Issues and Challenges Related to Digital Equity: An Overview

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Abstract

The chapter addresses two main concerns: Digital equity for social inclusion and digital equity in education. Five dimensions of digital equity are identified: (1) access to hardware, software, and connectivity to the Internet; (2) access to meaningful, high quality, and culturally relevant content in local languages; (3) access to creating, sharing, and exchanging digital content; (4) access to educators who know how to use digital tools and resources; and (5) access to high-quality research on the application of digital technologies to enhance learning. Issues, challenges, and informed strategies are pinpointed on the basis of what digital-divide and digital-equity research says.

Keywords

Social inclusion · Digital divide · Access · Digital tools and resources · Knowledge divide

Introduction

Digital equity is a highly challenging social justice goal. Stewart (2000) stressed that geographical, generational, cultural, and pedagogical issues and challenges combine to expand, or limit, school learners' participation in the determination of both individual and collective life chances. Physical access to devices is the first step in moving toward digital equity but, according to Gorski (2009), one that defines too narrowly the term digital divide. Referring to Light (2001), Gorski (2005) argued that a digital divide exists when a group's access to digital technologies and resources differs along one or more dimensions of social, economic, cultural, or national identity. In the first edition of this chapter, we adopted the following definition of the digital divide: "Situations in which there is a marked gap in access to or use of ICT devices" (Campbell 2001, p. 1). We retain it here while being aware that the meaning of the term keeps evolving.

In its 2015 resolution on the overall review of the outcomes of WSIS (The World Summit on the Information Society (WSIS) of the United Nations Educational Scientific and Cultural Organization (UNESCO) in Tunisia in 2005 stated: "*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 United Nations General Assembly (2015) expressed five major concerns: (1) existing digital divides prevail and new divides emerge; (2) the ubiquitous use of ICT must be based on new levels of confidence and security; (3) the rights of individuals must be protected equally online and offline; (4) the progress brought in by ICT should be measured not only in economic terms but also in terms of the realization of human rights and freedoms; and (5) to serve as a development enabler, ICT must be grounded in ethical foundations. These concerns apply to many fields, including education.

In education, progress regarding physical access to digital technologies and resources (first-level divide) has revealed, as in other fields, second-level divides related to skill and usage patterns and production (The gap that separates the consumers of content on the Internet from the producers of content.) (Attewell 2001; Hargittai 2002; Solomon et al. 2003). Now third-level divides are surfacing, ones that will bring new challenges to those professional educators guided by the principle of equality of opportunity. According to Van Deursen and Helsper (2015), third-level divides are "disparities in the returns from Internet use within populations of users who exhibit broadly similar usage profiles and enjoy relatively autonomous and unfettered access to ICTs and the internet infrastructure" (p. 30). The authors report that their findings suggest that "the Internet remains more beneficial for those at the highest education levels, with higher social status, not in terms of how extensively they use the technology but in what they achieve as a result of this use for several important domains" (p. 46). Therefore, they claim they found a link between Internet usage and widening inequality.

Access to the digital infrastructure and technologies remains a challenging first-level issue for all countries. For instance, in the country that spends the most for student education, (In 2010, The United States spent more than $11,000 US dollars per elementary student and more than $12,000 US dollars per high school student. See http://www.cbsnews.com/news/us-education-spending-tops-global-list-study-shows/) 11.6 million students do not have the Internet access they need for digital learning (EducationSuperHighway 2017). Nonetheless, attention is, and must be, increasingly devoted to second-level divides. For instance, the National Education Technology Plan (US Department of Education, Office of Educational Technology 2016) emphasizes that digital use divide is the new challenge for teachers and learners. In its 2017 update, NETP articulates a vision of digital equity for reaching equity in learning.

This introductory chapter provides a conceptual framework for understanding issues and challenges related to digital equity. For Warschauer (2004), "digital solutions" do not come without consideration of the complex factors, resources, and interventions required to support social inclusion. Challenges and informed strategies related to each of five dimensions of the digital divide are identified. Issues and challenges are also discussed in detail within each of the seven chapters of this section.

