A Teacher's Place in the Digital Divide

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Over the last decade, the term *digital divide* has been widely used to indicate unequal access to digital technology. However, there are in fact many forms of social and educational inequality related to technology access and use rather than a single divide (for an overview, see Warschauer, 2003). In this chapter, I first explore five types of digital difference that impact teaching and learning, which I call *school access*, *home access*, *school use*, *gender gap*, and *generation gap*, and then discuss strategies that teachers and schools can use to help overcome these multiple divides. I explore these divides and ways to bridge them from the perspectives of sociocultural learning theory, which emphasizes how learning is shaped by broad social and cultural contexts, and critical literacy theory, which situates reading, writing, learning, and meaning-making within the context of broader power differentials in schools and society.

Types of Digital Difference

School Access

School access refers to the unequal availability of digital technology in schools. Although differences in amounts of computing equipment and Internet access between high- and low-socioeconomic status (SES) schools have diminished, they still exist (see, e.g., Parsad, Jones, & Greene, 2005). In addition, some schools make special use of new technology for enrichment activities for students who are already performing at high levels, thus providing relatively less computer access for at-risk students (Schofield & Davidson, 2004).

Home Access

Home access refers to the availability of computers and Internet access to children in their home environment. Overall, teachers in

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high-SES schools are reasonably confident that just about all their students have access to a home computer and the Internet (see discussion in Warschauer, 2006; Warschauer, Knobel, & Stone, 2004). However, in low-SES schools, teachers know that many students might lack these resources or might face difficult conditions (slow Internet access, an outdated computer shared by several people, etc.) that prevent the efficient use of the Internet for schoolwork. They also know that many students might lack the basic computer skills that are developed from computer use in home contexts. Facing such a situation, many teachers in low-income communities are reluctant to assign homework involving computer use, and when they carry out school-based instruction with computers feel obligated to spend a good deal of time reviewing computer basics (Warschauer et al., 2004). In contrast, in high-income communities, teachers feel much more comfortable assigning computer- or Internet-based homework, as well as skipping over the basics when computers are used in school (Warschauer et al.).

School Use

The earlier point relates to a more general topic: differential ways that computers are used with high- and low-SES students in school. A number of studies (e.g., Becker, 2000; Schofield & Davidson, 2004; Warschauer, 2000, 2006; Warschauer & Grimes, 2005; Warschauer et al., 2004; Wenglinsky, 1998) provide evidence that student income and race correlate strongly with the type of use students make of computers in schools. Overall, students who are black, Hispanic, or low-income are more likely to use computers for drill and practice, whereas students who are white or high-income are more likely to use computers for simulations or authentic applications (Becker; Wenglinsky).

Of course, at one level, this is not surprising. Students with lower literacy and language skills require more basic levels of instruction to achieve proficiency, whereas students with higher language and literacy skills can leverage those skills to carry out more advanced project work. It would thus be unrealistic to think that all students, regardless of their background knowledge, skills, and abilities, are best served by the exact same instruction. Nevertheless, there are pedagogical approaches that can give *all* students more challenging and exciting experiences with new technology while still meeting their needs for language and literacy scaffolding, as will be discussed later on in this chapter. With the right approach, all students' education can be enhanced through meaningful use of technology.

Gender Gap

While the first three divides listed deal with socioeconomic status and race, this next divide considers differences based on gender. Simply put, do boys and girls access and use computers differently? Some earlier concerns that girls were being shut out of computer access and use have alleviated over time. Today, girls appear to use computers about as much as boys, but in different ways. Girls more frequently use digital technology to communicate and network with friends, whereas boys more often play computer games (Lehnart, Madden, & Hitlin, 2005).

Nevertheless, girls are still failing to enter computer science and other technological careers as much as boys (American Association of University Women [AAUW] Educational Foundation, 2000). One recent study suggested that computer science is seen by girls as being too individualistic for their needs and interests as well as too divorced from most academic content areas (Goode, Estrella, & Margolis, 2006). This suggests that developing technology-based instruction in schools that is more collaborative and more closely tied to academic content may be a successful strategy for increasing girls' comfort level with pursuing computer-based careers. Interestingly, the same approach may also be beneficial to boys, who are too often falling behind girls in academic achievement. A better integration of technology, and, in particular, of collaborative games and simulations with academic content should help boys leverage their interest in computers and gaming to improve their academic achievement.

