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Negotiating the multiple realities of technology in literacy research and instruction

Applying research and theory to instructional practice might be conceived as a process of negotiating multiple realities. On the research side, multiple realities are created when individual researchers adopt different theoretical and methodological perspectives, which limit the questions they ask and the interpretations they consider. On the side of instructional practice, to say that there are multiple realities is perhaps an understatement. Not only are two classrooms, even in the same school, different realities, they are also veritable kaleidoscopes of variability. We think that Duffy (1994) had this perspective in mind when he wrote

Viewing research findings as something to be handed down as technical information ignores the reality that teachers must make strategic decisions about when to apply findings, how to adapt them to certain situations, and even when it might be appropriate to ignore the findings altogether. (p. 19)

On a broader scale, multiple realities are created when practitioners subscribe to different pedagogical philosophies and adopt different instructional goals or emphases. A whole language teacher, a Reading Recovery teacher, a school principal, and a state-level legislator who chairs the education committee may attend to different research and may interpret the findings of the same research differently in relation to their respective domains of instructional practice. In short, multiple realities influence what research gets done and how it is interpreted and what research gets listened to, by whom, and under what circumstances.

In this article we consider the relation between literacy research and practice as it applies to new digital technologies. However, we believe that doing so is pointless and futile without considering the perspective of multiple realities, a perspective that limits any research-to-practice connection, but especially one focused on technology. In taking the perspective of multiple realities, we are building on and seeking to extend by example the writings of those who have looked broadly at the role of educational research in relation to instructional practice. For example, Labaree (1998) has characterized educational research as a lesser form of knowledge in light of the guidance it can realistically provide to those who work in the complex and idiosyncratic world of instructional practice. More specific to literacy, Gee (in press) interestingly includes technology in the following statement about instructional methods:

[I]nstructional methods (just like literacy itself and technologies like computers) do not work or fail as decontextualized generic practices. They have effects only in, and in relationship to, specific social and cultural contexts as they recruit different forms of cognition, and [as] they have different effects in different contexts.

Most specific to the focus of this article, we believe the perspective of multiple realities unifies diverse writings over an extended period by those who have considered the role of new digital technologies in literacy instruction. For example, in the early 1980s long before qualitative research enjoyed the popularity among literacy researchers that it does today, Venezky (1983) argued that investigating computer-based reading instruction in

classrooms should include *in situ* data, implying that quantitative measures alone were not adequate for understanding the potential influence of technology in classrooms (see also Papert, 1987).

At the same time, Rubin (1984) argued that the distinction between what *can* be done with computers needs to be clearly distinguished from what *should* be done based on the goals one has for instruction. In 1987 Miller and Burnett observed that the same software programs aimed at enhancing language arts instruction may be viewed differently by whole language teachers and skill-oriented teachers.

More recently Bruce (1997) categorized several distinct stances that researchers and educators tend to take toward technology and literacy, which affect the potentialities of research and practice. Likewise, Leu (1997; in press) hinted at the perspective we refer to here as *multiple realities* when he compared the relation between technology and literacy using the linguistic concept of deixis. *Deixis* identifies those terms in language, such as *today* and *tomorrow*, whose meanings shift quickly in relation to a changing point of reference. Leu argued that our orientation to technology and its implications for literacy continually change as technology and its uses advance rapidly, often undermining long-standing assumptions and perspectives that have arisen from print-based literacy.

Likewise, in our own efforts to investigate the use of new technologies in classrooms (Labbo, 1996; Labbo & Kuhn, 1998; Reinking & Pickle, 1993; Reinking & Watkins, 1996), we have sought out theoretical perspectives and approaches to research that acknowledge the complexity and variation inherent in classrooms and the diverse roles that technology can play in relation to complex sociocultural factors.

We see all of these issues concerning technology and literacy to be circumscribed by the perspective of negotiating multiple realities. In the remainder of this article we elaborate on why that perspective might be needed and useful in the area of technology, and how it might generate frameworks for conducting research and for applying that research to instructional practice. In a subsequent section we offer one possible framework based on the multiple realities created by different goals for integrating technology into literacy instruction. But first, we wish to briefly explain and contextualize in more detail the perspective of multiple realities in relation to technology in literacy research and instruction.

Why the perspective of multiple realities?

Taking the perspective of multiple realities confronts what we believe to be a common and unfortunate

tendency to treat technology in relation to literacy as a monolithic, unidimensional *topic* and a corresponding tendency to oversimplify its use or potential use in literacy instruction. That is, technology in the literal sense of the word *topic* has often been considered in the field of literacy as a discrete yet somewhat amorphous "subject of a discourse or of a section of discourse" (*Webster's New Collegiate Dictionary*, 1974, p. 1231) separated from what are considered to be more longstanding and mainstream aspects of literacy and literacy instruction.

In one sense it might be argued that technology as topic is no different than other topics that might become the focus of research or practice such as assessment, vocabulary, phonemic awareness, linguistic variation, and so forth. However, in another sense considering technology merely as a topic belies the breadth of literacy issues affected by new technologies, its increasing influence in daily literate activity, and the wide range of unprecedented questions of research and practice it generates, let alone the conventional questions and issues it threatens to make moot (Reinking, 1995). Topics should be treated as artificial constructions imposed on more encompassing realities, not treated as if they are reality itself. We believe that the perspective of multiple realities highlights this subtle but important difference by shifting the focus of technology in literacy from the latter to the former.

Examples of the distinction we wish to make by adopting the perspective of multiple realities are not difficult to find. For example, literacy researchers who employ new technologies, even incidentally, in their work may have papers reporting their work shunted into a technology strand at a conference. New editions of college reading methods texts must now have an obligatory chapter or section on technology, but rarely is technology mentioned elsewhere in these books (see Leu & Kinzer, 1999, for a notable exception).