Conceptual Framework

First and second-level digital divides set forth an alarming divide – the knowledge divide. Knowledge societies are becoming the aspiration of both Northern and Southern 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 (Johal and Thirgood 2016). Digital labor is beginning to be studied for the design of better digital work experiences (Bucher and Fieseler 2016). The main assumption here is that the access and the use of the Internet and digital technologies are critical elements for individuals to participate and derive the benefits of a global knowledge society. Therefore, the conceptual framework that follows is built around two concerns: digital equity for social inclusion and digital equity in education.

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. A requisite for participation in the global knowledge society is basic literacy. Literacy levels vary greatly across gender, nations, and the world (Fig. 1).

The fact that almost two-thirds of illiterates are women limits women's access to IT (UNESCO 2013). In the digital equity section of the 2008 edition of this handbook, a whole chapter was devoted to gender (Looker 2008). 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

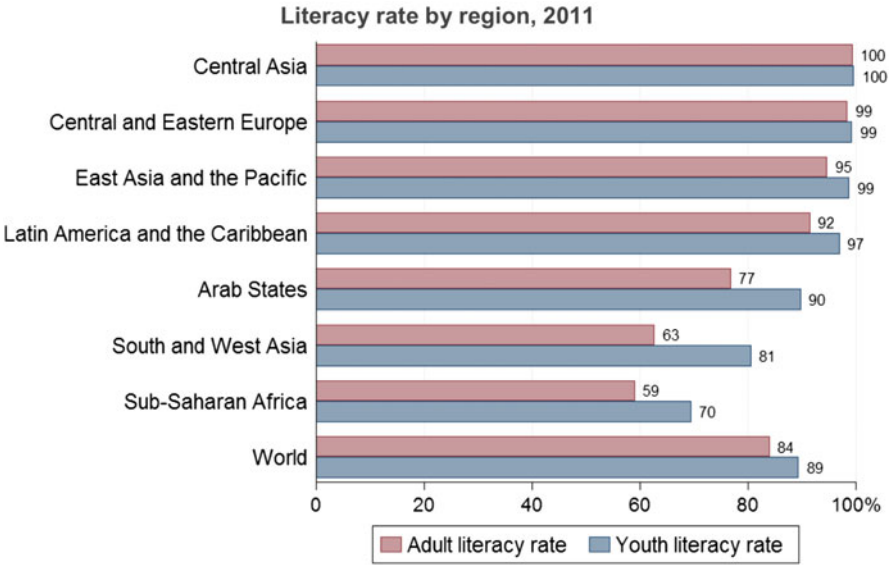

Fig. 1 Literacy rates by region and gender. UNESCO Institute for Statistics, Literacy data (2013). Available at http://uis.unesco.org/sites/default/files/documents/fs26-adult-and-youth-literacy-2013-en_1.pdf

impaired individual requires adaptive technology (Treviranus and Roberts 2008). In this second edition, Treviranus (► Chap. 69, "Learning Differences and Digital Equity in the Classroom") focuses on the needs of specific groups. 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, one based on the recognition of the strong relationship between education and socioeconomic development.

Digital Equity in Education

There are efforts being made throughout the world that attempt to put the potentials of IT in the service of education (Charania and Davis 2016; Gonzales-Perez 2014; Yuen et al. 2016). These efforts exemplify individual and/or collective emancipation (basic skills, twenty-first-century skills) through access to information or people, and to IT-supported content creation, including knowledge creation.

For such emancipation to occur, however, educators must understand that digital equity is more than access to computers and connectivity. The remaining of this chapter is structured around the following five dimensions of digital equity that we identified in the first edition of this handbook:

- Access to hardware, software, and connectivity to the Internet
- Access to meaningful, high quality, and 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, Challenges, and Informed Strategies

This section presents issues, challenges, and informed strategies related to the five dimensions of digital equity.

Access to Hardware, Software, and Connectivity to the Internet

Issues

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 (Cleary et al. 2006). 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 on all

continents. According to Internet World Stats (June 2016), Asia has now half the number of Internet users (Fig. 2), and an Internet penetration level of 45.6% (Fig. 3). North America remains the region with the highest level (89%) of Internet penetration whereas Africa has the lowest (28.7%).

Looking at the distribution of people online worldwide (Fig. 4), 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 from using them, including ones who are literate, wealthy, and living in the city.