Generation Gap

This last gap examines differences not among students, but rather between students and teachers. Many youth today have spent much of their lives surrounded by, and multitasking with, computers, video games, cellular phones, digital cameras, digital music players, and the Internet (Lehnart et al., 2005). These youth often feel more at ease in a digital environment than in the world of books, newspapers, and other forms of print (Howe & Strauss, 2000). They want and expect to have easy access to diverse sources of information, learning material in multiple media, and opportunities to network and interact online with peers (Levin & Arafeh, 2002). They are, in Prensky's (2001) words, *digital natives*.

In contrast, today's teachers did not grow up using computers, the Internet, and other digital media on a daily basis. They are thus, continuing Prensky's (2001) analogy, *digital immigrants*. Like all

TABLE 1
21ST-CENTURY SKILLS

Digital-age literacy	• Basic, scientific, economic, and technological literacies • Visual and information literacies • Multicultural literacy and global awareness
Inventive thinking	• Adaptability, managing complexity, and self-direction • Curiosity, creativity, and risk taking • Higher order thinking and sound reasoning
Effective communication	• Teaming, collaboration, and interpersonal skills • Personal, social, and civic responsibility • Interactive communication
High productivity	• Prioritizing, planning, and managing for results • Effective use of real-world tools • Ability to produce relevant, high-quality products

immigrants, they learn to adapt to their environment, but "they always retain their 'accent,' their foot in the past" (p. 2). Their teaching style, which likely reflects the way they were taught as children, may not match well with the learning styles of their digital native students.

Children today not only have different learning styles; they also face different learning requirements. Youth growing up in this new millennium will require a broad range of understanding, skills, and attitudes suitable to today's knowledge economy and society that go beyond the three Rs required a couple of generations ago. These have been nicely summarized (see Table 1) by one educational coalition as including digital-age literacy, inventive thinking, effective communication, and high productivity (North Central Regional Educational Laboratory & The Metiri Group, 2003). The teaching and learning of these 21st-century skills is greatly facilitated by, and in many cases dependent on, the use of information and communications technology, thus further complicating the role of teachers facing all the other gaps described earlier.

In summary, these five divides pose daunting challenges for teachers seeking to better meet the needs of a new generation through technology-enhanced learning, especially in low-income communities. How these challenges play out functionally was illuminated in our multi-site case study of technology integration and use in eight California secondary schools, including both low- and high-SES populations (Warschauer et al., 2004). We found three overriding themes related to technology use in schools, which we labeled *workability*, *complexity*, and *performativity*.

Workability referred to the challenge of coordinating technology use, including scheduling rooms, arranging appropriate software, and maintaining hardware, software, and network connections in working order. Workability difficulties surfaced more often in low-SES than high-SES schools, in part because of the higher turnover rates of teachers, administrators, and staff in those schools. For example, we encountered a teacher in a low-SES school who in one academic year taught in a room with high-speed Internet access but no computers, and in the following year in a room with several computers but no Internet access.

Even if all the equipment was accessible and working, there was still a good deal of *complexity* in integrating technology into instruction. The emphasis on standardized testing increased this complexity, as teachers often could not figure out how best to prepare students for tests while also emphasizing the kinds of discovery learning that are enhanced by technology use. Again, complexity was heightened in low-SES schools because of the special attention given to raising test scores in those schools as well as the larger numbers of English language learners (ELLs) those schools enrolled. For example, in a number of classrooms, we witnessed ELLs cutting and pasting information from the Internet to complete an assignment, with no evident understanding of the material they were working with. This last example is an illustration of what we called *performativity*, that is, technological performance for its own sake rather than in connection with meaningful learning goals.

Designing technology-enhanced lessons for culturally and linguistically diverse students with limited English literacy is without doubt complicated, but it can yield important rewards when done well (see examples in succeeding discussions and further examples in Brown, Cummins, & Sayers, 2007). In the remainder of this chapter, I examine some approaches for addressing these challenges that have been shown to be effective, using contexts of both limited and extensive technology penetration.