We, along with many of our well-intentioned colleagues, have perhaps too often been content to have our work considered singularly in terms of its technological aspects as opposed to how new digital technologies lead us to think in new ways about our interests in emergent literacy, in learning from texts, in positively transforming literacy instruction, in making an impact on classroom cultures, and so forth. As we have reminded our students, and sometimes ourselves, the courses we teach on the technological aspects of literacy are literacy courses that happen to be about technology, not technology courses that happen to be about literacy (Labbo & Reinking, in press; Reinking, in press).

There are several circumstances that reinforce a view of technology in literacy instruction as a topic instead of as a set of possibilities in relation to multiple realities. Perhaps foremost is a natural tendency to equate

technology exclusively with material devices instead of with the processes and capabilities those devices make possible. Although it is becoming less so (Bruce & Hogan, 1998), the computer remains a conspicuous device. Thus, it is easy for the keyboard, screen, and processor sitting on our desks or laps to become the material and conceptual anchors that define thinking about technology in relation to literacy. Rather than focusing on the computer as a device, the perspective of multiple realities focuses attention on what it might do, to what activities and tasks it might be applied, and on what effects and implications it may have beyond the conventional goals of literacy instruction.

This perspective is consistent with McLuhan's (1964) well-known aphorism about technologies of communication: The medium is the message. It is also consistent with Ellis's (1974) position that the computer is a machine that can become a machine, highlighting the uniqueness of the computer as an educational technology that must be understood in term of its uses. Thus, our perspective highlighting multiple realities is not entirely new, but it reemphasizes perspectives often lost because it is so difficult to see beyond the material representations of technology and to conceptualize it in terms of what has always been done.

Further reinforcing a singular view of technology as *topic* is that treating it as more than that poses a threat both to those who are highly invested in conventional understandings of and approaches to developing literacy and also to those invested in promoting technology, in both instances sometimes in apocalyptic terms. For example, it may be difficult for both researchers and teachers to accept that a career-long interest in developing strategies for reading conventional textbooks may be of marginal use for, or even irrelevant to, instruction centered on the World Wide Web or involving other more flexible forms of hypertext.

What would become of the spirited debates about beginning reading instruction if technology could lead to reading experiences that begged some of the key issues in that debate (e.g., talking books, see McKenna, 1998)? The understandable investment in the conventional understandings of literacy and in long-standing practices and issues based on printed materials is strengthened by the higher and firmly entrenched sociocultural status of print, particularly books, when compared to new digital forms of communication (Adoni, 1995).

As many writers have pointed out, digital forms of reading and writing threaten the cultural centrality of books and other printed materials (e.g., Bolter, 1991; Landow, 1992; Lanham, 1993). In that regard technologies have frequently been portrayed, again singularly, as the antithesis of reading (e.g., Birkerts, 1995) or to some

as the apotheosis of a new and enlightened form of communication and learning (e.g., Bolter, 1991; Papert, 1993; Rheingold, 1993). Both views are invested in seeing technology as a singular reality, either as a straw man or as a standard bearer.

In addition, we believe that the perspective of multiple realities provides a useful vantage point for examining the research that might intersect with technology and literacy instruction, while acknowledging the limitations of that research. That is, the perspective of multiple realities takes into account that the research pertaining to the use of new digital technologies in literacy instruction is by any measure broad and shallow rather than focused and deep. What research there is tends not to be published in mainstream literacy journals, as documented by Kamil and Lane (1998).

The perspective of multiple realities leads us not only to lament the dearth of research or to extend wake-up calls to an ambivalent or unenlightened community of literacy researchers and educators (as we have ourselves sometimes done), but also to consider what we might learn from what research has been done, or perhaps even more importantly what research has not been done, what questions are being asked or avoided, and so forth. It also allows us to seek research-to-practice connections that are specific to particular instructional realities, that is, to focus on research findings that might be applied more confidently to particular situations rather than to seek principles so general as to be relatively meaningless in any particular context. In addition, this perspective prevents us from making too much or expecting too much of research in guiding instructional practice.

Finally, the perspective of multiple realities leads us to consider what the relevant multiple realities are and what forces and trends are operating to create them. For example, multiple realities are created in part by the extremely rapid advances in digital technologies, how quickly they become integrated into society as a whole, what the technologies come to mean to those who use them, and in some cases how much more slowly they are integrated into conventional schooling. For example, the differential availability and use of e-mail and the World Wide Web in society when compared to schools, not to mention differences among schools, create multiple realities that change quickly over time and across specific contexts and that make it difficult but not impossible to create any meaningful, stable research-to-practice connection.

An illustrative set of realities

In this section we present a set of realities illustrating how the perspective of multiple realities might gener-

ate frameworks for guiding and interpreting research in relation to practice. Our framework represents a continuum based on potential goals, motivations, or reasons for integrating (or in some cases not integrating) new digital technologies with literacy instruction. Our framework is a continuum in the sense that it moves from goals that are more passive or rooted in the status quo to goals that place technology in a more active, transforming role.

However, we wish to stress two things. First, we do not mean to suggest that these realities are always discrete. Although presented separately, they are only meant to be anchor points for defining and discussing multiple realities in relation to theory, research, and practice. The multiple realities perspective acknowledges that different realities can operate simultaneously in guiding both research and practice. Second, consistent with the perspective of multiple realities, other frameworks or continua might be developed with different foci. More important than adopting one particular framework is acknowledging that multiple realities exist and that research and practice can be discussed within coherent schemes that acknowledge multiple realities. Doing so, we hope to argue by example, will facilitate a more fine-grained and realistic perspective for building bridges between theory, research, and practice in regard to new technologies.

