A Literacy Approach to the Digital Divide

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1. Introduction

As Manuel Castells notes, the ability to access, use, and adapt information technology is "the critical factor in generating and accessing wealth, power, and knowledge in our time" (1998: 92). Given the importance of information and communication technologies (ICTs) in today's world, a great deal of attention is focused on stratification of technology use. The *digital divide* is a concept frequently used for addressing this issue, but what exactly it means is imprecise. An income divide refers to unequal income. An employment divide refers to unequal employment. What does a digital divide refer to?

In this paper, I analyze the definition of the digital divide, and compare it to prior notions of a literacy divide. I then illustrate the importance of this definition by discussing research we have conducted on technology and learning.

2. Defining the digital divide

The name "digital divide" can, in fact, refer to several different phenomena. One, for example, is unequal Internet access and usage. A second is unequal ability to make use of the Internet, due not only to unequal access but also to other factors (such as education, language, content, etc.). While the second definition is preferable to the first, it is still somewhat vague—make use of the Internet toward what ends? I prefer a wider definition: the digital divide refers to **social stratification due to unequal ability to access, adapt, and create knowledge via use of information and communication technologies (ICT).**

Let us parse these pieces a bit. First, the term "stratification" indicates that the "divide" is not really a binary division at all, but rather a continuum based on different degrees of access to information technology (see WARSCHAUER 2003). Compare, for example, a professor at UCLA with a high-speed "Internet II" connection in her office, a student in Seoul who uses a cyber-cafe, and a rural activist in Indonesia who has no computer or phone line but whose colleagues in her NGO download information for her. The notion of a binary divide is thus inaccurate and can be patronizing, as it fails to value the social resources that diverse groups bring to the table. For example, in the United States, African-Americans are often portrayed as being on the wrong end of a digital divide (e.g. WALTON 1999), when, in fact, Internet access among Blacks and other minorities varies tremendously by income group, with divisions between Blacks and whites decreasing as income increases (see discussion of US divide in WARSCHAUER & MATUCHNIAK 2010).

Second, the adjective "social" is a welcome correction to the somewhat confusing term "digital." The stratification that does exist regarding access to online information has very little to do with the Internet per se, but has everything to do with the political, economic, institutional, cultural, and linguistic contexts which shape the meaning of the Internet in people's lives. The notion of a digital divide suggests that the divide can be breached by giving someone an Internet account. However, little data exists to support this. In fact, it is safe to predict that within one to two decades, Internet access will be ubiquitous in some countries, such as the United States, connecting not only computers but also televisions, game machines, and mobile phones. Yet just as the ubiquitous presence of other media, such as television and radio, has done nothing to overcome inequality, there is little reason to believe that the mere presence of the Internet will have a better result. If anything, recent economic trends suggest otherwise.

The rest of the above definition thus makes clear that what is at stake is not access to information technology in the narrow sense (of having a computer on the premises) but in a much wider sense of being able to make use of information technology for productive ends.

3. Models of social access

How then is a digital divide to be overcome? To understand this question, it is necessary to examine models of social access to particular technologies.

3.1 Devices

The simplest, but least helpful, way to think about ICT access is as access to a **device** (in this case, a computer). Access to a computing device is clearly part of ICT access, but obviously does not in itself constitute access, especially because the device itself, even if used properly, does not allow computer-mediated communication without some kind of connection to the Internet.

The one reason that the device model is appealing to some is because diffusion of devices is comparatively easy and quick, compared to diffusion of conduits, content, and practices. This is because devices are based on a one-time purchase, rather than a monthly fee (let alone the development of a skill), and the purchase price is often reduced through the availability of a wide variety of models sold both first and secondhand. In the United States, for example, television and radio both reached 95% saturation points within approximately twenty years, and their penetration rate in low-income communities and high-income communities is approximately equal (currently at 97+%).

The cost of personal computers is falling rapidly enough that, in the wealthier industrialized countries, price alone will not likely be a major obstacle to entry-level computing. However, other issues such as differential access to human and social capital will continue to play a role in fostering digital inequality.

3.2 Conduits

Whereas access to a device implies a one-time purchase price, access to a conduit implies connection to a supply line that provides something on a regular basis.

In one sense, televisions and radios are also conduit services, in that the device itself is worthless without the accompanying airwaves. However, since television and radio programming is often provided for free, and the consumer needs no special infrastructure or monthly fee to receive this free programming, the device model still holds.

Examples of conduits are electricity, telephone service, and cable television. Diffusion of conduits is generally slower than that of devices, either because a delivery infrastructure must be established or because the cost of a regular monthly fee is a disincentive toward access.