Addressing Challenges

Following my most recent study of learning and literacy development in 10 technology-intensive K-12 schools (Warschauer, 2006), I identified two general categories of how technology can benefit struggling students, which I labeled the *word* and the *world* (Warschauer, 2006). On the one hand, digital technology has proven to be a powerful tool for helping learners understand and manipulate text, that is, to grasp the *word*. Images and video can scaffold texts and provide clues for developing readers. Annotations can offer further scaffolding and encourage appropriate reading strategies. The use of different fonts, colors, and highlighting can draw attention to particular words and phrases and the relationship between them. Graphic organizing software can help students analyze texts or plan their own writing. Word processing software allows students to achieve a more iterative writing process and to carry out the formatting required for a wide variety of genres. Dictionaries, thesauruses, spelling and grammar checkers, and bibliographic software provide additional forms of support for students to improve the quality of their writing. The readability of computer-generated texts, as a result, makes them more suitable for evaluation and feedback from peer, teacher, and machine. Online discussion forums enable students to communicate in written form, thus providing further opportunities for learners to notice others' written language and hone their own writing. While these tools are potentially valuable to all students, they can have a special benefit for those facing literacy challenges such as ELLs, at-risk students, and learners in special education programs, as these groups of learners may have the most need for the kinds of scaffolding and support available via computer.

On the other hand, digital technology is a potent tool for bringing the wider *world* into the classroom and thus both motivating and contextualizing literacy practices. Students can discover authentic reading material on almost any topic and be introduced to up-to-date information and perspectives from peoples and cultures across the globe. They can gather information and resources to address diverse social issues from how to maintain varied ecologies, to weighing the benefits and disadvantages of technological progress, to understanding why and how societies go to war. Students can then develop and publish high-quality products that can be shared with particular audiences or the general public, whether in their community or internationally. And through these products, from book reviews published for Amazon.com to multimedia designs shared with children of other countries, students can not only learn about the world but also leave their mark on it.

Unfortunately, these perspectives of word and world are often separated from each other. Educational leaders and policymakers who are concerned about raising at-risk learners' test scores, as they should be, too often grab onto narrow means to achieve these ends. The resulting scripted literacy programs or drill and practice computer activities attempt to focus students' attention on the *word* without bringing to bear the wider resources of the *world* that make the word meaningful.

Not surprisingly, students view such teaching as disconnected from their lives and their community, and they disengage from school.

At the same time, many technology enthusiasts focus exclusively on the broader *world* and dismiss the *word*. In their excitement about the potential of media production, international communication, and video games for promoting student learning, they sometimes forget that stimulating environments in and of themselves do not magically transform learners. Realistically, sufficient amounts of scaffolding and support are required to help learners make sense of and learn from such environments. And, crucially, the amount of scaffolding and support necessary is inversely proportional to learners' prior expertise (Kalyuga, Ayres, Chandler, & Sweller, 2003). At-risk students, including ELLs, students with learning disabilities, and students reading behind grade level, are least able to cope with unstructured environments because the lack of structure places too heavy a cognitive load on the learner (see discussion in Feldon, 2004). As far as literacy development goes, exposing learners to the world without providing adequate support for them to master the word is a likely way to worsen educational inequity.