The following five goals for integrating technology with literacy instruction make up our framework:

1. New digital technologies should be available for literacy instruction.
2. New digital technologies should be used to enhance the goals of conventional literacy instruction.
3. New technologies should be used to positively transform literacy instruction.
4. New technologies should be used to prepare students for the literacy of the future.
5. New technologies should be used to empower students.

Within each of these realities we illustrate the intersection of theory, research, and practice, but our intent is not to provide an exhaustive review. Nor is it our intent to identify unequivocally best practice within each of these realities, although some implications for practice are mentioned or clearly implied.

Reality 1: New digital technologies should be available for literacy instruction

This goal defines a reality that might be summarized by the well-known line from the movie *Field of Dreams*: "Build it, and they will come." In other words the availability of technology, particularly hardware and

software, becomes a key issue in defining this reality, and keeping a finger on the pulse of that availability is considered a relevant and important focus of research. Likewise, acquiring technology and placing it in schools becomes a dominant factor, because it is assumed that doing so will influence instruction positively. Certainly technology cannot be integrated with literacy instruction if it isn't available. However, when this reality predominates, the issues of technology and literacy are driven by the assumption that good things will happen when hardware and software are available, with little if any attention being given to its actual use or to creating conditions that may facilitate its use.

A good example of how identifying this reality may illuminate research and its consequences for instruction can be seen by considering the issue of equity in the availability of technology. Data, periodically updated for more than a decade, have been gathered and reported about the extent to which computers are available in schools in the United States and other countries (e.g., Becker, 1991, 1993; U.S. Congress, 1995) and more recently the level of Internet access in schools (Heavyside, Farris, Malitz, & Carpenter, 1995). Recent studies report that 90% of K-6 teachers use computers in classrooms and that 52% have at least two computers (Carey & Worthington, 1997). This influx of computers into classrooms is due in part to monies earmarked for technology by federal-, state-, and district-level policy makers who are convinced that computers must become fixtures in the infrastructure of schools if the U.S. is going to compete in an increasingly global culture (Bork, 1997).

The availability of computers, as devices, is seen as a key issue to ensure a bright and secure economic future. Given this perspective, there is also much concern about equity in the distribution of computers. For example, the U.S. Congress (1995) reported that poorer school districts had an absence of computers or a much lower computer-to-student ratio than wealthier school districts, which paralleled other deficits in the quality of textbooks, the condition of equipment, and so forth (Kozol, 1991).

However, the perspective of multiple realities suggests that making too much of these data in isolation risks masking more subtle realities centered in use as opposed to availability alone. For example, a study conducted by the Policy Information Center of the Educational Testing Service (Wengling, 1998) reported an analysis of data from the National Assessment of Educational Progress indicating that "traditionally disadvantaged groups do not lag in access to school computers. Compared to White, non-poor, and suburban students, those who are minority, poor, and urban find at least as much opportunity to use computers in school." From strictly within the reality of availability,

these data might lead to complacency about inequities. However, the same report found that "Black students were less likely to be exposed to higher-order uses of computers and more likely to be exposed to lower uses than White students. Similarly, poor, urban, and rural students were less likely to be exposed to higher-order uses than non-poor and suburban students." The point is that data about availability and access without a consideration of use create a narrow sense of reality.

A similarly narrow reality can be seen within schools and classrooms where a preoccupation with availability may be reinforced by the national data. Administrators feel impelled to acquire the latest technology, often with less concern about how its use might be integrated into the curriculum. Computers are placed in separate rooms (interestingly referred to as labs), where teachers are assigned specific times to bring their students. More importantly, when the reality of availability prevails, it also drives use, which is consequently often minimal and perfunctory. Over the previous decade there has been considerable evidence that when computers are used during the school day in elementary schools they are most often used for noncurricular games or for drill-and-practice activities (Becker, 1993; Carey & Worthington, 1997; U.S. Congress, 1995).

A reality created by attention to availability is sustained, we believe, by two conditions, one conceptual and one practical, that might be considered realities in their own right. First, new technologies, as we will discuss further in a subsequent section, may threaten existing curricula and pedagogies. Thus, focusing on availability begs the question of whether new technologies imply a change in the status quo.

Papert (1993) has gone so far as to suggest that most schools treat technology as the body treats an invading virus—that is, to neutralize technology's potential effects by isolating it from its surroundings. While it is not likely that focusing on availability is a calculated strategy for subversion, that may be its net effect. Indeed, Wiburg (1997) has observed that the organization, communication structures, values, attitudes, and overall complexities of school culture (Bowers, 1988) may unintentionally conspire to subvert the use of new technologies in schools (see also Reinking & Watkins, 1996).

Second, focusing on availability may divert attention away from the many practical obstacles and challenges that inhibit new technologies from being integrated with instruction. There are frequently no established instructional niches into which technology-inspired content and activities readily fit, and the obstacles to creating them are formidable. These include problems of logistics, infrastructure, technological support, inservice training, finances, and so forth (Reinking, 1997). Making availability

a dominant reality conveniently pushes these difficulties to the background. Likewise, it puts the burden of addressing these difficulties on individual teachers who are often in the least favorable position to deal with them, and who, in our experience, are often decidedly frustrated by this reality (Wiburg, 1997). Unfortunately, when it comes to integrating technology with literacy instruction, Cuban's (1986) observation about the use of new technologies in schools remains far too contemporary:

Where favorable conditions exist, teacher use will increase.... Where unfavorable conditions exist....school wide use will be spotty....I predict no great breakthrough in teacher use patterns [of computers] at either level of schooling. The new technology, like its predecessors, will be tailored to fit the teacher's perspective and the tight contours of school and classroom settings. (p. 99)

We believe that making availability a dominant goal has created a reality contributing to this lack of progress.

