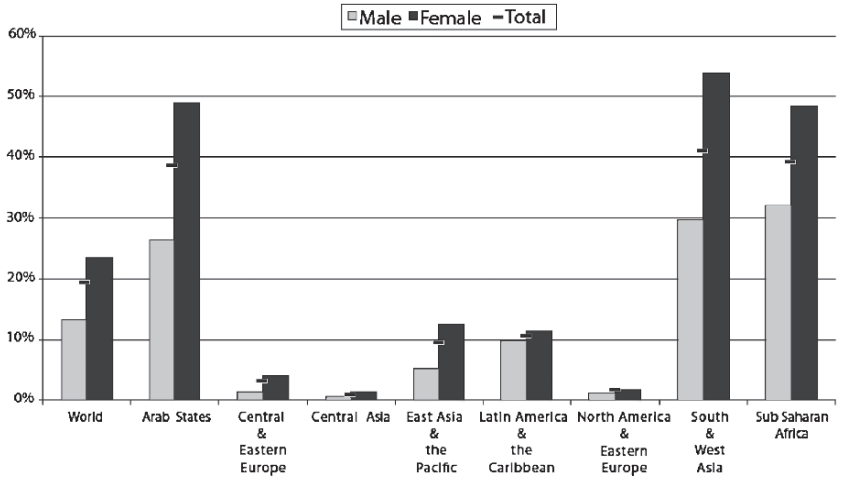

Fig. 1 Adult illiteracy rates by region and gender. UIS, Literacy database, June 2005

2005; Looker and Thiessen, 2003; Kawabata, 2003). Besides gender, another individual difference that impinges upon literacy and access to IT, even in developed countries with a high level of Internet penetration, is visual impairment and other disabilities. The visually impaired individual requires adaptive technology. This section devotes its two chapters to these issues. Looker (2008) discusses challenges and strategies related to womens' access and use of IT, and Treviranus and Roberts (2008) address trends, issues, and strategies in the use of adaptive technology.

Digital Equity in Education

Although the basic literacy or "print divide" remains an important issue in many parts of the world, the digital divide has become a growing concern in education based on the growing recognition of the strong relationship between education and socioeconomic development (economics of education, e.g., Barro, 1991; Cohen and Levinthal, 1989). There are efforts being made throughout the world that attempt to put the potentials of IT in the service of education. The final three chapters of the section address a number of critical issues and strategies related to digital equity in education. Pittman et al. (2008) discuss the value-added dimensions of IT in education. Roy et al. (2008) address issues related to culturally responsive use of IT in education, and Gibson (2008) discusses organizational empowerment issues and strategies in moving toward digital equity. These chapters exemplify individual and/or collective emancipation (basic skills, twenty-first century skills) through access to information or people, and knowledge creation using IT.

For such emancipation to occur, however, education must understand that digital equity is more than access to computers and connectivity. Digital equity involves the following five dimensions:

- Access to hardware, software and connectivity to the Internet
- Access to meaningful, high quality, culturally relevant content in local languages
- Access to creating, sharing, and exchanging digital content
- Access to educators who know how to use digital tools and resources
- Access to high-quality research on the application of digital technologies to enhance learning

Issues and Challenges

The following section describes the issues and challenges related to each major dimension of digital equity.

Access to Hardware, Software and Connectivity to the Internet

Internet providers are conscious of the value of their goods, and consumers want an affordable price, reliability of service, and speed. However, in the Southern hemisphere there are great numbers of individuals who are disadvantaged. Geographical location matters a great deal when it comes to digital equity. Although the Internet is spreading at a much faster rate than electricity, the latter is still missing in some rural areas of the world. The International Telecommunications Union (ITU, 2003) states that the Internet infrastructure is now in place in all continents. According to Internet World Stats (2007) (http://www.internetworldstats.com), Asia is now the world region that has the highest number of Internet users (Figure 2), but the Internet penetration level is only 11% (Figure 3). North America remains the region with the highest level (69.7%) of Internet penetration whereas Africa has the lowest (4%).