Balancing the Word and the World

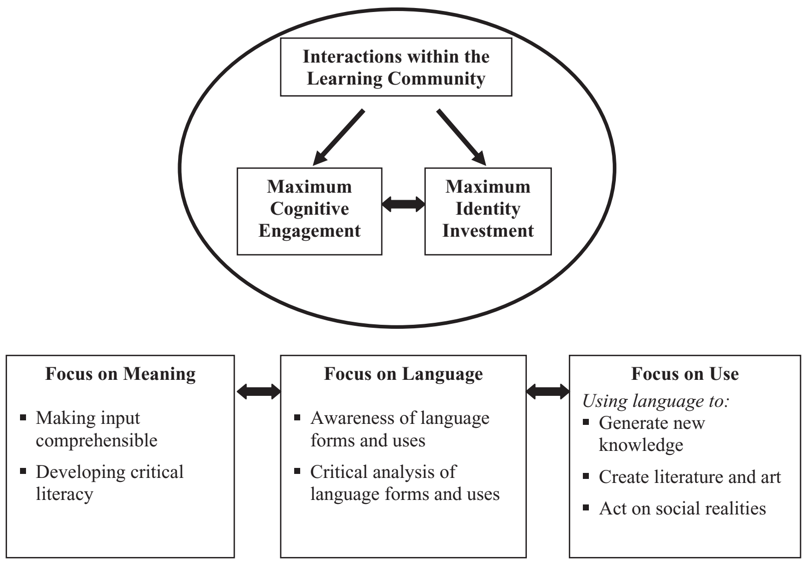
Fortunately, these two need not be separated. One excellent model of how to link them is provided by Cummins (1996; see also Brown et al., 2007), who first developed a model for promoting students' language and literacy abilities while engaging them in cognitively stimulating environments, and then adapted the model so that it could be applied to technology-enhanced classrooms (Brown et al.). In the model presented in Figure 1, the central sphere represents the interpersonal space created in the communication between teachers and students, both within an individual classroom and in online exchanges. Activities that provide maximum opportunities for both cognitive engagement and identity investment are chosen by teachers, and within these activities, teachers guide students in focusing on three aspects of language: meaning, form, and use.

This model is important for several reasons. First, many educators focus principally on how technology can be *affectively* or *behaviorally* engaging (see Fredricks, Blumenfeld, & Paris, 2004 for a detailed discussion of affective, behavioral, and cognitive engagement). The emphasis on cognitive engagement, again with appropriate scaffolding, helps ensure that activities are designed to maximize opportunities for thinking and learning. Identity investment is crucial for giving diverse

FIGURE 1

A FRAMEWORK FOR THE DEVELOPMENT OF ACADEMIC LANGUAGE LEARNING

Source: Brown, Cummins, and Sayers (2007, p. 215)



learners a real stake in the learning process and outcome through involvement in activities that reflect their backgrounds, experiences, and interests (see Cummins, 1996; Gee, 2000). And a focus on language meaning, form, and use helps ensure the proper scaffolding for students to handle challenging material and progress toward greater academic language proficiency (Cummins).

Brown et al. (2007) provide several detailed examples illustrating the power of this model for reaching at-risk learners. These include an oral history project by diverse middle school students that explored their own families' and communities' relationship to world events; a long-distance biography project of elementary school students integrating math, science, and language arts; an elementary school project to create a multimedia, multilingual dictionary; and a research project by elementary school students on the conditions of farm workers. I will discuss this latter example at length, drawing on the work of Brown and colleagues as well as on my own earlier discussion of this project following interviews with the two teachers involved (Warschauer, 2003).

FIGURE 2
STUDENTS AT MAR VISTA LOOKING OVER NEIGHBORING STRAWBERRY FIELDS

"Project Fresa": Fostering Critical Thinking With Technology

Mar Vista Elementary School is located in the midst of strawberry plantations in Oxnard, California, a couple of hours drive north of Los Angeles. About 80% of the students in the school are Latino (including Mexicans, Mexican Americans, and Latin Americans), and the majority of them have family members working as laborers in the strawberry fields that surround the school (see Figure 2). Even though most schools in California ended formal bilingual education following a 1998 statewide initiative, Mar Vista continued their bilingual programs thanks to a progressive administration and parental demand. Teachers at Mar Vista became leaders in effective use of new technologies to promote academic skills and critical awareness among traditionally marginalized students. This was accomplished through a theme-based, project-oriented instruction that was sensitive to students' own social concerns while at the same time engaging students in complex and cognitively demanding learning tasks.

