

A National Survey of Barriers to Integrating Information and Communication Technologies into Literacy Instruction

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Even though computers and Internet connections are available in virtually all schools in the U.S. (Wells & Lewis, 2006), and despite the increasing influence of Information and Communication Technologies (ICTs) on every aspect of literacy (Leu, Kinzer Coiro, & Cammack, 2004), there is evidence that ICTs are not integrated widely into literacy instruction, especially in ways that authentically address new forms of literacy (Hutchison, 2009; Cuban, 2001; Leander, 2007; Russell, Bebell, O'Dwyer, & O'Connor, 2003; Stolle, 2008; Smerdon, Cronen, Lanahan, Anderson, Iannotti, & Angeles, 2000). That lack of integration expands the increasing gap between forms of literacy practiced inside and outside of schools (Hutchison & Henry, 2010). The serious implications of that gap are implicit in repeated, forceful calls for more integration of ICTs into literacy instruction, for example, through position papers and new standards emanating from leading professional organizations such as the International Reading Association (2009) and the National Council of Teachers of English (2008).

Towards understanding and addressing a lack of integration, researchers have tried to identify what barriers teachers face in integrating ICTs into their instruction (Bauer & Kenton, 2005; Ertmer, Addison, Lane, Ross, & Woods, 1999; Honan, 2008; Stolle, 2008; Warschauer, Knobel, & Stone, 2004; Zhao, Pugh, Sheldon, & Byers, 2002). The purpose of the present study was first to determine if there were common barriers to integrating ICTs into instruction identified in previous studies. Then, especially when that review revealed a host of mostly non-overlapping barriers, to analyze the results of a national survey toward clarifying which of these barriers, and perhaps others, literacy teachers perceived as inhibiting their integration of ICTs into their instruction. That information is useful because it could inform professional development and other interventions aimed at increasing integration.

Theoretical Perspectives

The rationale for this study and its use of survey methods is based on Labbo and Reinking's (1999) position that research related to integrating technology into instruction is more likely to influence practitioners when it is framed within one or more of the multiple realities in which they might be invested. That view suggests the need for data to determine how teachers define their reality in relation to integrating ICTs into instruction, including their perceptions about the barriers they face. Consistent with that view, teachers' subjective beliefs about what barriers inhibit their integration of ICTs into instruction are as important, and arguably more important, than more objective data about what barriers may or may not actually exist. Research supports this theoretical perspective. Specifically, teachers' beliefs have frequently been found to be a major influence on

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how teachers conceptualize and use technology in their instruction (Bruce & Rubin, 1993; Ertmer, 2005; Clark & Peterson, 1986; Windschitl & Sahl, 2002; Zhao, Pugh, Sheldon, & Byers, 2002).

In related work, Reinking, Labbo, and McKenna (2000) suggested that the integration of digital technologies into instruction may occur developmentally. They drew an analogy between the Piagetian concept of assimilation and accommodation in children's learning, suggesting that teachers may first assimilate ICTs into their existing instruction. Subsequently, after greater experience, they may more authentically accommodate ICTs by more fundamentally transforming their instruction. At least indirectly, the kinds of barriers teachers identify may suggest where as a group they fall on a continuum from assimilation to accommodation, as illustrated by the research reviewed in the subsequent section. Survey data also have the potential to track changes over time in teachers' perceptions about barriers, which may suggest changes in their instructional beliefs and practices, as well as the practical circumstances that affect the extent to which they integrate ICTs into their instruction.

Barriers Identified in Previous Research

Possible barriers to technology integration across the curriculum have been studied using qualitative methods (Honan, 2008; Stolle, 2008; Warschauer, Knobel, & Stone, 2004; Zhao, Pugh, Sheldon, & Byers, 2002), mixed methods (Bauer & Kenton, 2005) and surveys (National Center for Educational Statistics, 2003). Studies have investigated teachers in elementary, middle, and high schools.