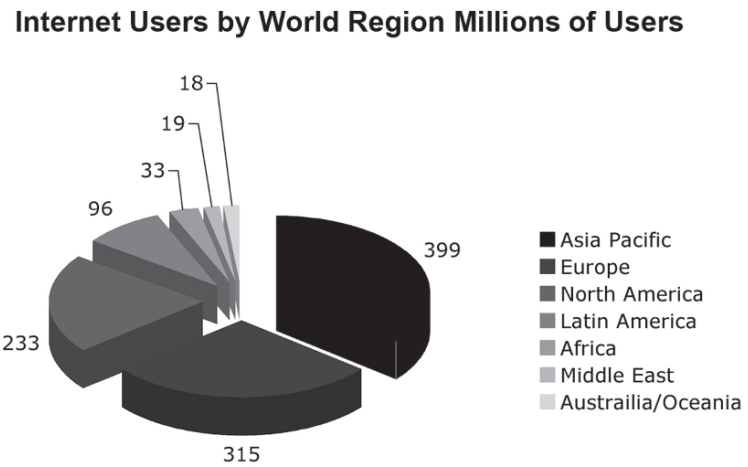

Fig. 2 Internet users by world region (World Internet Usage Statistics News and Population Stats, 2007)

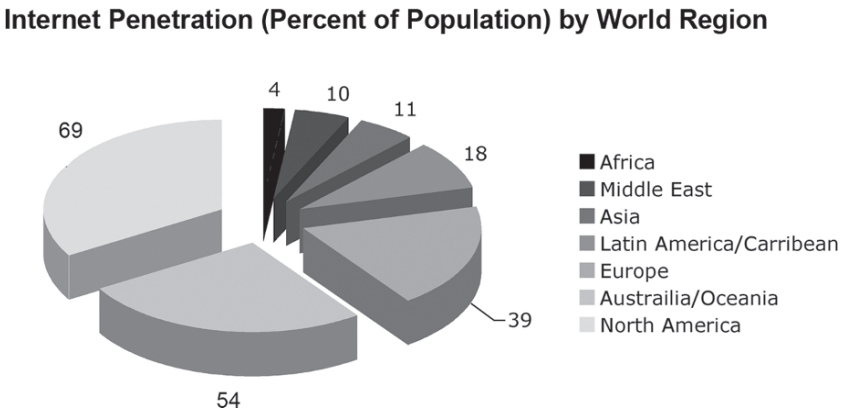

Fig. 3 Internet penetration (Percent of population) by world region (World Internet Usage Statistics News and Population Stats, 2007)

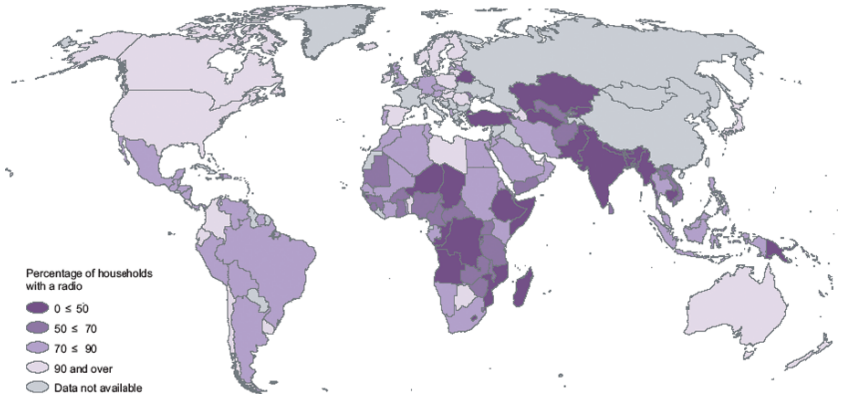

Fig. 4 Percent of households with a radio. UIS from ITU World Telecommunication Indicators Database (2005)

Looking at the worldwide distribution of radios (Figure 4), a rather simple information technology, one cannot help thinking that the digital equity goal is a far-reaching one. Contrary to radio, television, or print, computers are more complex, and this very factor keeps citizens away from using them, including ones who are literate, wealthy, and living in the city.