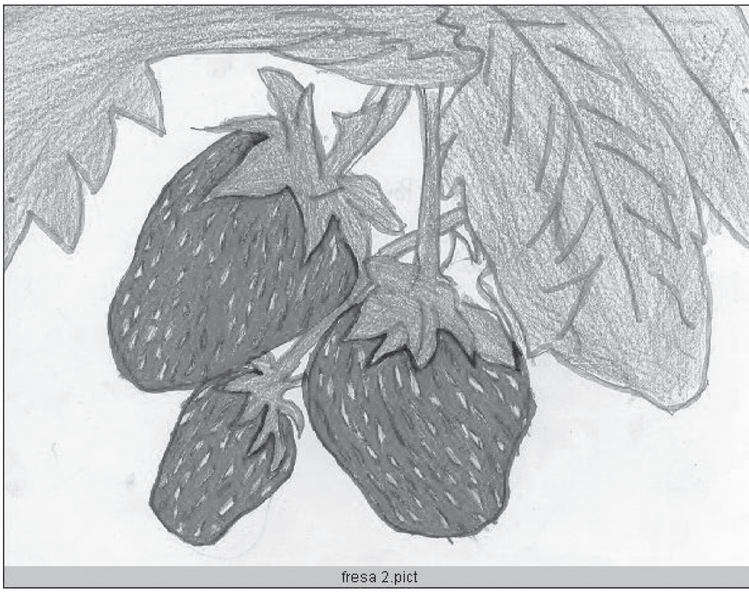
Project Fresa, a yearlong project for primary school students, took as its main focus the local strawberry (*fresa*, in Spanish) industry. A summary of the curricular activities is seen in Table 2. The children began by formulating their own research questions about the conditions of strawberry workers. They then used these research questions to

TABLE 2
CURRICULAR ACTIVITIES IN PROJECT FRESA

Activity	Subject Area	New Technologies Used
Formulating interview and survey questions	English Language Arts (ELA), Spanish, social studies	Word processing
Carrying out interviews and surveys	ELA, Spanish	—
Analyzing and graphing data	Math	Spreadsheets
Free writing and poetry	ELA	Word processing
Drawing	Art	Scanners
Searching online for information	Social Studies	Internet browsers
Writing letters to elected officials	Social Studies, ELA	Word processing, e-mail
Writing letters to strawberry growers	Social Studies, English	Word processing, e-mail
Writing letters to children in Puerto Rico	Social Studies, ELA	Word processing, e-mail
Making public presentations	ELA, Social Studies	Presentation software

generate interview and survey questions, enrolling their family members, relatives, and neighbors as respondents (they frequently conducted the interviews in Spanish and then translated responses into English). Afterward, the students learned to record the responses on spreadsheets and to produce graphs of the data in various formats (analyzing, for example, which types of graphs best display what types of information). The graphs were incorporated into slide presentations and web sites together with photos and quotations from the people they interviewed and students' original artwork, journals, and poetry (see Figure 3). With the guidance of the teachers, they then searched for further information about the conditions of strawberry workers on the Internet and also invited guest speakers into their classroom from environmental and workers' rights groups. Based on the information obtained from the Internet and guest speakers, students wrote letters via e-mail to the strawberry growers, expressing the concerns they had about strawberry workers' rights. They also sent e-mails to elected officials, including the governor, with real and informed inquiries about agricultural laborers' rights. Later they began an e-mail exchange with children in Puerto Rico who live in a coffee growing area to compare notes about the two industries and the condition of workers. At the end

FIGURE 3
STUDENT'S ARTWORK AND POETRY FOR PROJECT FRESA



Fields

Seeds, Soil

Growing, Picking, Eating,

Our Fields, Our History

Strawberries

-Victorico

of the year, the students at Mar Vista made a public presentation and their parents and other community members were invited to view the multimedia products they created.

Looking back at the model in Figure 1, we see that Project Fresa involved intense interaction, both within and outside the classroom. The project enabled maximal cognitive engagement, as students were challenged to understand—through art, mathematics, language arts, and social sciences—a series of complex phenomena. Students also heavily invested their own identities in the project because of the importance of the topic to themselves, their families, and their community. As one student wrote in her journal,

> I am related to the strawberries because my whole family has worked in the strawberry fields. Every day, my mom used to get up at 4:00 a.m., make her lunch, and go to work. When she got home I would be already asleep. My two aunts also worked in the strawberry fields. When they would get home they were very tired. It was really hard for them because they would have to stand up all day. (Eliana, quoted in Singer & Perez, n.d.)

Another student commented that, working on the project, "I feel nice inside because I know that with all this work some day we will make César Chávez's dream come true" (quoted in Brown et al., 2007, p. 145).