Challenges

Cost. The cost of hardware, software, and connectivity to the Internet remains a continuous challenge. 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:

- Internet connectivity is slow when students are asked to download a document at the beginning of a period.
- Early-adopter teachers less time than previously at the computer lab as more teachers are taking students to the computer lab.
- A suburban school in a wealthy city finds it difficult to keep up with the demand for 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 (e.g., 25% per year in increased power and lowered costs), and wireless technologies are growing rapidly in number and range (e.g., WiMAX, Google's project LOON (https://x.company/loon/)).

Technology Leadership. "While many countries have broadband policies in place and many Ministries of Education have called for broadband in all schools, progress towards reaching these goals is irregular and difficult to track..." (Broadband Commission for Digital Development ITU and UNESCO 2013, p. 14) (See also Fig. 5).

The level of the ICT infrastructure was found to be the most probable predictor of technology-leadership profiles assumed by Turkish principals (Banoğlu et al. 2016). In their study, the authors refer to ISTE's (2009) five indicators of technology leadership: (1) visionary leadership, (2) digital-age learning culture, (3) excellence in professional practices, (4) systemic improvement, and (5) digital citizenship. Technology leadership is the key challenge on the part of educational administrators, including school principals or master teachers, even after the early stage of IT integration to teaching and learning (Dexter 2008).

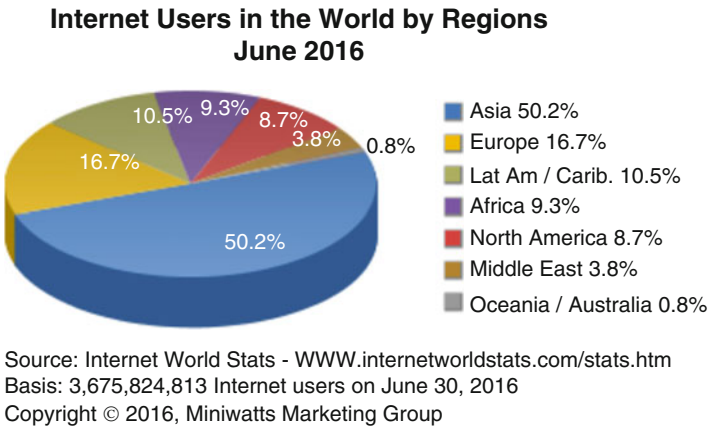

Fig. 2 Internet users by world region (World Internet Usage Statistics News and Population Stats, June 2016).

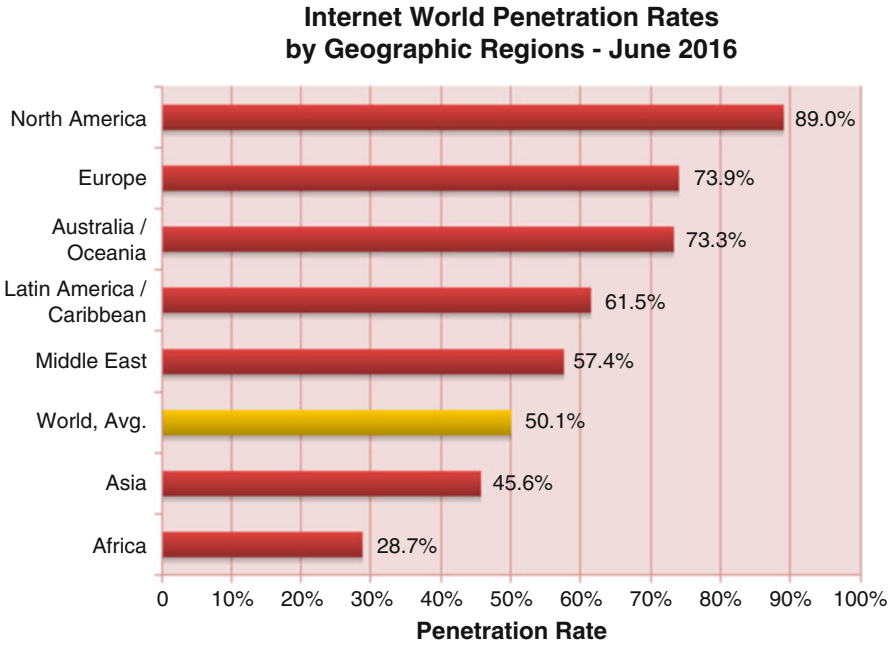

Fig. 3 Internet penetration (percent of population) by world region (World Internet Usage Statistics News and Population Stats, June 2016).