However, only Honan (2008) has investigated barriers specific to literacy teachers. She conducted semi-structured interviews with four literacy teachers working with students in Grades 2 to 4 to determine barriers to using digital texts in their classrooms. In five full-day meetings, during which teachers engaged in discussions and reflections, she discovered three dominant barriers that inhibited authentic curricular integration of ICTs into instruction. First, teachers' responses indicated a lack of knowledge about students use of technology outside of school, which was problematic because it hindered teachers from using various digital texts. They believed students would be unfamiliar with such texts. A second barrier was a focus on technical, rather than literacy, skills, which was problematic because it led to more superficial integration consistent with what Reinking, Labbo, and McKenna (2000) referred to as assimilation rather than accommodation. A third major barrier was the focus on production of a digital products as a final or culminating project, which also shifted attention away from developing the skills, strategies, and dispositions associated with reading and writing digital texts. She also concluded that the placement of computers in a central computer laboratory inhibited integration because computers were not available in classrooms for use throughout the school day. Although informative, Honan's study involved only four teachers in Australia and conclusions were based on her interpretations of teachers' responses rather than on directly querying teachers about what they perceived as barriers to integrating digital literacies into their instruction.

In another relevant study, Stolle (2008) gathered qualitative data from 16 high school English, social studies, and science teachers in the U.S. She examined the tensions, complexities, conceptualizations and practices of teachers in relation to technology. Her data included systematic observations, in-depth interviews, focus group interviews, response data interviews, and a researcher's journal. She identified four major tensions that affected integration of ICTs into instruction:

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is available in virtually all schools, the increasing influence of Information and Communication Technology (Leu, Kinzer Coiro, & Cammack, 2009) into literacy instruction, especially in elementary schools (Leu, 2009; Cuban, 2001; Leander, 2008; Smerdon, Cronen, Lanahan, & Henry, 2010). The serious consequences of the increasing gap between technology use in schools and the new standards emanating from the National Reading Association (2009) and the

researchers have tried to identify barriers to technology integration in literacy instruction (Bauer & Kenton, 2005; Stolle, 2008; Warschauer, Knobel, & Stone, 2004). The purpose of the present study was first to determine the barriers to technology integration into instruction identified in previous research, and second to determine the extent of mostly non-overlapping barriers, and third to determine which of these barriers, and perhaps the extent to which they inhibit the integration of ICTs into their instruction. That is, the purpose of the present study was to determine the extent to which these barriers inhibit the development and other interventions

The purpose of the present study is based on Labbo and Reinking's (2000) research, which suggests that technology integration into instruction is more likely to occur when teachers are aware of the multiple realities in which they work. The purpose of the present study was to determine how teachers define their barriers to technology integration, and to determine their perceptions about the barriers to technology integration, and to determine which of these barriers, and perhaps the extent to which they inhibit the integration of ICTs into their instruction. That is, the purpose of the present study was to determine the extent to which these barriers inhibit the development and other interventions

1. Lack of access to ICTs adequate for instructional tasks. For example, teachers were reluctant to assign homework that involved the use of ICTs because they believed that some students might not have access to necessary technologies outside of school. Further, teachers expressed that they lacked necessary equipment for in-class activities.
2. Insufficient knowledge of ICTs and how to use them. The teachers in the study did not believe that they were being taught how to effectively enhance learning with ICTs.
3. Teachers feared that ICTs threatened traditional literacy practices.
4. Uncertainty about the benefits of integrating ICTs into instruction and how benefits could be assessed.

Further, Stolle (2008) found that teachers often replicated existing literacy practices with technology instead of using technology in more innovative ways derived from the unique capabilities and uses of ICTs. Her study provides more nuanced insights into what teachers believe about ICTs. However, it was limited to high-school teachers in three different subject areas.

Bauer and Kenton (2005) conducted a mixed-methods study that illuminates barriers from another perspective. They focused on 30 teachers from several content areas who were identified as having technological savvy. Teachers in the study completed a questionnaire to identify their backgrounds and their experiences with, conceptions about, and use of computer technology. They also observed and conducted open-ended interviews with each teacher individually. Teachers reported the following barriers to integrating ICTs into their instruction: (a) lack of equipment or poorly functioning equipment, (b) time to use technology within a standard class period, (c) the varying levels of students' skills, (d) lack of teachers' skills in using digital technology, (e) scheduling computer lab time, (f) unavailability and incompatibility of software, and (g) Internet crashes caused by large numbers of students simultaneously searching Web sites. A questionnaire followed by observations in classrooms also revealed that teachers were most often simply using technology rather than integrating it meaningfully into instructional goals. However, it is not clear whether Bauer and Kenton's survey rigorously conformed to standards for survey development and administration. Specifically, they did not explain how the survey items were derived, nor did they report efforts to establish its validity and reliability. Further, they considered integration to be "a reliance on computer technology for regular lesson delivery" (p. 522), and seemed to consider any use of computers as evidence of integration. Thus, the findings and conclusions do not address specifically the issues investigated in the present study.