The variety of genres and formats involved, and the intense discussion of these genres and formats, helped students comprehend sophisticated texts and develop critical language awareness. For example, several of the strawberry growers who replied to student e-mails did so with standard disclaimers about unnamed labor contractors being responsible for working conditions. The students worked together to understand the meaning of these texts and to critique both the content of the message and the way it was delivered. They also used language to generate new knowledge (about the conditions of the laborers), to create literature and art (through their poetry and drawings), and to act on social realities (by writing to the governor, for example). Although the project has not been independently evaluated, the teachers believe that it contributed to higher standardized test scores, increased parental participation in their children's education, and enhanced students' academic motivation (see discussion in Lynn, 2000).

As positive as the project appeared to be, it was not continued after the two teachers left the school, one for retirement and one for an administrative position (M. Singer, personal communication, June 23, 2005). The difficulty in sustaining and expanding such projects is partly due to the current political climate, which emphasizes mastery of numerous discrete standards rather than deeper learning, and is partly related to the challenges of organizing technology-based learning in settings with limited computer access. It also stems from the difficulty that many teachers have in learning to teach in ways that are fundamentally different from the kinds of instruction they themselves experienced as both students and student teachers (Cuban, 1993). These obstacles, compounding issues of school access, home access, school use, and generation gaps, create an environment in which promising initiatives are difficult to sustain.

In the remainder of this chapter, I report on initiatives to provide more extensive student access to computers, together with more intensive professional development for teachers, thus making such groundbreaking project work as described earlier easier to organize.

Expanding Student Access

The student–computer ratio in U.S. public schools has fallen from 168.0:1 in 1983 (Anderson & Ronnkvist, 1999) to 3.8:1 in 2005 (Market Data Retrieval, 2005). Yet in spite of this marked improvement in computer access, teachers still have substantial difficulty integrating technology into instruction when multiple students have to share a single computer. In many school districts, only a small handful of pioneers (such as the two teachers involved in Project Fresa) take the time and initiative to implement complex technology-enhanced projects in the classroom.

To facilitate more and better technology-enhanced learning and teaching, some educational reformers have proposed what are known as *one-to-one* programs (see, e.g., Papert, 1996), in which a laptop computer is provided for each child to be used throughout the school day and, in most cases, at home (for a history of such laptop programs, see Johnstone, 2003). Currently, there exists a statewide middle school and a sizable high school laptop program in Maine; a countywide laptop program among middle and high schools in Henrico County, Virginia; and other smaller laptop programs throughout the country. Such programs are relatively expensive and can thus only be offered when there is a shared community investment. They can also represent a challenge for teachers who, as noted earlier, are often not as comfortable with new technologies as are their students. The most successful one-to-one laptop programs, such as Maine's, have a serious ongoing professional development component woven into their design.

I directed a team of researchers that investigated 10 diverse one-to-one laptop programs in California and Maine (Warschauer, 2006) in a mixed-methods multi-site case study. The laptop programs took place in urban, suburban, and rural schools, in high-SES and low-SES neighborhoods, and in regular education, gifted, and alternative education programs, as well as in programs targeted to second language learners. Our research team conducted 650 hours of classroom observations; interviewed about 200 teachers, students, staff, and parents; surveyed 1,000 students and teachers; collected and analyzed the print and digital work from 60 students; and examined state test scores before and after the laptop programs were implemented.

The study confirmed prior research indicating that teaching and learning changes markedly in the laptop classroom (see, e.g., Silvernail & Lane, 2004; Walker, Rockman, & Chessler, 2000). With students having constant access to a computer and the Internet, teachers can much more easily integrate technology into instruction without having to be concerned about when computers may or not be available. Teachers can also move quickly past instructing students on hardware and software operations (because children, with their own laptop, learn these matters quickly) and focus on underlying instructional content. In schools where students are allowed to take laptops home, the laptops become what one student in our study called a "portable study guide," (Warschauer, 2006, p. 135), providing children a place and means to organize all their school work; take, review, and edit their notes; search for, maintain, and incorporate educational resources; and bring all these resources back and forth between school and home.