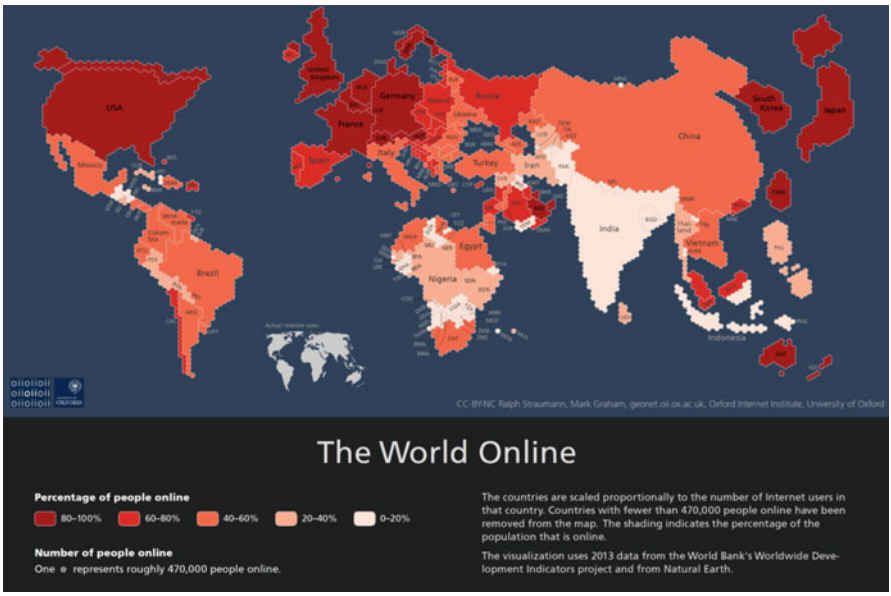

Fig. 4. Worldwide distribution of online people (Graham and Straumann 2015). Available at http://www.ox.ac.uk/news/2015-07-13-where-do-most-internet-users-live

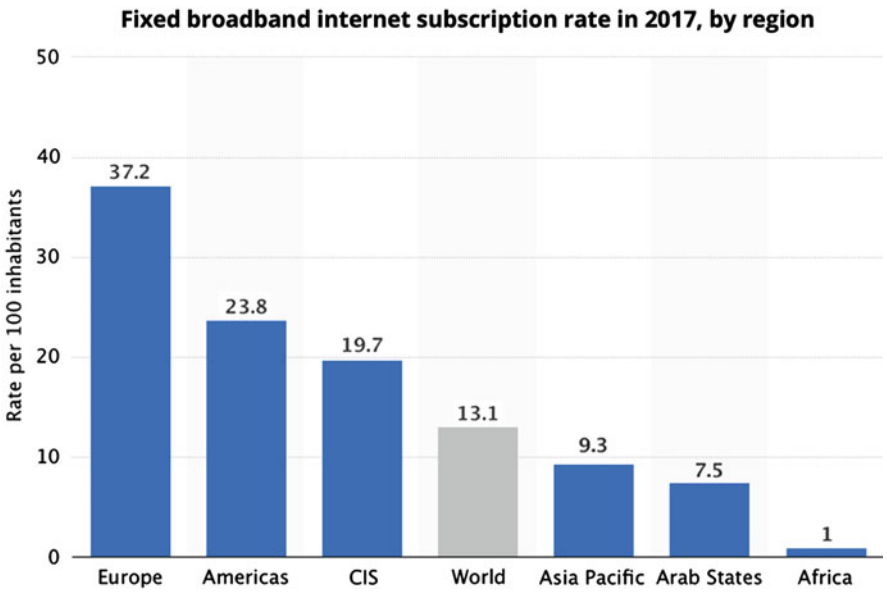

Fig. 5 Available at https://www.statista.com/statistics/370681/fixed-broadband-internet-penetration-region/