Among conduits, electricity is a useful example to consider in more detail, since electricity, like ICT, has been the key to an industrial revolution. Electrification has followed a variety of paths around the world based in large part on the constellation of class forces engaged in struggle on the issue in particular countries. In South Africa, for example, wealthy industrialists developed their electrical system primarily to improve diamond, coal, and gold mining, but they did not electrify the nearby homes of their black workers (RENFREW 1984). In the Soviet Union, Lenin launched a massive national electrification effort soon after the Russian revolution under the slogan of "Communism=Soviet Power + Electrification of the Whole Country" (ABAMEDIA 1999; NYE 1990). The campaign was largely successful, and the diffusion of electricity and power plants throughout the country was a prerequisite to the Soviet Union's rapid industrialization and eventual military success against Nazi Germany. At the same time, the highly-centralized and forceful nature of the electrification campaign, as with other aspects of Soviet industrialization, took a heavy toll on the work force and citizenry.

Between these two extremes lie the experiences of Western Europe and the United States, which used different combinations of market and governmental forces to extend universal access to electricity. In the industrialized nations of Europe, strong workers' and farmers' parties pushed for electrification to be viewed as a social service, rather than a private commodity. The state usually owned public utilities and developed electrification policies within the context of the welfare state. As a result, in Germany, Holland, and Scandinavia, 90% of all private homes—and fully 2/3 of all farmers' homes, had access to electricity by 1930 (NYE 1990). And electrical transportation systems, such as trolleys, were operated by the government at a loss. In the US, though, with its weaker labor and farmer movements and its laissez-faire style of capitalism, electric utilities came primarily under private ownership, with the government's role reduced to regulation (BROWN 1980). By 1932, public power produced only 5% of US electricity (NYE 1990). Unprofitable electric trolley systems in the US collapsed and were replaced by privately-owned automobiles. As a result of private ownership and the profit motive, American home electrification began "as a form of conspicuous consumption for the very rich, and only spread beyond the wealthiest classes at a slow pace" (NYE 1990: 140). By the end of the 1920s, 90% of US farmers could not get electricity in their homes, and those who did often had to pay twice the urban rate (NYE 1990). In the end, government intervention via Franklin Delano Roosevelt's 1935 Rural Electrification Act was necessary to complete the task of electrifying America. A component of Roosevelt's New Deal, the REA actually had its roots in decades of popular struggle for rural electrification (BROWN 1980).

The lesson of this for the digital divide is not that the ICT industry needs to be government-owned; indeed, privatization, done well, can be an important component

of extending telecommunications (and thus Internet) access. The lesson is rather that the diffusion of any technology is a site of struggle, with policy and access reflecting broader issues of political, social, and economic power.

The comparison with electrification is of interest, especially because, similarly to ICT, electricity opened the door to a new stage of industrial capitalism. However, beyond that, the comparison begins to fade. Access to electricity is generally provided through a one-time infrastructure commitment, with relatively minor continuous payments required by users and with differences of knowledge, skills, and content irrelevant to whether people can make use of electricity.

A closer comparison can perhaps be seen in the area of telephone service, which makes available an important means of public communication. Access to telephone services involves issues both of infrastructure (e.g. telephone lines, satellites, cellular antennae) and affordance of ongoing costs. Governments have sought to promote mass access to telephony for a number of reasons. First, telephone (in)access has been viewed as a factor which can compound or overcome other disadvantages related to poverty, unemployment, and access to goods and services (GRAHAM, CORNFORD, & MARVIN 1996). In addition, in developed countries, where telephone access has reached over 90%, lack of telephone access is seen by some as an inhibition of people's opportunity to participate in societally-recognized civil and social discourse (PRESTON & FLYNN 2000). Finally, before the advent of wireless telephone, it was recognized that universal telephone service, like universal electrification, could not be provided by market forces alone, since it involved laying expensive lines to rural areas that might have a small number of users.

Beyond the individual benefits of telephone services, governments have also promoted expanded telephone access for reasons of collective welfare. In today's world, telephony is a key component of development, and developing countries recognize that poor and limited telephone service restricts opportunities for foreign investment and economic modernization. In addition, even in countries where many are already connected, there is a network effect to telephony; a telephone network, like a fax network, or the Internet, gains value when more users are connected to it. (Think of the converse: the only telephone or fax machine in the world is valueless, because there is no one else to communicate with.) Therefore, each added user is seen as benefiting not only that user but the entire network and society.