Our study focused in particular on literacy practices, and we found that the processes, sources, and products of literacy changed substantially in the laptop classroom (see Table 3). Literacy practices in the laptop classroom became more autonomous, with students having greater control over content and pacing. Practices became more public, with greater opportunities for students and teachers to see student work, and were more frequently authentic in purpose and audience, as opposed to being produced for the sake of a grade. They were more frequently collaborative, based on student cooperation, and reflected a more iterative process, based on greater attention to planning and revising work. More scaffolding was provided, for example, through computer-based dictionaries, thesauruses, and spell checkers, and more feedback was provided by peers, teachers, and automated engines.

Students in laptop classrooms made use of a greater variety of published sources, taking advantage of the huge amount of material available online either on the public web or through proprietary information services. Students also made greater use of empirical data, either gathered from the web or collected in the classroom (e.g., using computer-connected scientific probes). They were better able to archive their own prior work and experiences (e.g., via digital video) as a source for analysis and reflection, and they produced a wider variety of textual genres including brochures, newspapers, petitions, posters, and business letters. They also produced considerably more multimedia of diverse genres—not only slide presentations (e.g., PowerPoint, common in

TABLE 3
CHANGES IN LITERACY PRACTICES IN THE LAPTOP CLASSROOM

Typical Classroom	Laptop Classroom
Literacy Processes	
Mostly teacher controlled	More autonomous student control
Mostly private and individual	More often public and collaborative
Mostly for teacher and a grade	More often for an authentic purpose and audience
Limited revision	More iterative process with greater revision
Little feedback provided	More feedback provided
Some scaffolding	More scaffolding
Literacy Sources	
Use of few published sources (mostly from school libraries or textbooks)	Greater use of published sources, with library and textbook material supplemented by a wide range of online material
Limited access to and use of data	Greater access to and use of data from online materials or collected by students in class (using computer-connected probes, etc.)
Limited ability to record and reflect on students' own experiences and prior work	Digitalized audio and video allow better opportunity to record and reflect on students' own experiences and prior work
Literacy Products	
Text products are mostly essays	Essays supplemented by other genres such as brochures, newspapers, and business letters
Multimedia products largely restricted to slide presentations (e.g., PowerPoint)	Greater diversity of multimedia products, including musical composition, videos, animation, and web sites

many classrooms), but also musical compositions, videos, animation, and web sites.

All these changes brought about four main benefits for students. The most important of these was in the teaching and learning of 21st-century learning skills. Students in the schools we visited had constant access to information, resources, and data, and learned to access that information, analyze and critique it, and work it into a wide variety of authentic products. This occurred especially in schools that already had strong information literacy programs, from the classroom to the library, and where critical inquiry was valued.

Second, we noted greater student engagement because of their use of multimedia. Students' ongoing work with texts, images, video, sound, music, and animation both increased their interest in school and heightened their ability to produce and interpret multimodal content, a valuable 21st-century skill in its own right.

Third, we found an increase in the quantity and quality of student writing. Students in laptop schools wrote much more than students in traditional classrooms. They revised their writing more easily and frequently. They took pride in the professional appearance of their writing. And they received more feedback on their writing.

Finally, we found that students engaged in deeper learning. Technology provided students multiple angles to get at the same material. It thus facilitated project-based work that allowed students to dig further and deeper into material. Nearly all the schools we visited reported a greater emphasis on in-depth research than before, and the work we collected from these projects was impressive.

Expeditionary Learning in a Laptop School

The laptop schools that were most effective with at-risk students used approaches consistent with the academic language learning model depicted in Figure 1. An excellent example is seen in Castle Middle School (a pseudonym) in Maine, whose students live in the most destitute housing projects of the eastern seaboard and include large numbers of African refugee immigrants. Castle has eliminated all tracking and also incorporates as many special education students and ELLs into regular classrooms as possible. Students at Castle are grouped into "houses" of about 60 learners and four main teachers, with the teachers having broad autonomy over class scheduling. Most important, almost all academic work in the houses and school is integrated into 8–12 week interdisciplinary research projects called "learning expeditions" (see Expeditionary Learning, 2006). For example, in a 10-week expedition called Four Freedoms, students drew on a 1941 speech by Franklin Roosevelt and a subsequent series of paintings by Norman Rockwell to examine freedom of speech, freedom of worship, freedom from fear, and freedom from want. Using magazine materials, the students produced art collages on one of these four freedoms to explore how the ideas of freedom change over time and how some people's notion of freedoms may conflict with others'. The students then wrote commentaries in which they explained the significance of their collages. Finally, students assembled the commentaries and collages in posters that were exhibited at the Maine College of Art as well as in a hypertext that was published on the Internet.