In primary and secondary schools and classrooms, the cost of computing equipment and connectivity is the first issue that comes to mind. In developed countries, those connected to the Internet require increasing bandwidth for audio and/or video use. Exemplars of new limits reached are as follows:

A suburban school in a wealthy city finds it difficult to keep up with the demand on bandwidth created by the 500 computers used by students during class time. A small student team from a remote rural school can hardly hear students from another school with whom they are doing a learning project because the latter students are part of a large school whose three computer labs take almost all of the available bandwidth.

Developing countries would be facing similar issues except that IT keeps improving. Leapfrog initiatives are expected as hardware costs are coming down (25% per year in increased power and lowered costs), and wireless technologies are growing rapidly in number and range (e.g., WiMAX). The One-laptop-per-child (OLPC) Negroponte's (2005) initiative (http://laptop.org) – also known as the MIT $100 computer – is an attempt to seriously address hardware, software, and connectivity costs.

Challenge

Technology leadership on the part of educational administrators, including school principals or master teachers, is the key challenge at any early stage of IT integration to teaching and learning (Solomon et al., 2003). Educational leaders will face many who are more trustful of traditional technology (blackboard, printed resources) for school learners, and wary of the costs of computers and connectivity. Government officials are looking for return on investment (ROI). "Despite the potential of ICTs to be an engine for social and economic development, there is limited quantifiable proof and little internationally comparable data" (ITU, 2006, p. 30).

Informed Strategy

The societal passage from print to digital information is underway. Educators and policy makers must understand the importance of bridging the digital divide in education as an important element of the national strategy to prepare students with twenty-first century skills needed in global society. While computers keep growing in interactive functionalities, countries can build capacity through dialogue and the development of partnerships between the governmental, educational, and the private sectors.

Access to Meaningful, High Quality, Culturally Relevant Content in Local Languages

The Declaration of Principles adopted at the World Summit on the Information Society (Geneva, 2003, Article 1) declared "[the] common desire and commitment to build a people-centered, inclusive, and development-oriented Information Society, where everyone can create, access, utilize, and share information and knowledge" (WSIS, 2003, p. 1). The impetus behind the Geneva Summit was the growing awareness of the digital divide. IT should be turned into "a digital opportunity for all" according to the Summit's Declaration of Principles and Plan of Action (UNESCO, 2001).

Although the Web offers vast resources that are of value to education and lifelong learning, it must be recognized that the quantity of information available on the surface

Table 1 Size of internet in terabytes (Lyman and Varian, 2003)

Medium	2002 (Tb)
Surface web	167
Deep web	91,850
Email (originals)	440,696
Instant messaging	274
Total	532,897

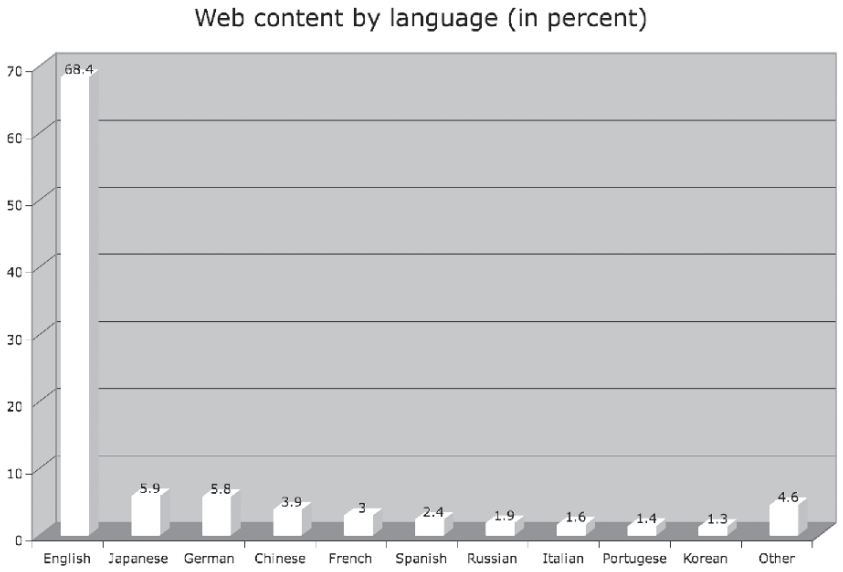

Fig. 5 Percent of Web content by language, 313 billion web pages (September 2004) (Global Reach, 2004 – http://global-reach.biz/globstats/refs.php3)

web (i.e., what is normally considered the Web) represents only a fraction of the resources that are available on the deep web. The deep web represents the part of the Internet that is inaccessible to conventional search engines and, consequently, to most users on the web. As shown in Table 1, the content available in the deep web is over 500 times greater than what is available on the surface web.