Warschauer, Knobel, and Stone (2004) conducted a qualitative study that did not specifically investigate the barriers teachers faced in integrating technology, but they did compare the use of new technologies among high schools in California serving respectively students from families of high- and low-socio-economic status. Based on the patterns they observed across the schools, they characterized the following difficulties teachers experienced in integrating technology into the school curriculum:

1. *Workability*, or how well equipment and networks function. For example, teachers voiced dissatisfaction with the need to plan back-up lessons in case the technology was not working properly.
2. *Complexity*, or the logistical challenges of integrating computers into instruction, such as taking students to the computer lab, dealing with different levels of skills in using the technology, and lack of access to computers at home for homework assignments.

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3. *Performativity*, or an emphasis on skills rather than more meaningful application such as locating and evaluating search engine results. For example, teachers emphasized being able to measure performance of technology-related activities, which often undermined attention to more meaningful integration.

Their study did not explicitly address barriers to technology integration, but it nonetheless suggests broad categories into which barriers might fall.

Zhao, Pugh, Sheldon, and Byers' (2002) study parallels Bauer and Kenton's (2005) work because they investigated what factors facilitated or hindered the use of technology among teachers who had received a competitive technology grant, and who were presumably savvy users of technology. They conducted case studies with 10 of 118 teachers who had received funding for technology-related projects. The 10 teachers were selected on the basis of geographical location, grade level, and subject matter, and through systematic analysis were determined to be representative of the entire sample. They identified three domains, each with several factors that influenced the successful integration of technology into instruction among these teachers. The first domain included teachers labeled as *innovators* based on technology proficiency, pedagogical compatibility, and social awareness of the school culture. Importantly, they found that not only is understanding how to use equipment necessary, but also equally necessary is understanding the enabling conditions of certain technologies. For example, in addition to knowing how to instruct students to read and to send e-mail, a teacher must have access to a functional network, networked computers, e-mail software, and possibly software to filter inappropriate content. Pedagogical compatibility was deemed important because efforts to use technology were more likely to yield positive results when teachers' pedagogical approaches matched the technology and technological applications they chose to use. Awareness of school culture was also deemed important because interestingly they found that teachers who successfully integrated the projects into instruction understood school resources and how they were allocated and the priorities of colleagues in accessing and using them.

The second domain pertained to the *innovation*, or project itself. Factors in this domain were associated with how the selected project contributed to successful technology integration considering the project's distance from the school culture, from existing practice, from available technological resources and whether it depended on others and on the availability of technological resources.

The final domain was the instructional *context*. The school-related factors that influence the integration of technology were the organizational and technological infrastructure supporting integration and social support. Their study revealed 11 factors related to technology integration: technology proficiency, compatibility between teacher pedagogical beliefs and the technology, social awareness, distance from school culture, distance from existing practice, distance from available technological resources, dependence on others, dependence on technological resources, human infrastructure, technological infrastructure, and social support. However, their study was conducted with teachers who had received a technology grant, and thus were likely to have greater interest in, commitment to, and knowledge about digital technologies and their integration into the curriculum.

In a more dated study, Ertmer, Addison, Lane, Ross, and Woods (1999) examined teachers' beliefs about the role of technology in the elementary classroom. They collected survey, interview, and observational data from seven teachers in one elementary school, and categorized barriers to

technology integration into first-order and second-order barriers. First-order barriers were those *extrinsic* to teachers, and included a lack of access to computers, lack of time, and lack of classroom help. Second-order barriers were those *intrinsic* to teachers, such as a teacher's beliefs or routines, lack of relevance, a mismatch with classroom management style, and a lack of teacher confidence about technology abilities.

Each of the studies reviewed here contributes to the base of knowledge regarding the barriers teachers face in using technology in a significant way. However, cumulatively they reveal limitations in our current knowledge about what barriers teachers face in integrating ICTs into instruction in general and literacy research in particular. Specifically, the studies are small scale. Most were conducted within only a single school. Further, only Honan's (2008) study of barriers to using digital text looked specifically at literacy practices. In addition, as illustrated in Table 1, which summarizes potential barriers to integrating ICTs into instruction across the studies reviewed, there is minimal overlap of the barriers identified and thus little consensus about what the barriers are to integrating technology into instruction. Therefore, a national study was designed and administered toward clarifying on a larger scale the barriers literacy teachers in particular face in integrating ICTs into their instruction. The survey included items that specifically addressed those barriers or categories of barriers identified in the existing literature reviewed here.

