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Chapter 7

Literacy and technology: Bridging the divide

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The relationship of literacy and technology

Let me start with an example, not from my own research, but from that of J. Hillis Miller, a colleague at UC Irvine. Miller (2002) documents the lives of two middle-class white teenagers, Horace, in 1946, and Jimjim, in 2001. Horace, as a post-World War II teen, is totally wrapped up in the lives of books, from *Alice and Wonderland* to *Wuthering Heights* to Dostoevsky's *Notes from the Underground*, the grand narratives of which all helped shape his identity. And beyond books alone, Horace's whole world was immersed in paper, from his mawkish diary to his love letters to his handwritten examinations.

Jimjim, in contrast, lives in an emerging post-typographic era. Jimjim rarely reads books. Instead, he spends virtually all his free time at his computer, usually doing five or six things at once: playing a collective computer game called SubSpace with a group from various countries, listening to MP3 songs, sending email to friends around the world, instant messaging with other friends, engaging in a multiperson chat through IRC, and completing homework assignments.

The case of Horace and Jimjim provides a nice example of the relationship of technology to literacy. The literacy practices of both these teenagers are clearly shaped by the available technologies, and not only in the ways most commonly thought of. Yes, Jimjim clearly has excellent skills in *information literacy* and *multimedia literacy*, two of the new technologically oriented literacies that have received the most attention in the field of education, and which are undeniably important. But he also has what I've referred to previously as *computer-mediated communication literacy* (Warschauer, 2003d)—that is, the ability to create, manage and participate in effective online communication in a variety of genres and formats. Though online chatting is often seen as a deterrent to literacy practices (due, for example, to the host of abbreviations and informality involved), Jimjim's extensive and purposeful communications in emails and chat groups has allowed him to acquire, according to Hillis, 'an impressive clarity and force in his use of language.'

(Note also the work of Jacobs (2003), who has suggested that online chatting is a mode of communication well-suited to today's *fast capitalism* (Gee, Hull, & Lankshear, 1996), and that the middle class youth who engage in it get a special benefit compared to poorer youth who do not.)

Now, let us do one more contrast, between Jimjim and Kadesha, an African American teenager in a low-income family in New York City, discussed in a paper by Paul Attewell and Hella Winston (2002). Kadesha, like Jimjim also spends much of her free time online, but in completely different activities. Kadesha and her school friends check out their favourite rappers and wrestlers, whom they refer to as their 'husbands', downloading their pictures as screensavers, pasting images into reports, and going cyber-widow shopping for everything from hot new sneakers to Barbie dolls. Unlike Horace or Jimjim, Kadesha's passions involve little use of texts. Reading below grade level, she energetically pursues images and sounds on the web, but forgoes sites that require her to read. When her teacher encourages her to investigate her career interests online, Kadesha tries to enter the word 'bakery' in a search engine, but is unable to find anything because she can't spell the word. When told how to spell 'bakery' and directed to a specific informational site, Kadesha is still unable to get any information from it due to her limited reading ability.

As this latter comparison illustrates, if technology is shaping the ways that we practise literacy in today's world, it is certainly also the case that literacy is acting as a gatekeeper for accessing and using technology. The real threat of a digital divide in the US is not that some people will have computers and some won't, but that they will be enabled to use them in entirely different ways, with one group able to muster a wide range of semiotic tools and resources to persuade, argue, analyse, critique and interpret, and another group, lacking these semiotics skills, limited to pre-packaged choices (Castells, 1996/2000; Warschauer, 1999).

A theoretical framework

How then do we think theoretically about these mutual interrelationships between literacy and technology? Leu (2000) makes a thoughtful distinction between what he refers to as the *transformative*, *transactional* and *deictic* approaches for interpreting this relationship. According to the transformative view, technology helps reshape literacy. According to the transactional view, technology and literacy both shape each other. The deictic view incorporates both, but goes a step further, highlighting the rapid and ongoing redefinition of the underlying forms and functions of literacy. This is a perspective that I hinted at in 1999, when I wrote that '[e]lectronic literacy involves not only adapting our eyes to read from the screen instead of the page, but also adapting our vision of the nature of literacy and the purposes of reading and writing' (Warschauer, 1999, p. 13).