When one looks at Web content by language (Figure 5), another major issue stands out, that is the dominance of the English language (68.4%). Although there are vast numbers of Chinese and other Asian users (see Figure 2) on the Web, Web content in Chinese is only 3.9%. English has become the world's lingua franca through globalization.

Challenge

Cultural preservation and development through the creation of digital content in local languages is a major challenge confronting many countries across the globe. Affirmative culturally oriented actions such as declarations and conferences (e.g., *Achieving quality of Access, Ireland, 2004, HEA Conference Proceedings*) are helping to raise the level of global visibility and concern over this trend. There are also a growing number of public/private initiatives, such as SchoolNet Africa (http://www.schoolnetafrica.net), and the eGranary Digital Library (http://www.widernet.org/digitallibrary) that have emerged to develop and/or provide access to high-quality educational content in local languages.

Informed Strategy

The use of open educational resources (e.g., open courseware initiatives (MIT, UNESCO), Creative Commons (some rights reserved), and open source software (Open Office, GIMP, Tux Paint, Nvu) for individual and community empowerment is the employed strategy. For instance, Native Americans have engaged in digital repatriation of sacred or important artifacts that reside in national or regional museums. Indigenous communities are now able to use technology to develop educational resources and materials that reflect the language, culture, history, and resident knowledge of indigenous communities to help support culturally responsive teaching and learning in schools serving native children (Resta et al., 2004).

Access to Educators Who Know How to Use Digital Tools and Resources

The relevance of IT to teaching and learning has been argued from the perspective of twenty-first century skills. Stewart (2000) stressed that geographical, generational, cultural, and pedagogical issues and challenges combine to expand school learners' participation in the determination of both individual and collective life chances.

When education systems plan to innovate through the use of digital tools and resources for teaching and learning, they face the issue of teacher development. They can rely on a small minority of innovative teacher educators and teachers (see Rogers' notion of early adopters, 1995; Cuban, 2001) willing to take risks. Innovation in teaching refers to new modes of delivery (e.g., learning object repositories), including online courses (see http://opentraining.unesco-ci.org), or new approaches to learning (e.g., Bransford et al., 1999). Teachers who are transforming their primary or secondary classrooms into hybrid (or blended) learning environments by combining onsite and online learning activities (Kozma and McGhee, 2003) are examples of early adopters and innovators in the use of IT in teaching and learning. To expand beyond this group, however, poses significant challenges and the need for leadership and administrative, collegial, and pedagogical support.

Challenge

IT partnerships that include universities, schools and sometimes governmental agencies are instrumental for capacity building in the use of digital tools and resources: see, for instance, Lating's (2006) study on hybrid e-learning for rural secondary schools in Uganda or Allaire et al.'s (2006) study on Quebec's (Canada) remote networked schools. Partners face coordination and collaboration challenges. For instance, in Allaire et al.'s study, the Ministry of Education, three universities, 13 school districts and over 50 schools were involved. Even the most capable and interested teachers kept having access problems to basic equipment and connectivity (e.g., delayed arrival of sufficient bandwidth, upgraded firewalls and antivirus software reducing computer processing power, reconfiguration of computers on a routine basis or on the arrival of new personnel, and competing choices regarding desktop videoconferencing systems), the cumulative effect of which posed significant challenges to engaging in collaborative planning among teachers and implementation with students from different schools. Moreover, most teachers had previously been operating in a system that valued teacher-proof curricula (objective testing aligned with discrete behavioral objectives). Although an educational reform effort was underway, one giving more deliberative power to teachers regarding classroom activity, finding time to engage school learners in online collaborative inquiry remained a serious challenge for most teachers. A minority of teachers who adopted the online tools to support their own collaborative planning and school learners' inquiries served as exemplars of the use of digital tools and resources to transform the classroom activity in helping to foster deeper student understanding of real problems (Bereiter, 2002).