3.3. Practices

Though conduits provide a better comparative model than devices, neither one captures the essence of access to information and communication technologies. What is most important about ICTs is not so much the availability of the computing device or the Internet line, but rather people's ability to make use of that device and line to engage in meaningful social practices, specifically to communicate with people, to access information, and to publish information. Those who are illiterate, who have never learned to use a computer, and who do not know major languages will have difficulty even getting online, much less using the Internet productively, at least with the types of computers, Internet connections, and online content currently available. And the ability to use the Internet for global exchange—whether for business, scientific, or cultural affairs—will often require sophisticated use of a particular language, English (CRYSTAL 1997).

Lievrouw (2000) discusses these issues and suggests the notion of **content** in opposition to that of **conduit**. According to her view, content encapsulates the physical access to the device and information channel, and two additional elements: (a) institutional sources of information, and (b) sufficient individual capacity to make use of that information to engage in social action and discourse. Though I agree with Lievrouw's notion, I will avoid the word content since it usually refers to the first of the preceding two elements, rather than the two of them combined. Another possible term is **skill**, though I will avoid that as well since it usually refers to the second of the two elements (rather than to both of them), and for additional reasons I will explain below.

4. Literacy

The word "practices" instead suggests the way that users are able to combine device, content and skill to be able to engage in activities. The best previous example of access to practices is that of **literacy**. There are many similarities between literacy and ICT access. First, both literacy and ICT access are closely connected to advances in human communication and the means of production of knowledge. Second, just as ICT access is a prerequisite for full participation in the informational stage of capitalism, literacy was (and remains) a prerequisite for full participation in the earlier industrial stages of capitalism. Third, both literacy and ICT access necessitates a connection to a physical artifact, to sources of information that get expressed as content within or via that physical artifact, and to a skill level sufficient to process and make use of that information. Fourth, both involve not only receiving information but also producing it. Finally, they are both tied to somewhat controversial notions of societal divides: the *great literacy divide* and the *digital divide*.

Because of the similarities between ICT access and literacy, it is worth exploring more in depth what literacy is, how it develops, and what research has shown regarding the existence of a literacy divide.

While the commonsense definition of literacy is the individual skill of being able to read and write, literacy theorists prefer a broader definition that takes into account the social contexts of literacy. What they point out is that what is considered skillful reading or writing varies tremendously across historical and sociocultural contexts (GEE 1996). For example, in the pre-Gutenberg era, writing principally involved memorizing and transcribing oral speech or carefully and accurately copying classical manuscripts (MCLUHAN 1962). A skilled writer thus had outstanding mnemonic and penmanship abilities. Reading was often done publicly, with an orator slowly reading a manuscript out loud. Whether done publicly or privately, though, the purpose of reading was to interpret a small number of classical and religious texts in order to achieve "a new consciousness of what a text *could have meant* or *could mean* to a putative reader" (OLSON 1994: 157, emphasis in original).

These notions of reading and writing started to change as early as the 12th century (OLSON 1994), but changed much more rapidly following the introduction of the printing press in the mid-15th century. In the new print era, scholarly writing came to be viewed as authorship of original material, and scholarly reading came to mean the gathering, comprehending, and making use of information from a variety of sources (EISENSTEIN 1979).

Notions of literacy have continued to change in the last 100 years. For example, De Castell and Luke (1986) identify three distinct paradigms of school-based literacy in recent US history, each highly dependent on the social, economic, and cultural norms of particular epochs. In the 19th century classical period, literacy was viewed as knowledge of literature and attention to rhetorical appropriateness. Literacy pedagogy involved rote learning, oral recitation, copying, and imitation of "correct speech and writing." And the literacy curriculum was based on exemplary texts such as the Bible, a narrow selection from Greek and Roman literature, and handwriting primers. This paradigm corresponded to the needs of an aristocratic social structure, in which, land, power, and knowledge was concentrated in few hands, and education involved obedience to tradition and power.

Following the mass industrialization of the early 20th century, a Deweyan progressive paradigm of literacy emerged as a "self-conscious attempt...to provide the skills, knowledge, and social attitudes required for urbanized commercial and industrial society" (DE CASTELL & LUKE 1986: 103). In this paradigm, literacy was viewed as a form of self-expression. Literacy pedagogy involved teacher/pupil interaction and the "discovery method." The literacy curriculum included civics, adventure stories, and self-generated texts.

But the progressive model never fully took hold; rather it was in constant struggle with a more technocratic paradigm which eventually won out (CUBAN 1993). In this technocratic paradigm, literacy was viewed as the "survival skills" necessary to function in society. Literacy pedagogy involved programmed instruction, learning "packages" with the teacher as the facilitator, and a "mastery learning" of a common set of objectives. And the literacy curriculum was based on decontextualized subskills of literate competence.