I would suggest that sociocultural theory, broadly defined, provides an excellent framework for understanding and deepening this deictic perspective. There are three particular aspects of sociocultural theory that serve this framework well (see discussion of these three aspects in Wertsch, 1991). The first is *genetic analysis* (Vygotsky, 1978; Wertsch, 1991)—that is, the notion that one can fully understand mental functioning only if one understand its origins and transitions at several levels, including microgenesis (the unfolding of particular events), ontogenesis (the development of the individual), socio-historical (the development of societies), and even phylogenesis (the development of the species). All of these levels are required to fully grasp the intersection of literacy and technology today. For example, just to take one level of analysis, the socio-historical, I have argued that the new forms and functions of technology-enhanced literacy are shaped not only by the capacities of computers but also by the broader socio-economic transformation in industrial capitalism, evidenced by globalisation, new post-Fordist industrial relations and the emergence of a network society (Castells, 1996/2000). It is clear that Jimjim's and Kadesha's literacy practices, as compared to Horace's, reflect not only the available technologies in 2001, but also the broader social transformations of the post-industrial era, including an emphasis on just-in-time processing and the prominence of horizontal associational networks.

A second important component of sociocultural theory is the concept of *mediation*—that is, the notion that all human activity is mediated by tools or signs (Vygotsky, 1962, 1978). From this perspective, the incorporation of mediational means—whether they be computers, writing, or language itself—does not simply facilitate action that could have occurred without them, but rather, by being included in the process of behaviour, alters the entire flow and structure of mental functions. Consider, for example, Gregory Bateson's (1972) question as to whether a blind person's sensory mechanism ends at the end of his hand, the end of his walking stick, or somewhere in between; obviously the walking stick becomes an integrated part of a person's activity system, similar to the way that a computer or any other tool does. Thus, from the perspective of sociocultural theory, online activities—whether Jimjim's game-playing or Kadesha's image-browsing—might be similar to activities carried out in or with other media, but take on a different life in the online medium, thus helping reshape Jimjim and Kadesha's communication patterns, learning behaviours and sense of identity.

Finally, the third aspect of sociocultural theory that informs our understanding of literacy and technology is the *social origin of mental functioning* (Vygotsky, 1981). Many have interpreted this through a modelling perspective, which emphasises the role of a tutor in assisting a tutee (e.g., Palinscar & Brown, 1984). More relevant, I believe (and especially considering the role that technology can play) is a text-mediational perspective, in which 'all participants in intermental functioning are actively engaged in shaping this functioning' (Wertsch & Bivens, 1992, p. 39) through the consideration, analysis, or sharing of texts. From this perspective, a mentor may play a

key role, but equally important is the active collaborative inquiry and involvement of all participants, who acquire 'a high social polish and lustre' in their communications by the effect of reactions and responses, resistance or support, on the part of a social audience (Volosinov, 1929/1973, p. 92). Think, for example, the benefits that Jimjim has received from years of written interaction through chatting, emailing and online publishing (at least as claimed by Miller, 2002). I believe that computer-mediated texts have certain characteristics that facilitate this type of collaborative text-mediated social learning, as will be discussed below.

Educational policy and pedagogy

What relevance, then, does all this have to how we bridge literacy and technology in the classroom? Let me begin again with an example. As part of a broader study of technology use in schools in a classroom in California, researchers observed science students who were given a homework assignment to create a PowerPoint presentation (see Knobel, Stone & Warschauer, 2002; Warschauer, 2003c). They were informed that their grade would be based in part on how many fonts, colours, sound effects, slide transition types, bullet types, background designs, shadow and 3-D effects, and animations a student used. In other words, if they created a 'PowerPoint presentation from Hell', which demonstrated mastery of software functions, but no real knowledge of effective communication strategies, they would receive an A. In our analysis, we labelled this an example of what Lyotard (1984) called *performativity*, a focus on the performance of technique without regard to relevant purpose. In the schools we visited, such performativity was rampant, ranging from an emphasis on keyboarding (but not composing) to internet 'research' activities that involved little more than cutting and pasting paragraphs from the first links that showed up in a search, without any attempt to interpret, analyse or even *read* the text material being pasted.

My international research suggests that this type of performativity is common in other countries too, both rich (Warschauer, 2001) and poor (Warschauer, 2003a, 2003b), as administrators or teachers respond to educational technology mandates from above by integrating computers in perfunctory ways. Sometimes performativity takes on the veneer of authentic learning. One illustrative case of this was in New Delhi, India, where a supposedly innovative 'hole-in-the-wall' experiment was launched. Based on a theory of *minimally invasive education*, children in an impoverished neighbourhood were given unfettered access to five computers that protruded through a wall (with two buttons and a joystick replacing the keyboard), without any adult supervision, guidance, or mentoring. The organisers claimed the project a great success, since the children managed to learn computer functions such as turning a computer on, dragging and dropping icons, and copying and deleting (Mitra & Rana, 2001). At the same time, without any adult assistance or access to educational Hindi-language software, children learned little more than basic computer operations, while losing time from other more potentially valuable learning activities, leading this observer to

conclude that minimally invasive education was in fact minimally effective education (Warschauer, 2002, 2003d).