Informed Strategy

Those who adopt a new technology tend to apply the tool in accordance with previous practices (Cuban, 2001; Perelman, 1992; Seidel and Perez, 1994). Rather than recognizing the immense potential for doing things differently, teachers often use technology in accordance with old instructional practices, doing the same thing as before, but a little more quickly, a little more frequently, or a little better. In many instances, the teachers are not able to realize the full potential of information and communication technologies to enhance the teaching–learning process because of lack of comfort and competency in using the new tools for learning. Thus, to achieve digital equity requires more than the provision of access to computers and connectivity in the classroom. It requires the provision of high quality and sustained professional development to teachers. This may be accomplished in a number of ways such as providing online learning and professional development resources for teachers and building online communities of practice (see also Turcsányi-Szabó (2008) and Looi et al. (2008) in this handbook. Another strategy would be to network teacher education institutions for online learning purposes (see the Teacher Education Goes Into Virtual Schooling project (TEGIVS) involving teacher educators from Iowa State University and Florida State University, http://www.public.iastate.edu/~vschool/TEGIVS/homepage.html).

Access to High-Quality Research on the Application of Digital Technologies to Enhance Learning

High-quality research is often considered to include quantitative studies involving large numbers of participants, pre-post testing associated with short-term experimentation. There is also an emerging trend toward ethnographic studies involving in-depth observation and/or analysis of a small number of subjects. The former provides descriptive low-end information on what is being applied on a large-scale basis whereas the latter provides higher-end but small-scale information growing out of detailed observations or interviews with limited generalizability. Both types of research have value provided they are done according to the highest standards of rigor for both types of research.

Challenge

Innovation requires both the use of well-established research approaches as well as the development of new research strategies to understand better the complex environments and interactions in learning with the new digital technologies. Design experiments (Brown, 1992; Collins, 1992) and design research (Bell, 2004) were especially conceived to these ends. These methodologies are collaborative (university-based researchers and classroom-based teachers); they take context into account, and reinvest in the next iteration lessons learned as well as questions arising from the preceding iteration. Research is needed in the following areas: (1) types of access to computers and Internet, (2) classroom activity with online tools and resources, (3) learning outcomes as innovative practices are put into place, and (4) community progress being made as teachers and learners are adopting digital tools and resources.

Informed Strategy

In places where the digital divide is the most pronounced, there is typically also a lack of access to high-quality research. One strategy for fostering research in these settings is through the creation of networked communities inclusive of experts, competent teachers, beginning and prospective teachers (Czerniewicz and Carr, 2005; Lamon et al., 2008). This may also involve multi-institution collaborations to support innovative and enduring onsite/online experimentation with digital technologies (see Kash and Rycroft, 1999).

Access to Content Creation

The Geneva Declaration of Principles, which was adopted at the World Summit on the Information Society (Geneva, 2003, p. 1), foresaw "an […] Information Society, where everyone can create, access, utilize and share information and knowledge." The rapid growth of digital libraries and repositories is not without issues and challenges related to access to content (see Chapter 2.3), but here the emphasis is on access to content creation opportunities. We understand the above quote from the Geneva Declara-

tion to be an incentive toward the democratization of content creation, one to engage school learners through collaborative ventures and the recognition of students' voices, and ability to learn, create, and disseminate under the guidance of their teachers.

Challenge

This approach (namely, knowledge building, Scardamalia and Bereiter, 2003) has implications for education, culture, and democracy. It requires trust in school learners' capacity to engage in collective inquiry and produce publishable work. It also requires a less normative approach to the digital equity problem, one that takes advantage of local circumstances and expertise to make contributions to one's community and to other networked communities. The Knowledge Society Network (http://ikit.org/ksn.html) provides numerous exemplars of knowledge creation through the use of the same suite of digital tools.