From this brief historical sketch, we can conclude that literacy is not a context-free value-neutral skill; rather, being literate "has always referred to having mastery over the processes by means of which culturally significant information is coded" (DE CASTELL & LUKE 1986: 374). Because there are different types of literacy—not only across time but also within the same society (basic literacy, academic literacy, etc.), the plural form "literacies" is often used by literacy theorists. In the same vein, literacy theorists often prefer to use the term "literacy practices" rather than "literacy skills," as the former term emphasizes the importance of actual application of literacy in social context.

4.1 A literacy divide?

One of the most significant theoretical questions related to literacy, and one that corresponds closely to current debates over a digital divide, is whether there exists a great "literacy divide." Literacy continues to be available on a highly unequal basis. Adult literacy rates range from over 99% in a some of the most developed countries (including Italy, Spain, Israel, Singapore, Greece, and South Korea), to the 50-60% range in some developing countries (e.g. 55.7% in India, 53.7% in Egypt), to under 30% in some of the poorest countries (e.g. 22.2% in Burkina Faso, 14.7% in Niger, UNITED NATIONS DEVELOPMENT PROGRAMME 2000). Literacy is highly correlated with income and wealth at both an individual and a societal level. So, in one sense, the importance of literacy to social and individual development is almost undisputed.

Yet there are some who go beyond this general claim about the benefits of literacy to assert that there are fundamental cognitive differences in individuals who are literate and who are not, resulting in a great literacy divide at both the individual and societal levels. Literacy is said to separate prehistory from history (GOODY & WATT 1963), primitive societies from civilized societies (Levi Strauss, in CHARBONNIER 1973), and modern societies from traditional societies (LERNER 1958; see discussion in SCRIBNER & COLE 1981). At the individual level, literacy is said to allow people to master the logical functions of language (GOODY 1968; OLSON 1977) and to think abstractly (GREENFIELD 1972; LURIA 1976).

The impugned cognitive benefits of literacy have proven very difficult for researchers to investigate. The problem is that literacy is almost always confounded with other variables, and, particularly, with schooling. For the most part, those who are completely illiterate have had little or no schooling, whereas those with high levels of literacy have had a good deal of schooling. The covariance of literacy with other social factors has made the cognitive impact of literacy a thorny question to attack.

Two American educational psychologists, Sylvia Scribner and Michael Cole, eventually found a very creative way around this obstacle. They identified a tribe in Liberia, called the Vai, who had developed their own script in their own local language. Literacy in the Vai script was passed on through informal tutoring, not through schooling. And Vai literacy was used in very limited ways, especially for personal correspondence and business records. By carrying out a three-way study that compared illiterate tribal members, those literate only in the Vai language (through personal tutoring), and those with English or Arabic literacy skills gained through secular or religious schooling, Scribner and Cole (1981) were able to separate which cognitive benefits were gained from literacy and which others were due to the broader environment of schooling.

Interestingly, Scribner and Cole found virtually no generalizable cognitive benefits from Vai literacy. Individual differences on a range of cognitive tasks, in areas such as abstraction, classification, memory, and logic, were instead due to other factors, such as schooling, or, in some cases, living in an urban (as opposed to rural) area. Vai literacy was found to be correlated with better achievement, as compared to non-literates, in functional tasks that were related to the practices of Vai literacy. These included giving grammatical explanations, picture reading (i.e., decoding graphics according to a pre-assigned code), and picture writing. Similarly, the cognitive benefits of Arabic literacy were closely associated with the functions of its use. The main benefit of Arabic literacy was in the area of verbal recall, which is not surprising since Arabic literacy is developed in Liberia through memorization of the Koran. More complex and generalizable cognitive tasks, such as solving abstract logic problems, were correlated only with schooling and English literacy, which is again, not surprising, given the types of abstraction and problem-solving which are practiced in school. And on no single task in their entire study did every Vai literate outperform every non-literate (in other words, individual variation trumped group variation according to literacy level.)

Scribner and Cole's study helped settle the question whether or not there is a great literacy divide, at least at the individual level. Their work showed that there is no single construct of literacy that divides people into two cognitive camps. Rather there are gradations and types of literacies, with a range of benefits closely related to the specific functions of literacy practices.

4.2 Acquisition of literacy

Finally, there is the issue of acquisition of literacy. Once literacy is understood as a social practice that involves a range of skills, knowledge, and resources, it is also easier to understand the social basis of literacy learning. Brian Street (1984; 1993) and other critical literacy theorists (e.g. COPE & KALANTSZIS 1993; FREIRE 1970; LANKSHEAR 1994) have shown how access to literacy is closely tied to issues of social, political, and economic power. From South Africa to Brazil to the impoverished ghettos of the United States, access to literacy intersects with unequal opportunities to attend school, inequitable distribution of resources within the educational system, and curricula and pedagogy that meet the needs of certain groups more than others. Because of this situation, in many cases literacy is not so much granted from above, but rather seized from below through the social mobilization and collective action of the poor and dispossessed.