Reality 2: New digital technologies should be used to enhance the goals of conventional literacy instruction

We refer to this goal as the horseless carriage rationale, and the reality it creates might be personified by the character John Henry competing against a new technology that threatens to replace him. The allusion to a horseless carriage highlights the idea that new technologies are often first understood in terms of the familiar technologies to which they most closely relate (Stokes, 1997; Wartella & Reeves, 1983). For example, it was not coincidental that the first automobiles looked like and made reference to horse-drawn carriages. The allusion to John Henry highlights the idea that new technologies are often not accepted and may be considered inferior until they can defeat more established technologies in accomplishing the tasks to which the existing technology has been applied.

This pattern of initial understanding and acceptance is clearly evident as one of the multiple realities shaping the use of digital technologies in literacy instruction. Similar to the horseless carriage of yesteryear, digital technologies were first seen in relation to a stand-alone device called a computer, a label aptly describing its initial use to process numerical data rapidly. While *computer* remains part of the common lexicon, more specific terms such as word processor, server, personal data assistant, and electronic book indicate that digital technologies are becoming more specialized and creating their own unique environments for literacy, much as the automobile became a vehicle in its own right. Just as automobiles began to have features uniquely suited to a new form of transportation (e.g., windshields and wipers),

word processors today have tools for creating multimedia documents as well as printed ones.

Similar to the story of John Henry, many questions of research and practice involving digital technologies have been guided by efforts to determine whether using computer-based activities can accomplish the goals of conventional literacy instruction better or more efficiently than traditional activities. For example, much of the early research on word processing was aimed at determining whether students wrote more or better prose electronically when compared to pencil and paper, an issue that seems moot today because of the dominance of word processing among accomplished writers.

When conventional instruction and activities are the starting point for any discussion of new technologies, researchers tend to frame their questions as head-to-head comparisons, which has been historically a distinctly unfruitful line of research, at least in terms of providing guidance for practice (Clark, 1983). Because conventional instructional goals and activities define this reality, such studies are typically atheoretical with no basis for predicting or explaining results (Reinking & Bridwell-Bowles, 1991). Educators and parents, too, perhaps again reinforced by their familiarity with head-to-head comparisons in the research literature, at least tacitly live within this reality. For example, this reality leads to questions such as, Will students learn more from reading a book or from locating information on the Internet? Even questions such as, What can I do with a computer in my classroom? or What is a good software program to help my students get better at...? implicitly assume that the computer must be justified in terms of what is currently being done.

We do not wish to suggest that these are irrational questions or that using new technologies to expand options for conventional instructional goals is trivial. We only wish to highlight that seeing technologies in such ways is only a single reality among many that might be considered in exploring the connections between research and practice, and that this reality is best considered as transient. That is, at first it is reasonable to consider how new technologies intersect with traditional instruction and whether those technologies add anything beyond what might be accomplished more efficiently and cost effectively using conventional technologies.

However, this reality can be limiting and misleading if it remains predominant as new technologies create new literacy demands, become more logistically and financially feasible, and so forth. It may also be limiting by leading to what Dertouzos (1997) labeled the additive fault of technology in which "people are doing everything they used to do before computers, plus the additional work required to keep the computers happy" (p. 254).

Thus, the results of head-to-head comparisons of computer- and noncomputer-based activities to accomplish conventional goals of literacy instruction, while being useful initially, may be much less so today. In addition, although the well-documented fact that skill-oriented, drill-and-practice applications have dominated instructional software (e.g., Medwell, 1996) may be understandable in light of this reality, we should increasingly be concerned if there is not a reversal in that trend as new digital technologies become more fully integrated with daily literate activity and as our understanding and use of it matures.

Nonetheless, it is important to note that the research conducted within this reality indicates that computer-based activities, while not always proving to be superior, overall compare favorably with more conventional instruction (e.g., Clements & Nastasi, 1992; Kulik, Kulik, & Bangert-Drowns, 1984; Reinking & Bridwell-Bowles, 1991). Despite common assumptions to the contrary, there has been in the past some evidence that investing in hardware and software to accomplish conventional goals is as cost effective as other options for improving instruction, such as reducing class size or peer tutoring (Levin, 1986).

However, to us an important distinction is embedded within the reality driving these investigations, and this distinction needs to be highlighted when considering research and its relevance to instruction. That distinction is between what might be learned *from* (Goldberg & Sherwood, 1983) a computer and what might be learned *with* (Clements, 1994; Haughland, 1992) a computer (cf. Salomon, Perkins, & Globerson, 1991).

Learning from a computer implies a focus on short-term and specific learning outcomes in which the computer is seen as one among several options for delivering instruction. The computer tends to be viewed as a device that is passive and essentially neutral in regard to specific learning outcomes (Clark, 1983), providing only generic advantages such as immediate feedback and individualized instruction when compared with alternative modes of presentation. Research guided by this focus tends to be atheoretical.

Learning with a computer, on the other hand, implies a focus on long-term, broader, less specific, and sometimes incidental outcomes in which the use of the computer plays an active role in fundamentally shaping orientations to learning, content, and tasks. The computer's advantages over other modes of instruction are considered more specifically in terms of the broader cognitive or social dimensions of learning. Research guided by this focus is more likely to be guided by some theoretical perspective.

This distinction can readily be found in existing research. For example, the findings of meta-analyses suggesting that computer-based instruction, including the areas of reading and writing, compares favorably with conventional instruction in terms of learning outcomes (i.e., learning from computers) can be contrasted with investigations focusing on whether consistent and long-term exposure to drill-and-practice activities on a computer may negatively affect imaginative or creative thinking (i.e., learning with computers, Haughland, 1992). Studies comparing whether children write more using word processors can be contrasted with studies of whether composing text with a word processor helps children gain insights about the recursive thinking involved in the writing process (Cochran-Smith, 1991; Daiute, 1985), whether their revisions are more superficial (Olson, 1994), and *why* they might write more or less (Chang & Osguthorpe, 1990; Jones, 1994).