Informed Strategy

The democratization of knowledge must be pursued at both ends, that is, both in access to and for the creation of knowledge. There is a growing number of Web 2.0 applications and user-created content. It is also important for educational systems to recognize that both teachers and students have the right to produce as well as reproduce knowledge. In areas where there is a lack of content in local languages, teachers, teacher educators, elders, and students may use IT tools to create content that reflects their culture and resident knowledge. A global problem is a growing loss of local languages. Although media and technology have largely contributed to the loss of local languages, they may also be used to help preserve them. In the Four Directions Project (http://www.4Directions.org), for example, a number of indigenous communities had very few fluent speakers of the native language. Teams of teachers, students, and elders worked together using digital technologies to develop audio recordings of the elders and to develop associated books and other materials to help students learn their native language.

Conclusion

This introductory chapter provides an overview of the global challenge of the digital divide and the critical conditions that must be addressed to move toward digital equity. The major issues and challenges also appear and are discussed within specific contexts in each of the following chapters. In a rapidly changing, technology-based, and knowledge-based global economy, it is important to understand where we are now and how far we have to go to reach the WSIS goals of a global information society. As daunting as the task may be, the effects of doing little or nothing to move toward digital equity can only result in the greater social and economic exclusion of people and greater instability across the globe.

References

Alampay, E. (2006). Beyond access to ICTs: Measuring capabilities in the information society. *International Journal of Education and Development using ICT, 2*(3). Retrieved November 12, 2006, from http://ijedict.dec.uwi.edu/viewarticle.php?id=196, pp. 4–22.

Allaire, S., Beaudoin, J., Breuleux, A., Hamel, C., Inchauspé, P., Laferrière, T., & Turcotte, S. (2006). *L'école éloignée en réseau*. Rapport de recherche, phase II. Québec: CEFRIO. See the English Summary. Retrieved November 12, 2006, from http://www.cefrio.qc.ca/projets/proj_34.cfm

Anderson, R. (2008). Implications of the information and knowledge society for education. In J. Voogt, & G. Knezek (Eds.), *International handbook of information technology in primary and secondary education*. Berlin Heidelberg New York: Springer.

Barro, R. J. (1991). Economic growth in a cross section of countries. *The Quarterly Journal of Economics, 106*, 407–443.

Bell, P. (2004). On the theoretical breadth of design-based research in education. *Educational Psychologist, 39*, 243–253.

Bereiter, C. (2002). *Education and mind in the knowledge society*. Mahwah, NJ: Lawrence Erlbaum.

Bindé, J. (2005). *Towards knowledge societies: UNESCO world report*. Paris: United Nations Educational Scientific and Cultural Organization.

Bransford, J. D., Brown, A. L., & Cocking, R. R. (1999). *How people learn: Brain, mind, experience, and school*. Washington, DC: National Academy Press.

Brown, A. L. (1992). Design experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. *The Journal of the Learning Sciences, 2*(2), 141–178.

Campbell, D. (2001). Can the digital divide be contained? *International Labour Review, 140*(2), 119–141.

Castells, M. (2001). *The Internet galaxy: Reflections of the Internet, business and society*. Oxford: Oxford University Press.

Collins, A. (1992). Toward a design science of education. In E. Scanlon, & T. O'Shea (Eds.), *New directions in educational technology* (pp. 15–22). Berlin Heidelberg New York: Springer.

Compaine, B. M. (2001). *The digital divide: Facing a crisis or creating a myth?* Cambridge, MA: MIT Press.

Cohen, W. M., & Levinthal, D. A. (1989). Innovation and learning: Two faces of R&D. *Economic Journal*, *99*, 569–596.

Cuban, L. (2001). *Oversold and underused*. Cambridge, MA: Harvard University Press.

Czerniewicz, L., & Carr, T. (2005). Growing communities of practice among educational technology researchers and practitioners in development-oriented contexts: Linking local and global debates. *International Journal of Education and Development using ICT, 1*(2). Retrieved February 22, 2006, from http://ijedict.dec.uwi.edu/viewarticle.php?id=72, pp. 3–24.

ETS. (2002). *Digital transformation: A framework for ICT literacy*. Princeton, NJ: ETS.

Gibson, I. W. (2008). Global partnerships enhancing digital equity and social equity. In J. Voogt, & G. Knezek (Eds.), *International handbook of information technology in primary and secondary education*. Berlin Heidelberg New York: Springer.

