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Mark Warschauer [a]
[a] Department of Education and Informatics, University of California, Irvine, Irvine, California, U.S.A.

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Digital Divide

Mark Warschauer
Department of Education and Informatics, University of California, Irvine, Irvine, California, U.S.A.

Abstract
The term "digital divide" is used to describe unequal access to computers, the Internet, and online information, whether among individuals, communities, or countries. Originally targeted at issues of physical access, such as whether people had a computer or Internet account at home, the concept is increasingly used to incorporate related issues, such as whether people have the skills and knowledge required to make effective use of digital media and information. A variety of initiatives have been taken within the United States and internationally to try to combat the digital divide.

INTRODUCTION

The term "digital divide" refers to the gap between those with access to computers, the Internet, and online information and those who lack such access. The digital divide has been discussed in relation to income group, race, ethnicity, age, gender, and language status among people within a community or country. Used internationally, it is often used to refer to gaps between countries that overall have greater access to information and communication technology (ICT) and countries with lesser access.

The term was originally used to refer to inequality in physical access, as represented by home ownership of a computer or having an Internet account. Soon thereafter, people began to include other factors that enabled people to effectively use new technology, such as skills, knowledge, and social support.

This entry introduces the origin of the term in the 1990s and examines how the concept has evolved since it first emerged. It reviews key facts about inequality in access to ICT, both within the United States and internationally, and discusses important individuals, organizations, and initiatives that have responded to this inequality.

HISTORICAL CONTEXT

Though online communication dates back to the late 1960s, the Internet first became widely popular following the introduction of World Wide Web browsers in the 1990s. With this growing popularity, both officials and activists became increasingly concerned about the consequences of unequal access to ICT. In the mid-1990s, journalists and government officials in the United States began to describe this unequal access as a "digital divide." *New York Times* writer Gary Andrew Poole used the term in several articles in late 1995 and early 1996,[1] and then both Al Gore and Bill Clinton used it in a speech in Knoxville, Tennessee.[2] That same year, sociologist Manuel Castells published the first of three volumes on the information age.[3] Castells' three-volume work laid out the most compelling analysis to date of the critical role of information technology access and use in generating wealth, power, and knowledge in the current era.

Beginning in the mid-1990s, the term was used regularly by Clinton administration officials, and especially by Larry Irving, Assistant Secretary of Commerce and Director of the National Telecommunications and Information Administration (NTIA). The NTIA published national studies in 1995, 1998, 1999, 2000, 2002, and 2004 that attempted to measure technological inequality through analysis of U.S. census data on computer ownership and Internet access as differentiated by race/ethnicity, income, gender, employment status, disability status, and urban/rural location.[4] These research efforts were backed by policy initiatives, including the E-rate program, which has provided funding to assist Internet connectivity in schools and libraries since 1996, and the Federal Community Technology Centers Program, which provided substantial funding for local technology training and access in fiscal years 2000 and 2001.

Just as steps were being taken to address the digital divide in the United States, international leaders and organizations became increasingly concerned about a global digital divide between rich and poor countries. The Group of 8 (G8) formed a Digital Opportunity Task Force in 2000 that brought together teams from government, the private sector, and nonprofit organizations in developed and developing countries to identify ways to spread the benefits of the digital revolution more broadly.[5] The following year, the United Nations Information and Communication Technologies Task Force was launched with a similar mission.[6] The U.N. task force, still in existence today, organizes awareness programs, develops stakeholder

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networks, assists countries and regional groups with strategy development, supports broadened international participation in policy development, works to improve Internet connectivity around the world, and promotes efforts to support local content and application creation.