4.3 Literacy and ICT access

Putting the contribution of prominent literacy theorists together, we arrive at five major conclusions about literacy:

- There is not just one, but many types of literacy
- The meaning and value of literacy varies in particular social contexts
- Literacy exists in gradations, rather than in a bipolar opposition
- Literacy alone brings no automatic benefit outside of its particular functions
- Acquisition of literacy is a matter not only of education and culture, but also of power

These points can also serve as the basis for a theory of the digital divide and ICT access: There is not one type of ICT access, but many; the meaning and value of access varies in particular social context; access exists in gradations, rather than in a bipolar opposition; computer and Internet access alone brings no automatic benefit outside of their particular functions; and acquisition of ICT access is a matter not only of education and culture, but also of power.

The development of a more sophisticated understanding of literacy did not lead to a downplaying of its importance – far from it. Actually, by better understanding literacy, academics, educators, and policy-makers could better promote it. By better understanding ICT access, we can also better promote it and thus help overcome social exclusion.

5. Amplifying Access

I will illustrate the above by discussing three elementary schools that have implemented educational reform programs with technology, one in Birmingham, Alabama, one in Oxnard, California, and one in Littleton, Colorado. The Birmingham school was part of the city's One Laptop per Child (OLPC) program, which emphasizes children's independent ability to teach themselves with computers (specifically, the OLPC's XO laptops), and thus de-emphasizes curricular reform, professional development, formative evaluation, or development of a technological or social infrastructure to support laptop use by students. As former Mayor of

Birmingham Larry Langford, who initiated the local program, said on the city Website, "If we give them these XOs and get out of their way, they'll be teaching us about the world" (EDUCATION INITIATIVES 2010).

Following a six-week pilot program at a single site, laptops were distributed in 2008 to all grade 1 to 5 students in Birmingham City Schools, an overwhelmingly low-income African-American school district. No funding was provided to expand the limited Internet access in schools, and only two hours of professional development training was provided to each teacher. With the program launched by the mayor's office and funded by the city council, the school district had little time, funding, or motivation to develop curricular integration plans.

My case study research in the district in December 2009, a survey of district students by Cotten (2010), and press reports (e.g. LEECH 2010) all indicate that the laptops are little used in school. A large number are broken and no funding has been provided for repairs; as a result, even in the few classrooms where teachers still want to use them, less than half of the students have functioning laptops on a given day. Without connections from the laptops to servers, printers, or the Internet, teachers have difficulty carrying out even the most common instructional uses of computers, such as having students access online information or share their writing. Many students use the XO computers at home, but without any apparent educational benefit. The frequency with which students use computers to conduct research, do homework, or create online content all went down following introduction of the XOs, while the frequency with which they visit chat rooms went up substantially (WARSCHAUER & AMES 2010). These results are consistent with the disappointing outcomes found in other settings in which low-income children gain access to computers without any additional social support for their use (e.g. VIGDOR & LADD 2010).

In spite of deploying low-cost XO computers and devoting little additional money to social or technical support, the ongoing costs of the Birmingham program are considerable. Since the laptops are given to and owned by the children rather than the schools, fully one-third of the inventory disappears from the program every year, as students either graduate out of the elementary schools or move out of the district. Substantial replacement funding is thus required year after year, with little benefits seen in return. If the city had put the same amount of funding into a better conceived and organized laptop program – one that focused initially on a few grade levels and provided substantial funding for curriculum development, teacher training, and technological infrastructure – Birmingham City Schools could have had one of the best educational technology programs in the US, rather than what has been accurately called a "costly lesson" (CROWE 2009).

The second school was located in the midst of strawberry plantations in Oxnard California, a couple of hours north of Los Angeles. About 80% of the students in the school are Latino (including Mexicans, Mexican Americans, and Latin Americans), and the majority have family members working as laborers in the strawberry fields. Though most schools in California have ended bilingual education following a 1998 statewide initiative, this is one of a small number of schools that have continued bilingual programs due to a progressive administration and parental demand. Though teachers at the school had only a small number of computers, two of the teachers developed a very interesting technology-based approach to promote critical literacy among traditionally marginalized students. This was accomplished through theme-based project-oriented instruction that was sensitive to students' own social concerns while at the same time cognitively demanding.