A study investigating whether a computer-based, drill-and-practice program employing immediate feedback increases sight-word vocabulary might be contrasted with studies examining whether the unique experience of reading with audio support may have more generalizable effects on word identification (McKenna & Watkins, 1994, 1996; Roth & Beck, 1987) or reading fluency (Reitsma, 1988).

In general, we believe that research originating from the reality of accomplishing the goals of conventional literacy instruction is more productive and useful if it takes the perspective of learning with the computer. In that regard it is interesting and important to note that several commercially successful programs have tended to be evaluated in terms of learning from a computer. For example, investigations of IBM's once popular and relatively expensive Writing to Read curriculum (Martin, 1986) provided little evidence of immediate or long-term gains in achievement (Krendl & Williams, 1990; Slavin, 1991), but these investigations tended not to focus on the individual components of the program or its potential effects beyond conventional measures of achievement. Likewise, producers of the currently popular Accelerated Reader program (Terrance, 1996) have made empirical claims concerning increases in the number of books that children read. However, the effects of the program on children's orientation to reading books, which is important given the program's use of external motivation and focus on low-level questions, has to our knowledge not been investigated.

Reality 3: New technologies should be used to positively transform literacy instruction

For some researchers and educators, the predominant reality of technology is its potential to transform in-

struction (Bruce, 1997). They see technology mainly as a stimulus for generating positive organizational and pedagogical changes in conventional schooling (Cuban, 1986; Neuman, 1990; Papert, 1993; Sheingold, 1991), and typically they see positive change in terms of progressive goals for education. For example, in 1998 the International Society for Technology in Education released technology standards and argued that meeting the standards implies shifting from teacher- to student-centered instruction; from isolated to collaborative work; from passive, fact-based to active inquiry learning; from artificial to authentic, real-life contexts; and so forth. We highlight this focus on the transforming potential of new technologies by referring to it as the *Wizard of Oz* reality, specifically in reference to the well-known line from the movie, "Toto, I have a feeling we're not in Kansas anymore."

It is not difficult to see how such an orientation might apply specifically to literacy instruction. For example, word processing clearly is consistent with and supports a view of writing as a process with distinct stages, and it provides capabilities to facilitate that process. Likewise, it has been argued that writing hypertexts more naturally creates opportunities for collaborative writing (Landow, 1992). E-mail promotes opportunities for reading and writing for purposes that have personal meaning as well as for encouraging more collaborative projects and interchanges among students (Garner & Gillingham, 1996, 1998; Tao & Reinking, in press).

Further, it might be argued that bringing access to the World Wide Web into classrooms encourages teachers and students to move away from limiting reading and discussion to the content of a textbook and provides opportunities to more critically consider the sources of information (Leu & Kinzer, 1999; Leu & Leu, 1998). Additionally, some writers have suggested that new digital forms of discourse are not simply versions of paper and pencil genres, but they are actually new genres worthy of transformed and unique approaches to literacy instruction (Garton, 1996). Researchers interested in new digital genres attempt to theoretically and practically understand how reading and writing and literacy instruction may be positively transformed (e.g., McKnight, Dillon, & Richardson, 1996; Rouet, Levonen, Dillon, & Spiro, 1996; Tergan, 1997).

To those who operate within this reality, the research-to-practice connection is viewed in terms of documenting the extent to which technology transforms classroom instruction, determining what factors are barriers to transformation, and consequently determining what might be done to facilitate the positive effects of positive transformations induced by technology. We believe the results of that research thus far are consistent with the perspective of multiple realities. That is, bring-

ing new technologies for reading and writing into the classroom does not in itself uniformly stimulate transformations, or at least the transformations expected. Again, not surprisingly from the perspective of multiple realities, technology taken out of the context of its use is transformationally neutral (Cochran-Smith, Kahn, & Paris, 1990; Greenleaf, 1992; Mehan, 1989; Weir, 1989). There is little evidence that hardware or software alone can transform instructional practice (e.g., Means, 1994; Papert, 1993).

In fact, a prominent example related to literacy instruction illustrates how easy it is to undermine the intentional use of technology to transform instruction. Bruce and Rubin (1993) provided a comprehensive review of their research over many years as they worked diligently to implement into many classrooms a comprehensive application of technology aimed specifically at enhancing reading and writing for meaningful purposes. However, after extensive study, they concluded that teachers manipulated the use of the program to accomplish their own more conventional values and goals for instruction.

Similarly, in a case study, Miller and Olson (1994) found that a first-grade teacher, who was enthusiastic about integrating technology into her instruction, used software for creating stories in a way that was consistent with her pedagogical goals rather than with the researchers' enthusiasm for its potential to transform instruction. In our own work (Labbo, Phillips, & Murray, 1995–1996) we have reported how a teacher who was invested in a literature-based approach to teaching children to read successfully modified a skill-oriented application of technology to fit her orientation and to transform instruction toward her goals.

These findings do not mean that introducing technology never acts as a stimulus for transforming instruction. For example, Garner and Gillingham (1996, 1998) reported six case studies of teachers in diverse contexts where positive changes in the teaching and learning environment occurred when the teachers integrated e-mail or the Internet with their teaching. One change across the six cases was the creation of a more positive social climate in which students and teachers began to tell their own stories through narrative. In one of our own long-term studies in seven classrooms across three schools (Reinking & Watkins, 1996), we found that involving teachers and students in creating multimedia book reviews in place of conventional book reports transformed in some but not all cases the teachers' outlooks, their approaches to instruction, and patterns of social interaction in the classrooms.