CONCEPTIONS OF THE DIGITAL DIVIDE

Early conceptions of the digital divide focused on the binary distinction between those who had and did not have access to ICT as indicated by availability of an Internet-connected computer. However, these conceptions soon came under criticism on several levels. First, since people access and use ICT in a wide variety of locations and contexts, the notion of a binary divide, rather than a complex continuum, was portrayed as simplistic, and one that could lead to failure to recognize the diverse ways that different individuals and groups do connect to digital information. Second, ICT access does not have a one-way relationship causal to individual and social development, but rather two-way; higher levels of development enable more ICT access, and ICT access can enhance developmental processes. Finally, the focus on physical access to technology was seen as too narrow since there are many other factors, such as language and literacy ability, computer skills, suitability of online content, and availability of instruction or social support that enable or constrain meaningful ICT use; any efforts to overcome inequity related to technology thus need to take these broader factors into account, rather than merely supplying additional hardware.[7,8]

Today, there is broad recognition that the digital divide must be understood as incorporating a broad range of variables. A number of models have been developed to portray the factors involved in meaningful technology access and use, such as the one by Warschauer seen in Fig. 1.[9]

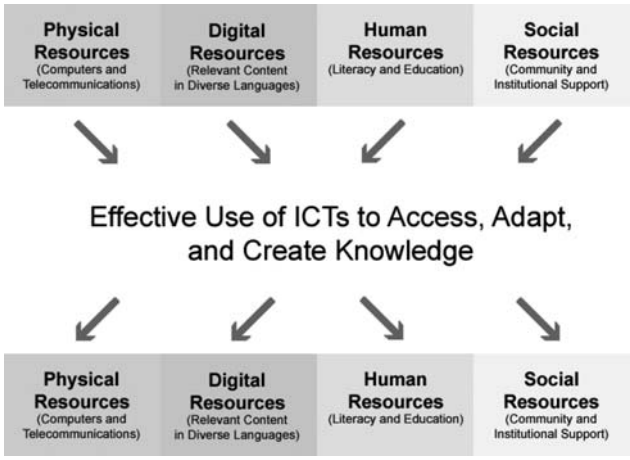

Fig. 1 A model of factors affecting technology access and use. **Source**: http://www.firstmonday.org/issues/issue7_7/warschauer/ (August, 2007).

Finally, some prominent individuals and groups have downplayed the notion of a digital divide. Michael Powell, chairman of the U.S. Federal Communications Commission from 2001 to 2004, compared the digital divide to a "Mercedes divide," suggesting that ICT represented a consumer product that people could purchase or not depending on their wealth and desire and that government had little interest in promoting equitable ICT access.[10] This view was echoed by the U.S. Heritage Foundation, which claimed that the free market will rapidly erase any digital divide in the United States and that government action would thus be counterproductive.[11]

MEASURING THE U.S. DIVIDE

A variety of approaches have been developed for measuring the digital divide, both within and across countries. Within the United States, the early standards on this issue were largely set by the NTIA, whose national reports were broadly seen as the authoritative source of information on the topic. The reports were based on the Current Population Surveys (CPS) of about 50,000 U.S. households conducted by the Bureau of Labor Statistics and the U.S. Census Bureau. The CPS surveys collect general demographic data on a monthly basis and supplements that with specialized data at different times; supplemental data on computer and Internet access was collected on six occasions between 1994 and 2003 and formed the basis of the NTIA reports.[12]

The 1995 NTIA report focused on the question of whether U.S. households had either 1) a computer (i.e., *computer access*); or 2) a computer, a modem, and subscription to an online service (i.e., *Internet access*).[13] Computer and Internet access were then compared by geographic region and by the income, race, age, and educational attainment of the head of household. The 1998[14] and 1999[15] reports used a similar methodology, though also added an additional variable of having an e-mail account (i.e., *e-mail access*).

The 2000 NTIA report included, as previously, comparative household data, but also included for the first time data on individual use, again compared by the same demographic variables. This represented an emerging recognition that any true measure of the digital divide needed to account not only for whether one had physical access to the technology, but also whether one actually used it. Also for the first time, the 2000 NTIA report included the category of disabled status, thus drawing attention to an important dimension of the digital divide.[16]