Performativity, unfortunately, provides another link between technology and literacy. Just as technology is now used in a performative mode in schools, so have literacy activities long been structured that way, with an emphasis on using texts to read aloud or to answer known information for discrete-item tests. In critiquing performative modes of text use in literacy activities, Wells and Chang-Wells (1992) urge that texts instead be engaged in an *epistemic* mode—in other words, treated ‘not as a representation of meaning that is already decided, given and self-evident, but as a tentative and provisional attempt on the part of the writer to capture his or her current understanding . . . so that it may provoke further attempts at understanding as the writer or the reader dialogues with the text in order to interpret its meaning’ (pp. 139-140).

This point hints at the potential of combining new information and communication technologies and literacy. Whether in society (Halliday, 1993), academia (Harnad, 1991), or the classroom (Wells, 1990, 1994a, 1994b; Wells & Chang-Wells, 1992), language has two main functions: it allows us to interact communicatively and to interpret experience by organising it into meaning (Halliday, 1993). Throughout human history, the interactive role has been principally played by speech, whereas the permanence of written texts has made them powerful vehicles for interpretation and reflection (Bruner, 1972; Harnad, 1991). Writing, unlike speech, could be accessed and analysed again and again by a limitless number of people at different times. It is for this reason that the development of writing, and later print, is viewed as having enabled dramatic developments in human cognition and the production of knowledge. Unfortunately, though, the strength of writing was purchased at the price of becoming a much less interactive medium than speech (Harnad, 1991).

Yet it is precisely the intersection between interaction and reflection which is of critical importance in education, which indicates why computer-mediated texts, combining the interactive qualities of speech and the recorded qualities of writing, can potentially serve as an intellectual amplifier (Harasim, 1990). The highly interactive, malleable and collective nature of computer-mediated texts—whether as part of real-time discussion, email, weblogs, or in other formats—makes them useful resources for epistemic engagement (Warschauer, 1997). Texts thus can be used not as sources of performance but rather as thinking devices to help students and mentors collaboratively generate new meanings (Lotman, 1988). Of course any text can serve as a thinking device, regardless of content or medium, if a skilled instructor uses it that way. But information and communication technologies—by allowing students to put their own conversations into writing; easily archive and edit what they or others have written; access a wide variety of authentic documents from their classrooms or homes; and write or publish for real audiences across the

school or the globe—can facilitate this epistemic engagement of texts and collaborative generation of knowledge, at least in the company of teachers who seek to achieve such ends.

What does that mean, for the teachers of the Kadeshas and Jimjims of the world? It means that there is great value in developing technology-enhanced literacy activities that are purposeful—that tap into student interests, make medium-appropriate uses of the (new and old) technologies at hand, and match the broader concerns and needs of the students and the communities they live in (Warschauer, 2000). ‘Project *Fresa*’ (Strawberry Project) carried out by Latino elementary school students in Oxnard, in an area surrounded by strawberry farms (see discussion of this project in Warschauer, 2003d) provides an example. The students devised their own research questions, interviewed their family members and neighbours about working conditions in the strawberry fields, published their findings online in poems, drawings and graphs, emailed the governor and agribusiness representatives to ask about conditions of farm labourers, and, in the end, started an email exchange project with students in Puerto Rico to compare the conditions of strawberry and coffee workers. For these students, there was little that could be considered performative among their technology or literacy tasks. Rather, technology and literacy were integrated in analysing their own and others’ social conditions and generating new knowledge about them. I have found many other similar examples in my research, from native Hawaiian youth who create websites for the community about Hawaiian history and society (Warschauer, 1998, 1999; Warschauer & Donaghy, 1997), to Brazilian teenage prisoners who published a newsletter about the social challenges they face (Warschauer, 2003d). It is noteworthy that several of these projects (e.g., Project *Fresa*, the Brazilian prisoners’ project) were carried out among students with limited reading or writing ability, but that the purposeful and collaborative print- and pixel-based literacy activities employed, under active and careful mentoring of a teacher, allowed these types of students to successfully progress.