These mixed findings and conclusions about whether technology transforms instruction can be understood within the perspective negotiating multiple realities. Instead of asking whether technology in a narrow

and unidimensional sense can transform instruction, the question becomes, From the perspective of multiple realities, under what conditions is it most likely to do so? This view we believe is an especially fruitful and needed area of research for which some preliminary findings may offer guidance.

For example, in six case studies of teachers who successfully integrated the Internet with instruction, Garner and Gillingham (1996) found that the teachers shared several common attributes: (a) they were not didactic or teacher centered in their orientation, (b) they tended to view technology as a means toward an end, (c) they believed that students could succeed, and (d) they sought out alternatives to current practice.

It is notable too that those researchers who take the transforming perspective as we have defined it here are also those who are exploring alternative research methodologies that more readily accommodate the perspective of multiple realities. For example, employing a conventional experimental paradigm, which requires careful control of the naturally occurring variation in classrooms, is more likely to perpetuate a decontextualized view of technology as if it were the predominant variable operating to transform outcomes (Reinking & Pickle, 1993). On the other hand, transformations may more often be incidental or secondary by-products of integrating technology into instruction. If so, they are more likely to be discovered through qualitative methodologies that more readily reveal subtle and dynamic effects.

Thus, researchers interested in the transforming potential of new technologies have turned to other methodologies that balance a desire to facilitate positive change with the desire to exercise rigor in the pursuit of deep understandings (Reinking & Watkins, 1998). For example, in the previously mentioned study by Bruce and Rubin (1993), they described their approach as situated evaluation, which is similar in orientation to what Neuman (1990) and others have referred to as formative experiments (see also Reinking & Pickle, 1993).

In these approaches the goal of the research is typically, as it is with those directing instruction, to accomplish a specific pedagogical goal and to discover the multiple realities that impinge on accomplishing that goal in unique contexts. We believe that such approaches to research not only are consistent with the perspective of multiple realities, but also hold much promise for increasing the likelihood that the research on technology and literacy will be able to inform practice more directly.

Reality 4: New technologies should be used to prepare students for the literacy of the future

Another reality that can generate questions of research and practice pertaining to technology is the belief

that new digital technologies imply a different and uncertain future for literacy. This reality is predicated on the assumption that what constitutes literacy and what the demands of literacy will be for citizens in the future are changing in light of digital technologies (Leu, in press; Reinking, 1995, 1998). The challenge of research and pedagogy within this reality is to monitor closely changes that are occurring and to formulate reasonable instructional responses to those changes. This focus on change and unpredictability creates what we call the Buffalo Springfield reality, taken from that group's well-known 1960s song containing the line "Something's happening here, what it is ain't exactly clear."

Acknowledging this reality and considering how it might affect research and practice inevitably mean engaging in dialogue and debate about the extent to which changes are occurring, what exactly those changes are, whether the observed or potential changes are positive or negative, what they imply for the future of literacy, and what kinds of instructional responses are necessary and reasonable. Like many issues that threaten the status quo and that leave room for speculation and diverse opinions, the pros and cons of new technologies have been fodder for many books aimed at general audiences including educators.

Books such as *Silicon Snake Oil* (Stoll, 1995) and *The Gutenberg Elegies* (Birkerts, 1995) highlight the negative potential of new technologies; some, such as *Technopoly* (Postman, 1992), take a more balanced perspective; while others, such as *Digital Literacy* (Gilster, 1997) and *Growing Up Digital* (Tapscott, 1998), are unabashedly positive. Regardless of which perspective proves to be the most accurate, the presence and popularity of these books is a clear indication that change and its potential effects on literacy pedagogy is a dominant reality.

In the realm of instruction, this reality in some instances has been operationalized naturally and intuitively without the need for theory or research. For example, it takes only common sense to determine that instructional activities should shift away from alphabetical searches of the almost obsolete card catalog used in libraries toward Boolean searches of large databases of digitally stored information. The importance of engaging students in word processing as a writing tool is self-evident, although less clear are the instructional implications of using new word processors that permit the creation of multimedia or hypertextual documents.

In fact, this reality defined by change and uncertainty, perhaps more than any other reality, reminds researchers and teachers of the inherent limitations in building strong connections between research and practice. That is, it is difficult to do so when the results of to-

day's research may either be outdated or irrelevant in a relatively short time. It is worth noting that new technologies create this effect not only on research and practice directly related to new technologies (e.g., research about locating information on the Internet when Internet design, access, and use change rapidly), but also across the full gamut of topics of interest to literacy practitioners (e.g., of what relevance is the research on classroom discussion centered on conventional texts when the text has been replaced by online documents and the discussion occurs via e-mail or chat rooms?). If the half-life of literacy research focusing on issues of technology is short, researchers who fail to acknowledge issues of technology in their work may have to face the reality that their findings too may soon be outdated, incomplete, or irrelevant (Reinking, 1995).

However, this reality does not mean that there is no role for research in facing the contingencies of instruction that exist within an awareness of change and uncertainty in the future of literacy. For example, extremely useful within this reality is research aimed at studying the processes of changes brought about purposefully or incidentally by encounters with technology at the level of individual teachers, students, classrooms, and schools. In this regard, research investigating the processes by which technology becomes or does not become integrated with the curriculum and instructional environment may be more immediately useful and less transitory than research aimed primarily at determining effectiveness of specific applications or models of implementation.

An example is Neuman's (1990) investigation of how an application of technology aimed at promoting insights about science was assimilated or accommodated in various classrooms. In our own work we have consciously focused as much on processes as outcomes when exploring the effects of various instructional activities that involve technology (e.g., how a kindergarten teacher over 2 years came to integrate technology with conventional literacy activities to promote the principles of emergent literacy [Labbo, Reinking, & McKenna, 1995], how a multimedia book review activity was shaped by understandings of the conventional book report, and why the activity seemed to produce richer findings in some classrooms than others [Reinking & Watkins, 1996]). Unfortunately, from our perspective, there is not more research addressing such issues of process.