Informed Strategy

The societal passage from print to digital information is now well underway. Understanding the importance of broadband in education as part of a nation's strategy to prepare students with the twenty-first-century skills is key. ITU's, UNESCO's, and OECD's publications are remarkable sources of information for keeping oneself informed regarding global developments regarding digital technologies and bandwidth. 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

Issues

The Declaration of Principles adopted at the World Summit on the Information Society (WSIS, Geneva, 2003, Article 1) highlighted "[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." 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). And Ronchi (2009) provided a broad overview of the issues of the e-culture and digital heritage (e.g., virtual museums issues and achievements, cataloging, digitizing, publishing, and sustainable exploitation of cultural content).

Although the Web offers vast resources that are of value to education and lifelong learning, which are increasing every day, it must be recognized that the quantity of information available on the Surface Web (i.e., what is normally considered the Web) is small compared to information on the Deep Web (i.e. resources stored in databases, and not in an HTML format). The Deep Web represents the part of the Internet (4% is often mentioned when one searches on the Surface Web) that is inaccessible to conventional search engines and, consequently, to most users on the Web. The content available in the Deep Web is over 500 times greater than what is available on the Surface Web, that is, the approximation referred to by Kumar and Mishra (2015, p. 137). They observe that the Deep Web is growing more rapidly than the Surface Web in all major sectors, including education. They argue for hidden data indexing, given the necessity for the public to access the Deep Web.

When one looks at the language of the users of the Internet today (Fig. 6), the dominance of the English language remains a major issue but the Chinese language is growing rapidly compared to all other languages on the Web. Web content in Chinese was only 3.9% in the first edition of this chapter. We stated: English has become the world's lingua franca through globalization.

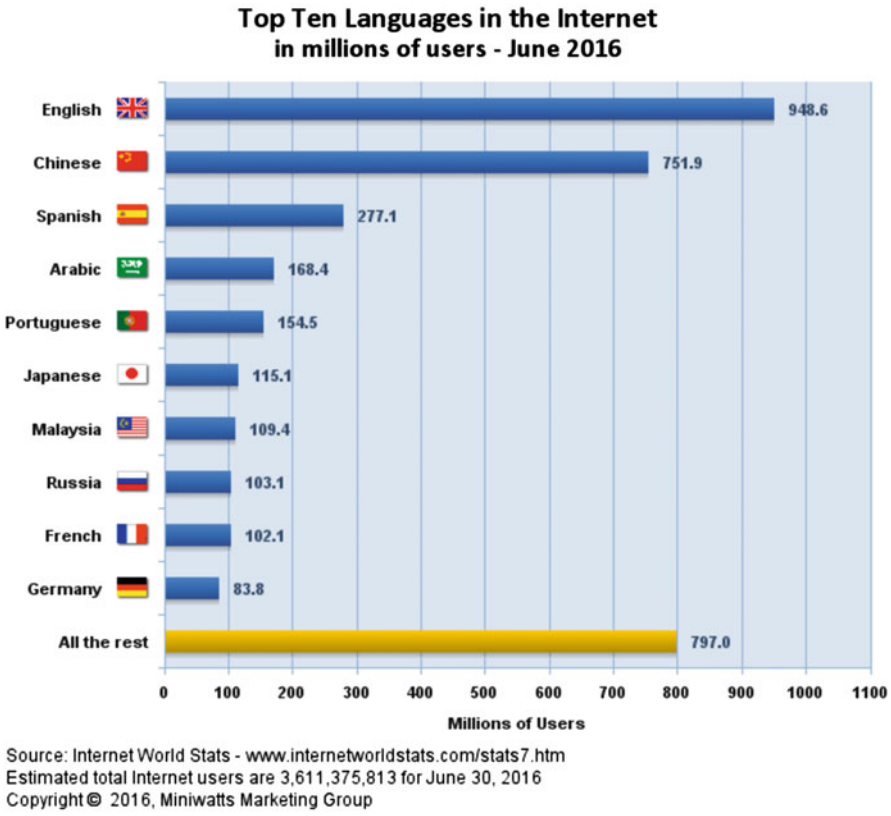

Fig. 6 Internet World Stats website, Miniwatts Marketing Group (2017). Available at: http://www.internetworldstats.com/stats7.htm