As computer and penetration into homes continued to expand, the NTIA further de-emphasized household access and instead discussed individual use in more detail. For example, the 2002 report compared different types of Internet use (e.g., finding health information, finding financial information, entertainment-oriented activity) by

the gender, age, race, and income of users; began to investigate who had broadband access to the Internet (though differentiated only by urban/rural location); examined types of computer use at work by the occupation of the user; compared amount of Internet and e-mail use at work by occupation and by gender; looked at whether diverse groups of children used computers at home, school, and other locations; and examined Internet use among particular categories of the disabled (e.g., blind, deaf, difficulty walking).[17] The 2004 report indicated Internet use in relationship to broadband access and other demographic factors (e.g., gender, race/ethnicity, employment, income, education, age, and particular types of disability).[18]

The CPS has not collected data on computer or Internet access and use since 2003, and no new NTIA reports on the topic have since been issued. Though no other group has sought to systematically measure the digital divide across so many dimensions in the United States, other groups have collected a range of data on Internet use that is helpful for understanding technology and equity. The most important of these groups is the Pew Internet and American Life Project, which carries out random-digit dial telephone surveys on a wide variety of topics related to Internet use. Topics addressed by the Pew project include home broadband adoption; the use of the Internet for particular kinds of pursuits (election news and activity, health information); typologies of Internet users; and uses of the Internet by particular demographic groups (see Table 1).[19] Data from NTIA, Pew, and others thus presents the following overview of the digital divide in the United States in relationship to particular demographic groups.

Gender. Differential computer and Internet access by gender had disappeared in the United States by 1997, and women and men continue to access the Internet to the same degree. However, women receive less than 28% of the computer science bachelor's degrees in the United States and encompass only 20% of professionals in information technology industries.[20] These facts have led many groups to be concerned about the types of early experiences girls have with technology, and whether these experiences are helping them develop the skills, knowledge, and attitudes to become leaders in technology-oriented careers.

Age. Age continues to be a major factor in the digital divide, with only 32% of U.S. seniors aged 65 or older using the Internet.[21] A recent study suggests that income, cognitive ability, and the availability of relatives to help with technology are all factors correlated with whether and how seniors access the Internet.[22]

Race/ethnicity. The race/ethnicity gap in Internet use has lessened over time but is still noteworthy, with 73% of Whites, 62% of Blacks, and 56% of Latinos using the Internet.[21,23] Research suggests that differences in income and education account for much of this gap, with high-income Blacks and Hispanics using the Internet approximately as much as high-income Whites.[16] Language is also a major factor for Hispanics, with 78% of English-dominant Latinos using the Internet, compared to only 32% of Spanish-dominant Latinos.[24]

Table 1 Demographics of U.S. Internet users

	Use the Internet (%)
Total adults	71
Women	70
Men	71
Age	
18–29	87
30–49	83
50–64	65
65+	32
Race	
White, non-Hispanic	73
Black, non-Hispanic	62
Hispanic	56
Geography	
Urban	73
Suburban	73
Rural	60
Household income	
Less than $30,000/year	55
$30,000–$49,999	69
$50,000–$74,999	82
$75,000+	93
Educational attainment	
Less than high school	40
High school	61
Some college	81
College+	91

Sources: http://www.pewinternet.org/trends/User_Demo_6.15.07.htm (August 2007); http://www.pewinternet.org/pdfs/Latinos_Online_March_14_2007.pdf (August 2007).

Geography. Urban and suburban residents access the Internet to equal degrees. The gap between them and rural users has lessened in recent years and appears to be due in part to lesser access to broadband in rural U.S. areas. Only 31% of the rural population has broadband access compared to 52% of the urban and 49% of the suburban population.[21]

Income. Though all income groups have expanded their access to the Internet in recent years, income remains a major factor, with only 55% of those with household incomes under $30,000 using the Internet compared to 93% of those with household incomes over $75,000.[21] Differences in quality of use are likely as well, due to the higher likelihood of high-income families of having up-to-date computers, multiple computers, and broadband Internet connections than low-income families.