Table 1. Comparison of Barriers to Technology Integration Reported in Previous Studies

	Honan (2008) [A]	Stolle (2008) [B]	Warshauer et al. (2004) [C]	Bauer & Kenton (2005) [D]	Zhao et al. (2002) [E]	Ertmer et al. (1999) [F]
Focus on technical rather than academic skills	X		X			
Emphasis on product as outcome	X					
Placement of computers in school setting	X			X		
Lack of equipment for desired tasks	X			X		X
Ability to use ICTs		X		X	X	
Fear of the Unknown		X				
Beliefs about the usefulness/benefit of ICTs		X				
Reliability of technology			X	X		
Logistical challenges such as varying skills & lack of home access			X	X		
Lack of time to implement ICTs during a single class period				X		
Fit of ICTs with teacher beliefs about learning					X	

the constructs used to design the survey. Cronbach's alpha ranged from .92 to .96 on each of the constructs, indicating internal consistency. Therefore all items on the revised survey were retained on the final survey.

Participants. Participants were 1,441 predominantly literacy teachers who are members of a state or local council of the International Reading Association (IRA). Participation was solicited from IRA members, because (a) members are predominantly literacy educators, the target population of this study; (b) every state in the U.S. has a state affiliate comprised of local councils, thus representing the potential for a national sample; (c) many, but not all, of the state affiliates have e-mail distribution lists, or they have other means available to disseminate information about an online survey, and (d) there is precedent in the literacy research literature for using IRA members to gather data about literacy issues in classrooms (Baumann, Hoffman, Duffy-Hester, & Moon-Ro, 2000). In some states, leaders of the state IRA affiliate declined to invite their members to participate in the survey or did not have the means available to efficiently disseminate invitations to participate. In those cases, respondents were contacted through other organizations or list-servs such as the Connecticut Association for Reading, and the enhancing Missouri's Instructional Networked Teaching Strategies (eMINTS) network. Thirty-one states are represented in the survey from every major region of the U.S.

Procedures for administering the survey. Invitations to complete the online survey were disseminated in several stages and through multiple contacts during three months. The first contact consisted of sending a personal e-mail to the presidents and membership chairs of all the state IRA councils to inform them of the study, to request their cooperation in facilitating the study, and, if they consented, to make them aware that they would subsequently receive further instructions about how they could participate. The e-mail also informed them that if at least 15% of their members completed the survey, they would receive a customized report of the survey findings for their state. Five days after the first e-mail, a second e-mail contact was made with state presidents and membership chairs. The second e-mail suggested several ways state presidents could invite their members to complete the survey, and it included a sample invitation e-mail. The presidents were asked to send the invitation letter to their members through their e-mail distribution list, or to inform the researcher if an e-mail invitation was not a possibility. A reminder e-mail was sent to presidents who had not replied approximately a week after the second contact was made.

Twenty-three state presidents did not respond to either the first or second e-mail. Four state presidents declined to participate because they did not have an e-mail list or because of concerns about members' privacy. In these cases an e-mail with other options for announcing the survey and distributing the survey link, including posting to the organization's Web page and announcing the survey in their state newsletter was sent. After determining which state reading associations would not participate in the study, we e-mailed personal contacts in those states to request suggestions about how to distribute the survey effectively to the appropriate population and who might be contacted to facilitate dissemination through e-mail. These contacts led to participation in five additional states.

Data analysis. In the part of the survey relevant to the present study, teachers were asked to identify on a Likert scale the extent to which several potential barriers and challenges interfered with integrating ICTs into literacy instruction by responding to the following item: "Please indicate the

extent to which language arts instruction reviewed in a previous years experience their instruction about how to integrate technology ability to use ICT high-stakes testing

Table 2 summarizes the extent to which barriers are at all" on the left of the top of the table

Table 2. Perceived

[Letters in bold reflects a barrier source]
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A Comparison of Barriers to ICT Integration

extent to which you believe the following are barriers to integrating technology into your literacy/language arts instruction," which was followed by a list of possible barriers derived from the studies reviewed in a previous section of this report. However, we added several barriers based on our many years experience working with literacy teachers and their efforts to integrate digital technologies into their instruction and/or that were pertinent to the focus of this investigation: lack of understanding about how to integrate technology into instruction, lack of professional development related to integrating technology into instruction, lack of understanding about how to evaluate students' ability to use ICTs, Internet texts being too difficult for students to read, and lack of time due to high-stakes testing.