Similar to Project Fresa, this project was designed to be cognitively engaging, in this case by asking students to relate important historical concepts to social realities today. The topics involved, such as freedom from fear and freedom from want, were highly relevant to the school's students, the majority of whom had experienced both impoverishment and violence in their lives. The combination of artistic and textual response provided students multiple ways to interpret these relationships, and to reflect on their own identities in doing so, and also made the projects appealing to both boys and girls. In creating work for public presentation, online and in a museum, the students became highly motivated to focus on the form and meaning of what they wrote. And in the process, they also developed technological skills such as finding and making use of online information. Overall, this project and a number of other projects we witnessed in the laptop schools showed us how improved access to technology, combined with an appropriate pedagogical approach, can help students access both the word *and* the world.

Additional Technology Resources

Although relatively few schools have laptop computers for all students, falling costs of laptops suggest that this could be a widespread model in the future. In the meantime, districts that cannot afford one-to-one initiatives are finding other ways to enhance student access to technology. Many schools are experimenting with laptops on mobile carts shared by multiple teachers. These carts allow teachers to provide a one-to-one wireless computing environment in their own classroom, but not on a daily basis. In addition, keeping school computers available after school, either in a computer lab or in the school library, can ensure that all students have opportunities to complete computer-based homework assignments. Many neighborhoods in low-income areas also provide computer access in children's afterschool programs or in public libraries, and schools can pass on information about these computer resources to parents and may also work with municipal authorities to try to encourage the provision of free wireless access in their community. Finally, because data suggests that even in low-SES neighborhoods the great majority of families already have at least one computer (see, e.g., Warschauer et al., 2004), schools can build on this by loaning computers to the minority of families that lack them, thus helping ensure that all students have some kind of access to a computer outside of school.

If steps such as these are taken, teachers can then with more confidence assign homework that may require or benefit from the use of a computer. Students in low-SES schools are cheated of important educational opportunities when their teachers shy away from assigning in-depth research projects that may depend on access to technology outside of school. Rather than avoiding these important assignments, teachers and schools should instead work to ensure that all students have at least minimal access to the technologies needed to complete them.

In summary, then, the aforementioned issues of complexity and workability can be addressed by providing students and teachers more consistent and reliable access to computers and the Internet, either through true one-to-one programs or through leveraging other technology resources in schools and communities. Overcoming performativity depends on instructional approaches that focus not only on mastery of technological applications, but also on broad learning goals related to academic content, as seen in the examples of Project Fresa and Expeditionary Learning discussed earlier. A focus on developing both technological skill and academic expertise around topics related to students' life experiences makes such projects engaging and meaningful to both male and female students of diverse cultural backgrounds.

Conclusion

A recent national study commissioned by the U.S. Department of Education (Dynarski et al., 2007) suggests that tutorial software in reading and mathematics is ineffective in raising student test scores. Many will likely respond to such research by questioning the suitability of computers in schools.

However, evidence suggests that it is principally low-income students who are predominately subjected to such drill-and-practice software, while high-SES students have more opportunities to use school technology for broader purposes of research, simulation, data analysis, and creative expression (see, e.g., Becker, 2000). Thus, sadly, the same low-SES students who often lack opportunities to use technology creatively at home—because of lack of computer access, Internet access, or social support (Warschauer, 2003)—also too often lack similar opportunities at school.

If we are going to overcome multiple digital divides, we can neither ban computers from schools nor subject low-SES students to the most narrow uses of such technology. Rather, we must continue to expand student access to technology, either by lowering student–computer ratios or by finding other ways to connect low-income students to school and community technology resources. And we must choose pedagogical approaches that combine cognitive engagement, identity investment, and a focus on language meaning, use, and form. Project Fresa in California and Expeditionary Learning in Maine provide a view of what can be accomplished when good teaching and technology are combined to help diverse students access both the world and the word.

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