Education. Educational attainment is one of the most prominent factors of the digital divide, with 40% of those with less than a high school education using the Internet and 91% of college graduates using the Internet.[21] Differences in types of usage are also strongly correlated

with education, with college graduates far more likely than others to use the Internet to enhance their productivity or manage digital content.[24]

Disability. Disability status is also strongly correlated with Internet use, with only 30.8% of people with disabilities using the Internet.[25] Limited mobility, limited income, and the high cost of specialized adaptive technology are all barriers for people with disabilities using computers. Inconsistent implementation of accessibility standards in the design of online content also makes it difficult for people with certain disabilities, such as visual impairment, to make effective use of the Internet.

MEASURING THE INTERNATIONAL DIVIDE

Assessments of the international digital divide are usually made at the level of countries, or groups of countries, rather than individuals. Indicators that are taken into account include number of computers, Internet subscribers, or Internet users as a percentage of the population. Countries are then often aggregated by either region or continent for comparison purposes. For example, as seen in Table 2, dramatic differences exist between regions of the world in Internet penetration. Though regions with the least Internet access are expanding at the fastest rate, it will still take a long time for them to catch up.

The international digital divide is also reflected in production of Internet content. An earlier study demonstrated that Internet domains are overwhelmingly concentrated in certain countries (e.g., the United States, Germany, the United Kingdom) and in major cities within those countries[26]; follow-up studies have not been conducted to show how these trends may have changed over time.

The International Telecommunication Union (ITU) has attempted to develop a more complete measure of the international divide using a wide variety of indicators measuring network infrastructure (e.g., international Internet bandwidth), individual use (e.g., Internet users per 100 inhabitants), individual access (e.g., broadband subscribers per 100 inhabitants), and skills that enable computer and Internet use (e.g., adult literacy rates). It then brings this data together into an ICT Opportunity Index and group countries based on this index into high, upper, medium, and lower levels. The ITU study found a huge gap between these different levels, with the divide steadily increasing further between the high and low extremes from 2001 to 2004. However, in 2004, the divide between high- and low-ICT opportunity countries began to decrease, suggesting the beginning of a small catch-up effect in overcoming the international digital divide.[27] Researchers have also investigated the social, economic, and political factors that tend to correlate with the digital divide internationally. Studies suggests that general developmental level, amount of political openness and democracy, mass education, the presence of a sizeable service sector in the economy, and flexible telecommunication policy are all factors that correlate with Internet diffusions in particular countries.[28,29]

Table 2 World Internet usage

Region	Percent of population using the Internet	Usage growth, 2000–2007 (%)
Africa	3.6	643.1
Asia	11.8	282.1
Europe	39.8	206.2
Middle East	10.1	494.8
North America	69.5	115.2
Latin America/ Caribbean	19.8	508.6
Oceania/ Australia	54.5	146.7
World Total	17.8	225.0

Source: http://www.internetworldstats.com/stats.htm (August 2007).

THE EDUCATIONAL DIVIDE

A good deal of attention on the digital divide has focused on the role of schools. Within the United States, for example, the National Center for Educational Statistics has carried out eight national studies since 1998 measuring Internet and computer access in public schools throughout the country. Though gaps between the number of Internet-connected computers in high-minority schools (i.e., with 50% or more of their students being racial or ethnic minorities) and low-minority schools (i.e., with fewer than 6% of their students being racial or ethnic minorities) steadily fell from 1998 to 2002, it remained steady thereafter (see Fig. 2). The most recent data in 2005 indicates that there are 3.0 students per Internet-connected computer in low-minority schools and 4.1 students per computer in high-minority schools.[30] The digital divide in schools goes beyond the availability of computers and extends to how technology is used. Blacks, Hispanics, and low-income students have been shown to disproportionately use computers for drills, remediation, and vocational education, whereas whites, Asians, and high-income students more frequently use computers for advanced simulations and research.[31] These differences are due to a number of factors, including the different levels of background, skill, and knowledge that students have; the differential amounts of technology they have at home (that may help them prepare for more advanced uses at school); and the different levels of skill and experience among teachers in low-income versus high-income neighborhood schools.[32]

On the international level, little data exists as to the number of computers or Internet connections in schools around the world; however, obvious differences in these measures exist between developed and developing