RESULTS

Table 2 summarizes the responses to the survey item requesting that participants identify the extent to which each factor was perceived as a barrier to integrating ICTs into instruction. Values in bold indicate the one or two categories that reach a threshold of at least 50% of the respondents. The barriers are listed in an order from how quickly that threshold was reached beginning at "not at all" on the left side of the table to "a large extent" on the right side of the table. Thus, barriers at the top of the table are considered overall to be less of a barrier than those at the bottom of the table.

Table 2. Perceived Barriers to the Integration of ICTs into Literacy Instruction

Potential Barrier [Letters in brackets indicate that the item reflects a barrier found in the corresponding sources listed in Table 1.]	Not at all % (n)	Small Extent % (n)	Moderate extent % (n)	Large extent % (n)	Not applicable % (n)
I don't believe technology integration is useful [B]	85.0 (1225)	9.6 (139)	1.9 (28)	1.3 (19)	2.2 (32)
I don't think technology fits my beliefs about learning [E]	75.7 (1091)	16.0 (231)	4.1 (60)	1.8 (26)	2.4 (35)
I have difficulty managing the classroom when students are working on computers [F]	56.9 (820)	28.0 (404)	7.1 (103)	3.4 (49)	4.8 (70)
I don't know how to use technology [B,D,E, F]	51.6 (744)	29.9 (431)	11.9 (172)	3.9 (57)	1.9 (28)
I don't understand copyright issues [B,D,E]	51.5 (743)	34.4 (496)	9.2 (133)	3.3 (48)	1.6 (24)
Lack of support from administrators [E]	45.8 (660)	24.5 (354)	16.3 (235)	11.6 (168)	1.9 (28)
I don't think technology is reliable [C,D]	43.7 (630)	37.9 (547)	12.1 (175)	3.8 (55)	1.8 (26)
I don't understand how to integrate technology into my literacy instruction	41.9 (604)	34.0 (490)	17.8 (257)	4.9 (71)	1.3 (19)
I think Internet text is too difficult for students to read	40.4 (583)	35.5 (512)	15.9 (230)	6.8 (98)	1.5 (22)

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Potential Barrier [Letters in brackets indicate that the item reflects a barrier found in the corresponding sources listed in Table 1.]	Not at all % (n)	Small Extent % (n)	Moderate extent % (n)	Large extent % (n)	Not applicable % (n)
I don't know how to incorporate technology and still teach content standards [A,C,F]	39.3 (567)	34.1 (492)	17.7 (256)	6.4 (93)	1.6 (24)
I don't know how skilled my students are at using technology [C,D]	39.2 (565)	39.7 (573)	12.3 (178)	6.2 (90)	2.6 (38)
Lack of incentives to use technology [E]	38.9 (561)	28.5 (411)	20.1 (290)	10.9 (158)	1.5 (22)
I have difficulty controlling what information students access online [B]	34.4 (496)	39.0 (562)	16.5 (238)	6.9 (100)	3.2 (47)
I don't know how to evaluate or assess students when they work online	34.2 (493)	38.9 (561)	18.2 (263)	5.9 (86)	2.7 (39)
I don't think I have time to integrate technology because of the amount of time required to prepare students for high stakes testing [F]	29.1 (420)	26.4 (381)	20.6 (297)	20.9 (302)	3.1 (45)
I don't have time to teach students the basic computer skills needed for more complex tasks [C,D]	24.3 (351)	30.8 (444)	21.3 (307)	20.9 (302)	2.7 (39)
I don't think I have enough time to prepare for using technology [F]	21.7 (313)	30.0 (433)	23.1 (333)	23.9 (345)	1.4 (21)
Lack of technical support [E,F]	19.5 (281)	27.9 (403)	25.0 (361)	27.2 (392)	0.5 (8)
Lack of professional development on how to integrate technology	17.9 (258)	26.8 (387)	26.7 (385)	28.1 (405)	0.5 (8)
Lack of access to technology [A,B,D,E,F]	17.7 (254)	24.8 (356)	22.2 (319)	35.5 (511)	0.0 (0)
Lack of time during a class period [D]	12.3 (177)	23.1 (333)	27.3 (394)	36.4 (525)	0.9 (12)

Note. Bold values represent the one or two largest values in each category reaching a threshold of at least 50% of the responses.