Another productive line of research that clearly connects to this reality is monitoring sociocultural trends, such as views about technology among children and adults (e.g., Adoni, 1995), levels of availability and use (see the previous section discussing Reality #1), and how the demands of the workplace may be changing in relation to literacy (e.g., Mikulecky & Kirkley, 1998). Reliable

and valid information about trends and changing patterns in these areas can be useful in guiding the development of the literacy curriculum and of appropriate instructional activities, as well as in determining what curricula or activities may no longer be needed or relevant.

Data are needed to offset idle speculation, ill-informed opinions, and biased viewpoints that too often enter into discussions of what literacy may entail in the future and how the education system should respond today. Again, unfortunately, there is relatively little research that can be cited in this area that speaks directly to these issues and even less that might speak to those who must provide literacy instruction.

Finally, this reality highlights the sobering responsibility and formidable challenge that literacy educators face in fostering literacy during a period of rapid technological change. As Leu (in press) has poignantly observed, preparing the current generation of students to become literate is difficult not only because it is unclear what the literacy of the future will be, but also because the task falls to a generation of educators who as a whole are not fully literate themselves, even considering the changes that have already occurred. An aggressive agenda of research will not resolve this dilemma, but we believe it may help if it is guided by an understanding of this reality and a focus on gathering the most relevant data.

Reality 5: New technologies should be used to empower students

Commitment to this goal creates what might be called the Excalibur reality. That is, new technologies are seen mainly in terms of their potential to empower students just as King Arthur's legendary sword empowered him to accomplish great deeds. Within this reality, technology's influence on literacy and literacy instruction is seen through a sociocultural lens. Its potential and influence are typically judged and understood within a social constructivist framework in which technology, like any aspect of instruction, cannot be seen as neutral or apart from personal actualization or from the advancement of agendas such as those identified by a critical pedagogy.

Another aspect of this reality can be represented by extending the allusion to Excalibur. That is, technology can be a double-edged sword that expands or restricts opportunities for promoting personal growth and egalitarian goals. Thus, in this view a primary goal of literacy education in relation to digital technologies should be to deconstruct not only texts and the technologies that produce them, but also the ideologies with which they resonate. In addition, the enthusiasm for technology among those who exist within this reality may be driven in part by the concern that rejecting or neglecting new technologies can unintentionally perpetuate a status quo

where those who are not in power stand to remain disenfranchised. At the same time, technology is seen as a potential equalizer that may help some students move beyond limits imposed by ethnicity, poverty, or gender.

This reality looks to a broad literature in the sociocultural aspects of education (e.g., Giroux, 1983), literacy (e.g., Gee, 1996), and technology (e.g., Emihovich, 1990; Latour, 1991) for guidance in considering relevant research questions and instructional applications. However, recently several literacy researchers have elaborated on how this reality might be interpreted and applied more specifically in relation to particular issues involving technology and literacy.

For example, Bruce and Hogan (1998) have argued for an ecological model of literacy aimed at revealing the hidden effects of technologies that often disappear as they become firmly embedded into our social lives. Their perspective is echoed by Lemke (1998) who argued that new technologies play an important role in expanding the boundaries of literacy, and in so doing require us to understand those technologies as part of a social ecosystem. Likewise, Tierney and Damarin (1998) provided several examples of how "media and text [are] inextricably connected with ongoing social interactions and thus [serve] as cultural tools for forming students' identity of themselves and of their individual and collective views of society" (p. 253).

There is a modicum of research that exists within this reality. That research tends to support the view that new technologies can be understood in sociocultural terms and that they can promote goals related to empowerment and critical perspectives. For example, Cooper and Selfe (1990) discovered that college-level computer conferences empowered the students they studied to resist academic programs that did not match their deeply held convictions, values, and needs as learners. On the other hand, Knowlton (1997) has criticized the bland and uncritical quality of term papers written by university students, presumably because they draw heavily on information quickly and superficially accessed from the Internet.

Meyers, Hammet, and McKillop (1998) examined the role of multimedia hypertext in moving students toward critical literacy. Using Storyspace (Bolter, Joyce, Smith, & Bernstein, 1993), software that allows students to author multimedia projects involving linked paths through stacks of images, videos, sound, and text, students were able to link information to a variety of sources and to display multiple sources simultaneously on the computer screen.

As the students constructed unique and complex messages, many of which exhibited opposing viewpoints, they naturally had occasions to take a critical literacy perspective and to discover previously hidden

ideologies. For example, one group of students created a hypermedia QuickTime™ movie of opposing images of Pocahontas, involving the Walt Disney cartoon heroine, a photograph of a Native American child, and a 17th-century oil painting. In doing so they confronted cultural assumptions related to representations and historical interpretations.

Neilsen (1998) has documented how introducing e-mail into several Canadian high schools allowed some students to confront and to subvert the authority of teachers, administrators, and school policies. At the same time it allowed issues of class and gender to readily surface in e-mail conversations. In fact, research suggests that e-mail can play a powerful role in promoting the goals associated with this reality. For example, Fey (1998) has reported that nontraditional college students using e-mail to participate in a distance-learning course gained personal insights and understanding of gender that were attributable to this mode of communication. Likewise, Garner and Gillingham (1996, 1998) documented the cross-cultural understandings that were promoted in classrooms using e-mail and the Internet.

These findings suggest to us that this reality is an important dimension of considering the role of new technologies in literacy instruction and therefore is an important dimension of considering how research might contribute to practice in regard to new technologies. However, as the perspective of multiple realities implies, it is likely that researchers and practitioners who focus on other realities are less likely to attend to this dimension of technology. That observation leads to our concluding section, where we consider what, ultimately, the perspective of multiple realities might contribute to the connection between research and practice in regard to new technologies.