The theme-based yearlong project organized by the teachers was called "Project Fresa" (Strawberry Project). It took as its main focus the local strawberry industry. The children began by formulating their own research questions about the conditions of strawberry workers. They then conducted interviews and surveys of their family members, relatives, and neighbors based on these research questions. (They often conducted the interviews in Spanish and then translated responses into English.) Afterwards, they learned to record in spreadsheets and to produce graphs in various formats of the data they gathered (analyzing, for example, which types of graphs best the information). The graphs were incorporated into PowerPoint presentations together with photos and quotations from the people they interviewed. With the guidance of the teachers, they then searched for further information about the conditions of strawberry workers on the Internet, and also had guest speakers come to their classroom from environmental and workers' rights groups. Based on the information from the Internet and speakers, they wrote letters via e-mail to the strawberry growers expressing any concerns they might have about strawberry workers' rights. They also sent e-mails to elected officials, such as the governor, with inquiries about agricultural laborers' rights. After engaging in this kind of work, they began an e-mail exchange with children in Puerto Rico who live in a coffee growing area to compare notes about the industry and the condition of workers. At the end of the year, they had a public presentation, in which their parents and other community members come view the multimedia products they have created.

This kind of project-based teaching has several strengths. Students learn to actively master technology, rather than use it in a passive manner. They engage in their own research, data collection, analysis, and interpretation, and produce quality products such as letters to elected officials and data-based presentations. They also learn to speak out and take action on issues of importance to their community. Through gathering and weighing information from a variety of sources, including workers, non-governmental organizations, businesses, and politicians, they gain a better understanding of how different actors shape the strawberry industry and the conditions of its workers. And they hone their ability to use both their new language and their home language in socially relevant ways.

Project Fresa was a small, local project and is discussed here for its illustrative value, rather than for its broad impact. And just as there have been problems with sustaining the OLPC initiative in Birmingham, there have also been problems sustaining and extending the kind of rich, alternative curriculum represented by this project, largely due to the pressure to prepare students for standardized tests. Nevertheless, this approach, which emphasizes students' empowerment to use technology to improve their learning and social conditions, is much more promising than simply handing out laptops and getting out of the way.

The third school, East Elementary, is located in Littleton, Colorado. Some 70% of the students in Littleton are English language learners, with the largest group being immigrants from Mexico and Latin American. As in Birmingham, low-cost networks using open source software were provided to all students at East as part of a district-wide one-to-one computing initiative. However, similarly to the school in Oxnard, the technology is used as part of a curricular reform that emphasize student meaning-making in new semiotic domains.

The program at East Elementary and other Littleton schools was designed in support of the district's Universal Literacy Framework, a curricular initiative developed to guide research-based, effective practice in reading and writing

instruction. A key component of the literacy framework was an emphasis on increased student writing, drawing on the work of Reeves (2002), who found that student writing, collaborative scoring of student work, and frequent formative assessment were all critical to academic achievement. A districtwide curricular approach to writing, based on Lucy Calkins's (1994) Writers' Workshop model and emphasizing authentic writing for a real purpose and audience, was implemented. Teachers in the program participated in a week-long training in the hardware and software, and, especially, how to integrate both into writing instruction. Following the training, teachers continued to collaborate across and within schools.

Students at East and other elementary schools use the netbooks throughout the school day, but especially in literacy instruction, with students drafting and revising their writing on the netbooks and sharing their writing via wikis and a variety of blogs (see WARSCHAUER, ARADA, & ZHENG 2010). For example, one blog allows students to ask anonymous questions in relationship to a unit on human sexuality, while others were set up for a partner writing project with a school in Uruguay or for student literary analysis. Students also use live blogging tools to discuss reading passages, while one teacher reads thought-provoking stories aloud and another moderates the online discussion, and occasionally have Skype discussions with experts around the world.

Students at East and other schools in the district also have Skype discussions with experts around the world, including authors and photojournalists, and then blog about their discussions. We were told in interviews that having even one outside mentor involved in communicating with a class of students can have a big impact as it helps students develop their writing with an audience and purpose in mind, and we noted students' great enthusiasm for writing in our observations and interviews.

Our observations, surveys, interviews and test score analysis all indicated a very positive effect on both writing ability and technology skills of the Littleton program, with the English learners at East experiencing special benefits (see also GABRIEL 2010). Typically, upper elementary grades are a challenge for English language learners, who often fall further behind due to the increasingly complex vocabulary and syntax they encounter, but English learners at East were thriving at school and strengthening their identity as skilled writers in their new language. A comment by Lupita, a fifth grader at East, epitomized students' excitement about the program:

> I used to not like writing but now I keep looking at the time and inside I am saying, "Is it time for writing yet?" If you don't believe me come visit us….You have to see it to believe it because your eyes will pop out.