Lack of time during a class period was the most common barrier reported when considering the percentage of teachers indicating that a factor was a barrier to a moderate or large extent (63.7%), followed by lack of access to technology (57.7%), lack of professional development on how to integrate technology (54.8%), and lack of technical support (52.2%). A majority of the respondents indicated that all of the other factors were not a barrier at all or a barrier to a small extent.

Using a more liberal approach to determining the possible range of barriers, Table 3 lists, in descending order, the factors that at least 50% of participants listed as a barrier to some extent

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(small, moderate, or large) and compares these to barriers identified in previous studies or indicates if it is a barrier not previously reported.

Table 3. Barriers to Integrating ICTs Compared to Previous Studies

Identified as a barrier to a small, moderate, or large extent (% reporting as barrier)	Reported in Literature
Lack of time to implement during a single class period (86.8%)	Bauer & Kenton, 2005
Access to equipment (82.3%)	Honan, 2008; Stolle, 2008; Bauer & Kenton, 2005; Zhao, et al., 2002
Lack of professional development on how to integrate ICTs (81.6%)	Not previously reported
Lack of technical support (80%)	Bauer & Kenton, 2005; Stolle, 2008; Zhao, et al., 2002; Ertmer, et al., 1999
Lack of time to plan for using technology (76.9%)	Ertmer, et al., 1999
Necessity of teaching basic computer skills for more complex tasks (73%)	Honan, 2008
Lack of time to integrate due to high stakes testing (67.8%)	Not previously reported
Ability to evaluate student work using ICTs (63.1%)	Not previously reported
Difficulty controlling information students access online (62.4%)	Stolle, 2008
Lack of incentives for using technology (59.6%)	Zhao, et al., 2002
Lack of knowledge about how skilled students are at using technology (58.2%)	Bauer & Kenton, 2005; Warschauer, et al., 2004
Ability to integrate ICTs and still teach content standards (58.2%)	Ertmer, et al., 1999; Honan, 2008; Warschauer, et al., 2004
Difficulty level of Internet text (58.2%)	Not previously reported
Ability to integrate technology specific to Literacy instruction (56.7%)	Not previously reported
Unreliability of technology (53.8%)	Bauer & Kenton, 2005; Warschauer, et al., 2004
Support for integration (52.4%)	Zhao, et al., 2002

Using this more liberal approach resulted in an expanded list of possible barriers, although the same barriers emerged as most prominent in this list that emerged from taking a more conservative approach. The list in Table 3 also shows that several of the barriers reported by literacy teachers have not been reported previously. The following do not appear to be major barriers to integration of ICTs among literacy teachers, because more than 50% of respondents identified them as no barrier at all: Beliefs about usefulness of technology integration, fit of technology with beliefs about

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Large extent % (n)	Not applicable % (n)
1.4 (93)	1.6 (24)
1.2 (90)	2.6 (38)
0.9 (158)	1.5 (22)
.9 (100)	3.2 (47)
.9 (106)	2.7 (39)
1.9 (102)	3.1 (45)
1.9 (102)	2.7 (39)
.9 (115)	1.4 (21)
.2 (112)	0.5 (8)
.1 (115)	0.5 (8)
.5 (111)	0.0 (0)
.4 (115)	0.9 (12)

learning, difficulty of managing the classroom when students work on computers, knowledge of how to use technology, understanding of copyright issues.

DISCUSSION

From our systematic review of previous studies, it is clear that many diverse factors have been identified as barriers to integrating ICTs into instruction in general. That diversity of factors and the identification of many non-overlapping barriers (see Table 1) may be because of differences in the populations studied (e.g., teachers with different levels of technological expertise teaching different subjects), in the approaches to data collection and analysis (e.g., observations, case studies, interviews, surveys) and in technologies and their availability across time (the studies reviewed spanned almost 10 years).