UNESCO has taken notice of the importance of access to content and promotes open Educational Resources (OERs) that are defined as follows:

> any educational resources (including curriculum maps, course materials, textbooks, streaming videos, multimedia applications, podcasts, and any other materials that have been designed for use in teaching and learning) that are openly available for use by educators and students, without an accompanying need to pay royalties or licence fees. (Commonwealth of Learning and UNESCO 2015, p. 5)

The Commonwealth of Learning and UNESCO (2015) identify four policy issues for making more effective sharing and use of OERs:

1. *Provision in policy of clarity on intellectual property and copyright* on works created during the course of employment (or study) and how these may be shared with and used by others.

2. *Human resource policy guidelines* regarding whether or not the creation of certain kinds of work (e.g., learning resources) constitutes part of the job description for staff and what the implications are for development, performance management, remuneration, and promotion purposes.
3. *ICT policy guidelines* regarding access to and use of appropriate software, hardware, the Internet and technical support, as well as provision for version control and back-up of any storage systems for an institution's educational resources.
4. *Materials development and quality assurance policy guidelines* to ensure appropriate selection, development, quality assurance, and copyright clearance of works that may be shared (pp. 16–17).

In an attempt to better understand educators' perceptions of collaborative OER development, Pirkkalainen et al. (2017) find that "emotional ownership" is a barrier to collaboration: "The stronger one's attachment to the ideas, the less unlikely one would engage in sharing or building new resources and related practices in a collaborative manner based on it. Thus, the educator becomes more hesitant to share that idea with others" (p. 127). Moreover, their findings also show that "increase in reputation and status in the network" does not seem to influence the intention to share knowledge. Emotional ownership becomes an enabler rather than a barrier "when working in a trusted environment with peers" (p. 129).

Challenge

Trust is key to collaboration, and the open online environment is both a place of opportunity and uncertainty for content producers. Cultural preservation and development through the creation of digital content in local languages, a major challenge confronting many countries across the globe, is enabled by affirmative culturally oriented actions such as declarations, conferences, and publications (e.g., International Symposium on the Measurement of Digital Cultural Products, Montreal 2016; Linked Heritage Cultural Digitisation Conference 2013; Ronchi 2009). There are also projects such as Europeana (http://antennalab.org/project-europeana-access-to-culture-and-heritage-in-the-digital-age/), the European SchoolNet (http://www.eun.org/), SchoolNetAfrica (http://196.1.95.39/schoolnet/english/index.htm), and the eGranary Digital Library (https://www.widernet.org/eGranary/) that are developing and/or providing access to high-quality educational content in local languages.

Informed Strategy

The use of open educational resources (e.g., open courseware initiatives, Carnegie Mellon Open Learning Initiative, MIT OCW, UNESCO), Creative Commons (some rights reserved), and open source software (e.g., Apache Open Office, G Suite (email, drive, group, etc.), GIMP, Nvu, Tux Paint, Open Source Initiative) for individual and community empowerment is the employed strategy. For instance, Native Americans have engaged in the 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). The Broadband Commission for Digital Development ITU and UNESCO (2013) recommends the use of OERs to "accelerate free access to knowledge and facilitate the adaptation of content to local needs and languages" (p. 10).

Access to Creating, Sharing, and Exchanging Digital Content

Issues

The Geneva Declaration of Principles, which was adopted at the World Summit on the Information Society (WSIS 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 but here the emphasis is on access to content creation opportunities. We understand the above quote from the Geneva Declaration 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.

UNESCO (2011) promoted three teacher competencies – technology literacy, knowledge deepening, and knowledge creation. They are all necessary for content creation. The knowledge-building principles put forward by Scardamalia (2002) include one on the democratization of knowledge, meaning that primary and secondary school students are to be considered capable of knowledge creation. This is an advanced form of participation that may be exercised during both primary and secondary education. Robles Morales et al. (2016) address the relationship between digital participation and the digital participation divide: "The first concept refers to the use of the Internet to produce cultural goods that are subsequently shared on a global scale; the latter, refers to the inequalities generated by the uneven distribution of these creative uses of the Internet in a given population" (p. 97).