6. Conclusion

As examples from these three schools show, overcoming the digital divide involves much more than mere provision of a computer or an Internet account. Rather, it involves the mastery of new forms of meaning-making involving multiple media, languages, and genres. These in turn are learned through dynamic engagement in communities of practice addressing relevant social concerns.

Full access to the information society thus requires not just devices, but rather the well-supported deployment of a variety of technologies in the service of collective

inquiry, semiotic knowledge, and social action. This is the lesson of a literacy approach to understanding the digital divide.

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References

ABAMEDIA."Propaganda in the propaganda state". 1999. Available at http://www.pbs.org/redfiles/prop/inv/prop_inv_ins.htm. Accessed on 10.8.2001.

BROWN, Deward Clayton. *Electricity for rural America: The fight for the REA*. Westport, CO, Greenwood Press 1980.

CALKINS, Lucy. *The art of teaching writing*. Portsmouth, NH, Heinemann 1994.

CASTELLS, Manuel. *End of Millennium*. Malden, MA, Blackwell 1998.

CHARBONNIER, Georges. "'Primitive' and 'civilized' peoples: A conversation with Claude Lévi-Strauss". In DISCH, R. (Ed.): *The future of literacy*. Englewood Cliffs, NJ, Prentice-Hall 1973.

CHRISTIE, Renfrew. *Electricity, industry, and class in South Africa*. Albany, NY, State University of New York Press 1984.

COPE, Bill & KALANTSZIS, Mary (Eds.). *The powers of literacy*. London, Falmer Press 1993.

COTTEN, Sheila. "A vision realized or a continuing digital divide?: Examining the One Laptop Per Child program in Birmingham, Alabama". Paper presented at the Department of Education, University of California, Irvine, 2.2010.

CROWE, Christina. "A costly lesson: A look at Birmingham's curious commitment to the XO laptop". In: *Black & White* 26.11.2009, Available at: http://www.bwcitypaper.com/Articles-i-2009-11-26-232786.113121_A_Costly_Lesson.html.

CRYSTAL, David. *English as a global language*. Cambridge, Cambridge University Press 1997.

CUBAN, Larry. *How teachers taught: Constancy and change in American classrooms 1890-1980* (2nd ed.). New York, Longman 1993.

DE CASTELL, Suzanne & LUKE Allan. "Models of literacy in North American schools: Social and historical conditions and consequences". In DE CASTELL, Suzanne; LUKE, Allan; & EGAN, Kieran (Eds.). *Literacy, society, and schooling*. New York, Cambridge University Press 1986, p. 87-109.

EDUCATION Initiatives. Available at: http://www.birminghamal.gov/pdf/education.pdf. Access on 25.5.2010.

EISENSTEIN, Elizabeth L. *The printing press as an agent of change: Communications and cultural transformations in early-modern Europe*. Cambridge, Cambridge University Press 1979.

FREIRE, Paulo. *Pedagogy of the oppressed*. New York, Seabury 1970.

GABRIEL, Anne R. "Inspiring education". *EdTech: Focus on K-12, April-May* 2010. Available at http://www.edtechmag.com/k12/issues/april-may-2010/inspiring-education.html.

GEE, James Paul. *Social linguistics and literacies*. London, Taylor & Francis 1996.

GOODY, Jack (Ed.). *Literacy in traditional societies*. Cambridge, Cambridge University Press 1968.

GOODY, Jack & WATT, Ian. "The consequences of literacy". In: *Comparative studies in history and society* 1963, p. 304-345.

GRAHAM, Stephen; CORNFORD, James; & MARVIN, Simon. "The socio-economic benefits of a universal telephone network: A demand-side view of universal service". In: *Telecommunications Policy* 20/1996.

GREENFIELD, Patricia M. "Oral and written language: The consequences for cognitive development in Africa, the United States, and England". In: *Language and Speech* 15/1972, p. 169-178.

LANKSHEAR, Colin. *Critical literacy*. Belconnen, Australia, Australian Curriculum Studies Association 1994.

LEECH, Marie. "XO laptops are loved, but use is limited". *Birmingham News* 18.3.2010. Available at: http://blog.al.com/spotnews/2010/03/xo_laptops_are_loved_but_use_i.html

LERNER, Daniel. *The passing of traditional society*. New York, Free Press 1958.

LIEVROUW, Leah A. "The information environment and universal service". In: *The information society* 16/2000, p. 155-159.

LURIA, Alexander R. *Cognitive development: Its cultural and social foundations.* Cambridge, MA, Harvard University Press 1976.

MCLUHAN, Marshall. *The Gutenberg galaxy: The making of typographic man*. Toronto, University of Toronto Press 1962.