Gorski, P. (2005). Education equity and the digital divide. *AACE Journal*, *13*(1), 3–45.

Global Reach. (2004). *Global Internet statistics: Sources and references*. Retrieved March 28, 2007, from http://global-reach.biz/globstats/refs.php3

Haddad, W. D., & Draxler, A. (2002). *Technologies for education: Potentials, parameters, and prospects*. Paris: United Nations Educational Scientific and Cultural Organization.

International Telecommunications Union (ITU). (2003). *World telecommunication development report: Access indicators for the information society*. Switzerland: Geneva. Retrieved March 28, 2007, from http://www.itu.int/pub/D-IND-WTDR-2003/e

International Telecommunications Union (ITU). (2006). *World communication/ICT development report 2006: Measuring ICT for social and economic development*. Executive summary. Switzerland: Geneva. Retrieved March 28, 2007, from http://www.itu.int/ITU-D/ict/publications/wtdr_06/index.html

Internet World Stats. (2007). Retrieved March 28, 2007, from http://www.internetworldstats.com

Kash, D. E., & Rycroft, R. W. (1999). *The complexity challenge: Technological Innovation for the 21st Century*. London: Pinter.

Kawabata, T. (2003). Comparative study on trials for closing the digital divide. In *Proceedings of World conference on educational multimedia, hypermedia and telecommunications 2003* (pp. 2421–2422). Norfolk, VA: American Association for the Advancement of Computing in Education.

Kozma, R. B., & McGhee, R. (2003). ICT and innovative classroom practices. In R. B. Kozma (Ed.), *Technology, innovation, and educational change: A global perspective* (pp. 40–80). Eugene, OR: International Society for Educational Technology.

Lamon, M., Laferriere, T., & Breuleux, A. (2008). Networked communities. In P. Resta (Ed.), *E-learning for teacher development*. Paris: United Nations Educational Scientific and Cultural Organization.

Lating, P. O. (2006). *Hybrid e-learning for rural secondary schools in Uganda*. Sweden: Blekinge Institute of Technology. Retrieved March 10, 2007, from http://www.bth.se/tks/teknovet.nsf/(WebFiles)/A6622DE57A0668A5C1257225004AAE33/$FILE/lating_lic.pdf

Looi, C.-K., Lim, W.-Y., & Chen, W. (2008). Communities of practice for continuing professional development in the 21st century. In J. Voogt, & G. Knezek (Eds.), *International handbook of information technology in primary and secondary education*. Berlin Heidelberg New York: Springer.

Looker, D., & Thiessen, V. (2003). *The digital divide in Canadian schools: Factors affecting student access to and use of information technology*. Retrieved May 10, 2005, from http://www.cesc.ca/pceradocs/2002/papers/EDLooker_OEN.pdf

Looker, E. D. (2008). Gender and information technology. In J. Voogt, & G. Knezek (Eds.), *International handbook of information technology in primary and secondary education*. Berlin Heidelberg New York: Springer.

Lyman, P., & Varian, H. R. (2003). *How much information? 2003*. Retrieved October 20, 2006, from http://www2.sims.berkeley.edu/research/projects/how-much-info-2003/

Negroponte, N. (2005). *Access2Democracy*. Presentation at the World Summit on the Information Society, Tunis. Fourth Plenary Meeting. Retrieved November 8, 2005, from http://www.itu.int/wsis/tunis/webcast/archives/index.html

Norris, P. (2001). *Digital divide: Civic engagement, information poverty, and the Internet worldwide*. Cambridge, MA:Cambridge University Press.

Organisation for Economic Co-operation and Development (OECD). (2001). *Understanding the digital divide*. Retrieved November 8, 2005, from http://www.oecd.org/dataoecd/38/57/1888451.pdf

Ono, H., & Zavodny, M. (2005). Gender differences in information technology usage: A U.S.-Japan comparison. *Sociological Perspectives, 48*(1), 105–133.

Perelman, L. (1992). *Schools out: Hyperlearning, the new technology and the end of education*. New York: Avon Books.