Summary and implications

We believe that one main goal of educational theory and research is to reveal the underlying complexities of instructional practice while providing frameworks for dealing with that complexity in the service of enhancing learning and human development. In this article we characterized that goal as a process of negotiating multiple realities, and we illustrated how considering multiple realities might be applied to considering the connection between literacy research and practice in relation to new technologies.

We have argued here that considering new technologies in literacy research and practice is a good example because new technologies intersect with a broad range of issues and practices in literacy instruction, because new technologies are rapidly becoming integral to

daily literate activity, and because new technologies are generating instructional issues and demands that are not readily addressed within, and indeed may challenge, conventional frameworks of instruction.

Moreover, a perhaps understandable response among researchers and practitioners has been to conceptualize new technologies as an amorphous, isolated topic anchored in considering the computer as a device with certain technological capabilities instead of as a device that is only the material representation of an extensive array of new challenges and possibilities. In other words, the computer has tended to personify a singular, unidimensional reality within the realm of literacy research and practice instead of being considered a development that connects with and generates many different realities.

Further, we asserted that the perspective of multiple realities counters this trend by revealing the diversity and complexity of issues that might be considered in interpreting existing research, in conceptualizing future research involving new technologies, and in considering how research related to technology might enlighten and guide instructional practice. To illustrate, we identified one set of interrelated realities created by alternate goals that might be adopted to integrate new technologies into literacy instruction.

We emphasized that the realities we identify here are only one possible set of realities, but we feel they are a useful set because they represent a coherent progression of potential goals that might guide research and practice. That is, the goals we have identified represent a progression from seeing new technologies as extensions of the status quo to seeing new technologies as a potential catalyst for transforming instruction, from seeing new technologies in terms of how their presence or absence in classrooms might affect literacy achievement as it has been conventionally defined to seeing new technologies as creating new dimensions of literacy embedded within a matrix of sociocultural influences.

There are clear implications of our perspective for considering the connection between research and practice, in a general sense, although again illustrated particularly well by the use of new technologies in literacy. For example, when a question related to instructional practice begins with the phrase "What does the research say about...?" we believe it should be followed by an explicit consideration of which reality or set of realities is being considered. Doing so means that the answer will inherently be more complex than citing a string of studies and drawing conclusions from them. It also suggests that it may be important to identify the realities to which a potential answer does not apply or why a question is not a relevant or particularly good one within certain realities.

The often asked or implied question about whether research has demonstrated the computer to be effective in enhancing literacy instruction is a good example. Not only is the question too general to be answered simply, but it implies that whoever poses the question is operating within a reality that views the computer primarily as a device for delivering instruction and that it must prove its value in comparison to more conventional alternatives (see Reality #2 in the previous section). It begs the more subtle realities made visible by related but more specific questions such as for what students, toward what goals, under what circumstances, with what content, and so forth.

These and similar questions reveal the general limitations of educational research in guiding instructional practice and portray it as a lesser form of knowledge (Labaree, 1998). Moreover, the larger question, as well as its more specific variations, is not a relevant one for those whose reality is defined primarily by the goal of preparing students for a future literacy that they recognize will inevitably be shaped by new technologies (see Reality #3). To them, questions about the effectiveness of computers in literacy instruction is like asking whether books are effective—a question that few would even think to ask because books are a given within the realm of literacy and literacy instruction.

We believe that seeing the research-to-practice connection in terms of negotiating multiple realities has several advantages. Most importantly, it reveals or reinforces an awareness of the complexities of instructional practice and the limitations of research in speaking definitively to practitioners. It also reveals one reason why there can be so many debates on what the research says about various issues of instructional practice. This view also suggests that it is important for researchers to frame their research with an explicit consideration of the reality or realities to which it relates. Likewise, it suggests that practitioners need to be conscious of the realities that shape their own practice and consequently to be sensitive to the fact that all research may not speak to the reality in which they operate.

We believe that the set of realities we have identified in this article may facilitate the process of negotiating multiple realities in considering the relation between research and practice regarding new technologies and literacy. We wish to suggest that explicitly identifying specific realities may also be helpful to literacy researchers and practitioners interested in other dimensions of literacy and literacy instruction.

Finally, we believe that ongoing literacy-related technology practice and research must continue to be designed, cultivated, developed, and disseminated in consideration of multiple, complex realities presented

across a broad spectrum of unique cultural contexts. We join others (e.g., Bruce & Hogan, 1998; Weir, 1989) in promoting an ecological stance that takes multiple influences on computer use into account. Various forms of research, such as many of the studies cited in this article, stand to make valuable contributions to the field.

Small-scale qualitative, quantitative, and hybrid explorations of computer-related literacy innovations should be conducted throughout a network of teachers who are willing to form a learning community that extends beyond the walls of the classroom or school campus (e.g., Leu et al., 1998). Large-scale quantitative examinations of the present use of computers can inform stakeholders about the impact of computer systems on the literacy learning of their constituents. Case studies that delve into the sociocognitive dimensions of students' encounters with particular instructional activities that involve new technologies will provide an important window to view the construction of knowledge in digital environments.

Most important from the standpoint of negotiating multiple realities, researchers and practitioners need to seek understandings that take into account the unique interaction among cognitive processes, learning, socio-cultural factors, and instructional goals. Then, our understanding of the symbiotic relation of new technologies and literacy will continue to be refined, redefined, and shaped in intellectually honest and culturally responsive ways.

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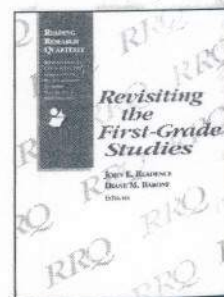
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