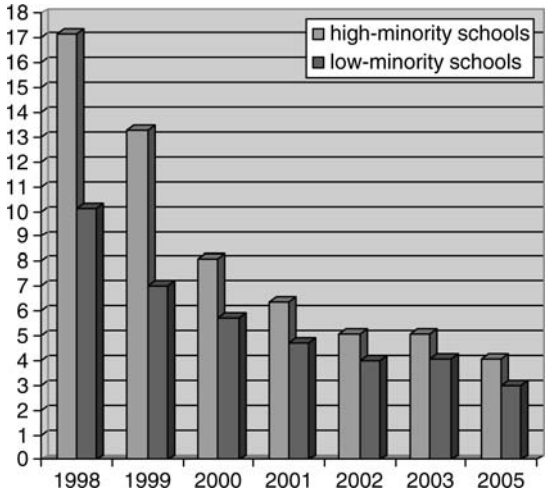

Fig. 2 Number of students per Internet-connected computer in high-minority and low-minority U.S. K-12 Schools, 1998–2005. **Source**: From Wells, J.; Lewis, L.; Greene, B. *Internet Access in U.S. Public Schools and Classrooms: 1994–2005*; National Center for Educational Statistics: Washington, 2006.[30]

countries. Many developing countries think of schools as a critically important arena for overcoming the digital divide and are thus making efforts to outfit schools with computers and Internet access.

Schools have been a major focus for overcoming the digital divide. In the United States, the federal program known as E-rate has made use of the Universal Service fee charged to telecommunication companies to distribute funds for schools and libraries to obtain affordable telecommunications and Internet access. Internationally, efforts are underway to develop inexpensive educational computers for developing countries. The most ambitious of these efforts is the U.S.-based One Laptop Per Child program, which seeks to develop an ultra low-cost laptop for sale to ministries of education in developing countries and distribution to children in public schools.[33] The program has been lauded for the innovative design of its computer, known as the XO, but has also been criticized by some who believe that developing countries have more pressing educational priorities than making large-scale investments in laptop computers for individual students.[34]

ADDRESSING THE DIGITAL DIVIDE

A number of programs have been put in place for addressing the digital divide. At the infrastructural level, programs have been launched to reduce the cost of computers or Internet connectivity for low-income citizens, for example, through providing free municipal wireless access. Other programs, such as the aforementioned One Laptop Per Child initiative, seek to develop special versions of hardware or software that are both lower in cost and more suitable for use among the urban and rural poor.

As regards content, advocacy groups work to create online materials that reflect local economic or social needs (e.g., information about health care for low-income residents in the United States or local crop prices for rural farmers in India) and are available in multiple languages and dialects and at reading levels suitable for mass access.

As regards human capital development, initiatives have focused on making computers and the Internet more affordable to schools and for developing curricular and pedagogical approaches that ensure that all students have equal access to advanced forms of learning with new technology.

Finally, as regards social support, a number of governmental and nongovernmental organizations have fostered the development and promotion of community technology centers, where individuals can not only make use of computers and the Internet but can also receive technical support and training. In countries with widespread rural poverty, such as India, community technology access often takes place through Internet kiosks where users for a small fee can either use the technology themselves or gain access to online information via the kiosk manager. In many countries, public libraries serve as a point of computer and Internet access for low-income citizens.

A number of grassroots groups attempt to coordinate information and organizing aimed at tackling the digital divide. Prominent among these is the Digital Divide Network,[35] which includes discussion lists, blogs, event announcements, and article archives for educators, activists, policy makers, and others concerned with technology and social inclusion.

CONCLUSION

In the 1990s, governments and organizations around the world became concerned about unequal access to new technologies, whether among individuals or nations. Labeling this unequal access a *digital divide* helped draw attention to the issue. Since that time, the concept has broadened to address not only physical access to computers and the Internet, but also the kinds of knowledge, skills, online content, and social support necessary to make such access meaningful. In that sense, there is not one digital divide but many, and diverse efforts on many fronts are needed to overcome them.

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