NYE, David. *Electrifying America: A social meaning of new technology, 1880-1940*. Cambridge, MA, MIT Press 1990.

OLSON, David R. "From utterance to text: The bias of language in speech and wiring". In: Harvard Educational Review 47/1977, p. 257-281.

OLSON, David R. *The world on paper*. Cambridge, Cambridge University Press 1994.

PRESTON, Paschal & FLYNN, Roderick. "Rethinking universal service: Citizenship, consumption norms, and the telephone". *The Information Society* 16/2000, p. 91-98.

REEVES, Douglas. *Accountability in action.* Denver, Colorado, Advanced Learning Press 2002.

SCRIBNER, Sylvia & COLE, Michael. *The psychology of literacy.* Cambridge, Harvard University Press 1981.

STREET, Brian. *Literacy in theory and practice*. Cambridge, Cambridge University Press 1984.

STREET, Brian. "Introduction: The new literacy studies". In: STREET, B.V. (Ed.). *Cross-cultural approaches to literacy.* Cambridge: Cambridge University Press 1993, p. 1-21.

UNITED Nations Development Programme. "Human development report 2000". New York, Oxford University Press 2000.

VIGDOR, Jacob L. & Ladd, Helen F. "Scaling the digital divide: Home computer technology and student achievement". NBER Working Paper No. 16078, 2010. Access on 21.6.2010. Available at: http://www.nber.org/papers/w16078.

WALTON, Anthony. "Technology vs. African-Americans". *Atlantic Monthly* 1999. Access on 1.11.2000. Available at: http://www.theatlantic.com/issues/99jan/aftech.htm.

WARSCHAUER, Mark, ARADA, Kathleen, & ZHENG, Binbin. “Laptops and Inspired Writing”. *Journal of Adolescent and Adult Literacy 54*/2010, p. 221-223.

WARSCHAUER, Mark. *Technology and social inclusion: Rethinking the digital divide.* Cambridge, MA, MIT Press 2003.

WARSCHAUER, Mark & AMES, Morgan. “Can One Laptop per Child save the world’s poor?” *Journal of International Affairs* 64/2010, p. 33-51.

WARSCHAUER, Mark & MATUCHNIAK, Tina. “New technology and digital worlds: Analyzing evidence of equity in access, use, and outcomes”. *Review of Research in Education* 34/2010, p. 179-225.

Abstract

Unequal access to new technology is often referred to as the "digital divide." But the notion of a digital divide is unclear. This paper explores the concept by attention to prior research on information access. It considers three forms of access, to a device, to an ongoing conduit, and to new social practices, with the latter being the most encompassing and valuable. Earlier research on literacy provides a useful framework for an interpretation of the digital divide based on practices, rather than merely devices or conduits. Both literacy and technology access are multiple, context-dependent, stratified along continua, tied closely for their benefits to particular functions, and dependent on not only education and culture but also power. They also both entail new forms of semiotic interpretation and production. Research in schools illuminates the importance of a precise understanding of the digital divide. Educational reform efforts that place emphasis on a device, such as the One Laptop per Child program, have proven unsuccessful, while those that support new forms of meaning-making and social engagement bring more significant benefits.

Keywords: literacy, technology, digital divide, media.

Resumo

O termo “exclusão digital” é normalmente usado para fazer referência ao acesso desigual de diferentes camadas da população às novas tecnologias. Mas a noção que subjaz ao termo ainda não está muito clara. Neste trabalho, discutimos esse conceito focalizando pesquisas anteriores a respeito de acesso à informação. Três formas de acesso são consideradas: acesso a equipamentos, à conexão contínua e a novas práticas sociais, sendo este último tipo de acesso o mais abrangente e valioso. Pesquisas anteriores sobre letramento fornecem um arcabouço útil para que se possa interpretar o sentido de exclusão digital com base nas práticas e não só na disponibilidade de conexão e dispositivos. O acesso tecnológico, assim como o letramento, apresenta uma natureza múltipla, é dependente de seu contexto, é estratificado ao longo de um *continuum*, está intimamente ligado aos benefícios que traz para funções sociais específicas e, ainda, resulta, não só da educação e da cultura, mas também de estruturas de poder. A exclusão digital e o letramento implicam, também, novas formas de representação e produção semiótica. Pesquisas realizadas em escolas revelam como é importante entender melhor o que caracteriza a exclusão digital. Vários esforços de reformas educacionais que privilegiam um equipamento, tais como o programa “Um Computador por Criança” (*One Laptop per Child*) se mostraram ineficientes, enquanto aqueles programas que dão apoio a novas formas de construir sentido e de interação social têm resultado em benefícios mais significativos.

Palavras-chave: letramento, tecnologia, exclusão digital, mídia.