This approach, emphasising literacy not only as social practice but also as social action, is of course not new. Freire most famously emphasised it, noting that literacy is not only about ‘reading the word,’ but also about ‘reading the world’—and not only about reading the world but also *writing* it and *rewriting* it (Freire & Macedo, 1987, p. 37). New technologies now provide a helpful resource for achieving this end. So, to update Freire’s perspective, technology-based literacy is not only about *surfing the net*; it is also about *making waves* (Shneiderman, 1997).

Finally, it is important to point out that the presence of new technologies is not the only element, or even the central element, allowing this type of transformative pedagogy to take place, as illustrated by the examples of performativity discussed above. Let me give one additional example to demonstrate this point. It was once believed that participation in internet-based science research projects had almost a magical power to develop children’s scientific literacies. These projects, collectively referred to as *network science*, involved children in different locations in gathering and

sharing scientific data regarding, for example, rainfall, weather conditions or bird migrations. Recently, a group in Massachusetts completed and published a five-year study of these network science projects (Feldman, Konold, & Coulter, 2000), and they found surprisingly disappointing results. First, students tended to upload data to the internet without even bothering to download others' data. Secondly, when they did download data, they often had no idea about how to analyse or interpret them in any meaningful way. And thirdly, although the students reported that they enjoyed communicating with other students online, it was found that this interaction was usually about personal issues and had very little to do with science.

The study found that the only situations in which students really developed their scientific literacy through these projects were those in which strong teaching, guiding and mentoring for scientific thinking (through, for example, teaching children how to carefully collect, analyse, interpret and discuss scientific data) was already taking place *inside* the classroom *before* students began the network science project. In other words, these projects benefited most from a combination of online communication (with its advantages of long-distance, multi-site interaction) and face-to-face communication (with its advantages of better timing, monitoring, nuanced voice and eye contact, and informed on-the-spot decision-making by teachers). And—in contradiction to the often-asserted notion that the effective technology-using teacher is merely a 'guide on the side'—these projects required a teacher well-prepared to actively mentor students in scientific literacy, rather than simply allowing the online medium to magically do a job.

It should be noted that the mentor's role in this example was not that of an instructional tutor to tutees, but a leader in a collaborative process of inquiry, as suggested by the text-mediational perspective discussed earlier. The importance of social context in shaping learning should also be taken into account. As suggested earlier, an individual such as Jimjim, with the support of his well-educated middle-class parents, may polish his argumentative style through online debate and discussion without the presence of a teacher mentor. In contrast, a class of diverse students, attempting to acquire complex scientific literacies of data analysis and interpretation, appears to require stronger teacher mentoring.

This network science example helps us understand how the online medium can be a helpful resource for increasing students' epistemic engagement, but that the medium itself is not sufficient to bring this about independently of a supportive social context.

Conclusion

Shirley Brice Heath (1983), in her classic ethnography of language use in three communities, illustrates the way middle-class uses of language work to develop their children's literacy. Heath

explains that these parents 'freeze scenes and parts of scenes' and then 'focus the child's attention on objects or events in the frame, sort out referents for the child to name, give the child ordered turns for sharing talk about this referent, and then narrate a description of the scene.' Through this focused language, 'adults make the potential stimuli in the child's environment stand still for a cooperative examination and narration between parent and child.' As a result, the child learns to focus attention on a preselected referent, master the relationships between the signifier and the signified, and 'create narratives placing the referent in different contextual situations' (p. 351).

Information and communication technologies provide a new means for carrying out this process, but now in an interactive written form that can complement other media and means of communication, interaction, and reflection. Children and teachers can use new technologies to freeze texts and parts of texts, to focus on events in a text, sort out referents, and give learners turns for sharing oral or written talk about these referents. And as seen in the example of Project *Fresa* above, the life stories of children and their communities can provide the material for these texts, brought into the classroom through interviews, reports, photos, audio and video, and then digitised for further collaborative analysis, revision and publication.

I believe that this kind of epistemic engagement best allows educators to bridge the divide between technology and literacy. This involves purposeful use of a variety of media, both new and old, to enable students to more actively participate in text-mediated intermental dialogue around issues of importance to their lives and communities. When, instead, due to the pressure of district mandates or simply a naive belief in the power of technology as a force unto itself, we emphasise technological performativity—in essence, teaching 'hammer' instead of teaching carpentry (Bellino, quoted in Oppenheimer, 1997, p. 62)—then the gap between technology and literacy only grows.

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