Challenge

This knowledge-building approach (Scardamalia and Bereiter 2006) has implications for education, culture, and democracy. It requires trust in school learners' capacity to produce content of value for their classroom-based knowledge building community. 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 knowledge and access to opportunities to create knowledge. Web 2.0

applications and user-created content are more available than they were in 2008. 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. During the Four Directions Project, back in the nineties, 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. To be aware that social skills, as well as sociopolitical attitudes, may prevent the digital participation divide (Robles Morales et al. 2016) is part of the strategy we suggest.

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

Issues

The relevance of IT to teaching and learning has been argued from the perspective of twenty-first-century skills, and now assessment methods and tools are unfolding (e.g., Griffin and Care 2015; OECD 2017). Innovation in teaching refers to new modes of delivery (e.g., learning object repositories), including online courses (see http://opentraining.unesco-ci.org), new approaches to learning (e.g., Bransford et al. 1999), and new pedagogies (OECD 2015). 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 minority of innovative teacher educators and teachers willing to take risks (see Cuban 2001). The US National Education Technology Plan (US Department of Education, Office of Educational Technology, 2016) stresses the "digital use divide" that is now prevailing. Rather than recognize the immense potential to do 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. Teachers who are transforming their primary or secondary classrooms into blended learning environments by combining onsite and online learning activities – the "flipped classroom" is the buzzword – are beginning to see it as "the new normal." To expand beyond this group, however, continues to pose significant challenges (Cuban 2001; Selwyn 2013) and stresses the need for leadership and administrative, collegial, and pedagogical support.

Challenge

IT partnerships that include universities, schools, and sometimes governmental agencies are challenging but 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. Partners face coordination and collaboration

challenges. Passey et al. (2016) argue that third-party providers have to better ground their initiatives in local education systems to face the sustainability challenge of innovation with digital technologies.

Informed Strategy

In many instances, 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 the provision of high quality and sustained professional development for teachers. This may be accomplished in a number of ways such as providing online learning and professional development resources for teachers and building online and onsite communities of practice (see Looi et al. 2008; Turcsányi-Szabó 2008), including for preservice teachers (De Neve and Devos 2017; Hall 2017). Another strategy would be to network teachers such as in eTwinning, a European-wide teacher network that has become "an incubator for pedagogical innovation in the use of Information and Communication Technologies (ICT) for cross-border school collaboration and for formal and informal teacher professional development" (Vuorikari et al. 2015).

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

Issues

Effective uses of digital technologies to enhance learning are what governments, school principals, teachers, and parents want to see for evidenced-based decision regarding IT. High-quality research is often considered to include quantitative studies involving large numbers of participants, prepost testing associated with short-term experimentation, and a control group (gold standard research). Even such research, however, may be misleading. For instance, Archer et al. (2014) reassessed inconsistent outcomes presented in three previous meta-analyses, and found that training and support were mediating factors. They suggested that "researchers include implementation factors such as training and support, when considering the relative effectiveness of ICT interventions" (p. 140).

There is also an emerging trend toward ethnographic studies involving in-depth observation and/or analysis of a small number of subjects. The so-called gold standard research 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 better understand the complex

environments and interactions in learning with the new digital technologies. Design research (Collins et al. 2004; McKenney and Reeves 2012) is especially conceived to these ends. The process is collaborative (university-based researchers and classroom-based teachers); it takes context into account and reinvests in the next iteration lessons learned as well as questions arising from the preceding iteration. Research is still needed for monitoring level 1 divide issues and challenges (access to Internet and digital tools and resources – Pittman et al. 2008), level 2 divide issues and challenges (uses of digital tools and resources; barriers and enablers of personalized learning or collaborative practices; learning outcomes as innovative practices are put into place – Terry et al. 2016), and level 3 divide issues and challenges (extended access to families, support services and communities of practice – Katz and Levine 2015; advantages of alternate certifications for students – Collins and Pea 2011; collateral benefits of being online – Van Deursen and Helsper 2017).

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 (Hall 2017). This may also involve multi-institution collaborations to support innovative and enduring onsite/online experimentation with digital technologies (see Laferrière et al. 2015).

Conclusion

This introductory chapter provides an overview of the global challenge of the digital divide and the critical strategies 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.

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