Pittman, J., McLaughlin, R. T., & Bracey-Sutton, B. (2008). Critical success factors in moving towards digital equity. In J. Voogt, & G. Knezek (Eds.), *International handbook of information technology in primary and secondary education*. Berlin Heidelberg New York: Springer.

Resta, P., Christal, M., & Roy, L. (2004). Digital technology to empower indigenous culture and education. In N. E. Davis, & A. Brown (Eds.), *The World yearbook of education 2004: Digital technology, communities and education* (pp. 179–195). London: Kogan Page.

Rogers, E. (1995). *Diffusion of innovation*. New York, NY: Free Press.

Roy, L. Chen, H., & Cherian, A., & Tuiono, T. (2008). The relationship of technology, culture and demography. In J. Voogt, & G. Knezek (Eds.), *International handbook of information technology in primary and secondary education*. Berlin Heidelberg New York: Springer.

Scardamalia, M., & Bereiter, C. (2003). Knowledge building. In J. W. Guthrie (Ed.), *Encyclopedia of education* (2nd ed., pp. 1370–1373). New York, NY: Macmillan.

Sciadas, G. (2003). L'Observatoire de la fracture numérique. *Série sur la connectivité*, *7*. Retrieved October 21, 2005, from http://www.orbicom.ca/index.php?option=com_content&task=blogcategory&id=19&Itemid=225

Seidel, R. J., & Perez, R. S. (1994). An evaluation model for investigating the impact of innovative educational technology. In H. F. O'Neil Jr., & E. L. Baker (Eds.). *Technology assessment in software applications* (pp. 177–212). Hillsdale, NJ: Erlbaum.

Selwyn, N. (2004). Reconsidering political and popular understandings of the digital divide. *New Media Society*, *6*, 341–362.

Sen, A. (1999) *Development as freedom*. Oxford: Oxford University Press.

Solomon, G. (2002). Digital equity: It's not just about access anymore. *Technology & Learning, 22*(9), 22–26.

Solomon, G., Allen, N., & Resta, P. (2003). *Toward digital equity: Bridging the divide in education*. Boston: Allyn and Bacon.

Stewart, A. (2000). Social inclusion: An introduction. In P. Askonas, & A. Stewart (Eds.), *Social inclusion: Possibilities and tensions* (pp. 1–16). London: Macmillan.

Tolbert, B. J., Mossberger, K., & Stansbury, M. (2003). *Virtual inequality: Beyond the digital divide*. Washington, DC: Georgetown University Press.

Treviranus, J., & Roberts, V. (2008). Disability, special education and IT. In J. Voogt, & G. Knezek (Eds.), *International handbook of information technology in primary and secondary education*. Berlin Heidelberg New York: Springer.

Túrcsányi-Szábo, M. (2008). Online professional development for teachers. In J. Voogt, & G. Knezek (Eds.), *International handbook of information technology in primary and secondary education*. Berlin Heidelberg New York: Springer.

United Nations Development Program (UNDP). (2001). *Human development report 2001: Making new technologies work for human development*. New York: Oxford University Press. Retrieved May 1, 2005, from http://hdr.undp.org/reports/global/2001/en/

United Nations Educational Scientific and Cultural Organization (UNESCO). (2001). Declaration of principles and plan of action. Retrieved November 21, 2005, from http://www.itu.int/wsis/documents/doc_multi.asp?lang=fr&id=1532|1191

Warschauer, M. (2002). Reconceptualizing the digital divide. *FirstMonday*, *7*(7). Retrieved July 9, 2005, from http://www.firstmonday.org/issues/issue7_7/warschauer/

Warschauer, M. (2004). *Technology and social inclusion: Rethinking the digital divide*. Harvard:MIT Press.

World Internet Usage Statistics News and Population Stats. (2007). Retrieved March 6, 2007, from http://www.internetworldstats.com/stats.htm

WSIS. (2003). World summit on the information society, Generva 2003. Retrieved June 7, 2007, from http://www.itu.int/wsis/docs/geneva/official/dop.html

WSIS. (2005). *Tunis commitment*. World summit on the information society, Tunisia 2005. Retrieved June 7, 2007, from http://www.itu.int/wsis/docs2/tunis/off/7.html