Taken as a whole, then, the current literature provides no common core of a few barriers that inhibit integration of ICTs into instruction and thus provides little guidance about what course of action might be taken to increase integration by overcoming barriers. Further, only one of the studies reviewed (Honan, 2008) focused on barriers to integrating ICTs into literacy instruction. Thus, we conclude that a more focused, systematic approach to research is needed if the field is to identify what barriers teachers most often face and to use that information as a foundation for addressing specific barriers and for increasing the integration of ICTs into literacy instruction. The existing research is ad hoc, local, not nuanced by subject area, and in some instances outdated. Researchers need to focus attention on identifying factors that are barriers to integrating ICTs into literacy instruction and to explore possible interventions that take into account those barriers. Given rapid changes in technology, it may also be useful to periodically monitor perceptions about barriers. Survey methods may be particularly useful to monitor changes in teachers' perceptions.

To move a step toward addressing these goals, the barriers identified in previous research were included in a national survey of literacy teachers aimed at increasing understanding various dimensions of integrating ICTs into literacy instruction. An analysis of that data indicated that literacy teachers, as a whole, did not perceive many of the barriers identified in previous research to be clear barriers to integrating ICTs into their instruction. That finding may be an encouraging sign and suggest progress. For example, unlike previous research, relatively few literacy teachers found the reliability of technology or the ability to use ICTs as a barrier, which may be due to the increasing availability of technology (e.g., one-on-one laptop initiatives and digital projectors), and to the increasing use of ICTs in the daily lives of teachers.

More importantly, a large majority of the teachers responding to this survey indicated that their own beliefs about technology and learning (75.7%) and their beliefs about integrating ICTs into instruction (85%) were not barriers even to a small extent. Thus, literacy teachers, as a whole may, perhaps contrary to common assumptions, be fundamentally open to efforts aimed at increasing integration of ICTs into their instruction. That finding has added importance because considerable research has shown that teachers' beliefs play a predominant role in how they conceptualize and use computer-based technologies in their teaching (Bruce & Rubin, 1993; Ertmer, 2005; Clark & Peterson, 1986; Windschitl & Sahl, 2002; Zhao, Pugh, Sheldon, & Byers, 2002). In particular, that finding also suggests that literacy teachers in general seem to be receptive to accommodating

ICTs into instruction. The overwhelming majority of teachers engaged them in their instruction. Literacy teachers were consistent with

A majority of teachers reported that technology integration was a high priority (31.4% were evaluating integration as a high priority). Analysis of data as to how teachers integrate ICTs into instruction shows that teaching the skills that await further research is how they define

On the whole, at least 50% of teachers (to that extent), literacy teachers in previous studies have integrated ICTs into their instruction. The time for instruction to integrate ICTs into their curriculum that is much of the literacy curriculum depends on how they inform their curriculum. For example, literacy teachers include the knowledge of ICTs (Leu, 2002) that professional teachers integrated into their curricular models.

Other barriers to support the professional lack of school access to information. Inappropriate stakes testing instruction. Teachers also use technology in instruction, via the Internet, as d

ICTs into instruction (Reinking, Labbo, & McKenna, 2000). Knowing that literacy teachers are overwhelmingly supportive of integrating ICTs into instruction may also inform those who wish to engage them in professional development aimed at integrating ICTs into their teaching. Specifically, literacy teachers may not need to be convinced that ICTs are useful and that ICTs are potentially consistent with their goals for students' learning.

A majority of the participants indicated that their own knowledge about how to integrate technology into instruction was either not a barrier at all (39.3%) or was a barrier to only a small extent (31.4%). However, that item in particular begs the question of on what basis teachers are evaluating their own knowledge and how they define integration. For example, preliminary analysis of data from the larger study suggests that teachers may define integration more narrowly as technological rather than curricular integration. That is, to many literacy teachers, integration of ICTs into instruction may simply mean using the technologies associated with ICTs rather than teaching the skills, strategies, and dispositions necessary for their effective use. That possibility awaits further analysis of our data and ideally studies, for example, that interview teachers about how they define integration of ICTs into instruction.

On the other hand, using the more liberal standard for listing barriers in Table 3 (i.e., at least 50% of the respondents indicated that the items were a barrier to a small, moderate, or large extent), literacy teachers identified several barriers that were consistent with those identified in previous studies. Specifically, they perceived the following to be barriers: the ability to integrate ICTs into the curriculum, lack of planning time and time to carry out ICT activities during allotted time for instruction, diversity of students' computer skills, access to technology, lack of incentives to integrate ICTs into instruction, and lack of technical support. These barriers fall mainly into a category that Ertmer et al. (1999) refers to as extrinsic factors, which suggests that in teachers' views, much of the burden of achieving more integration of ICTs into literacy instruction falls more on curriculum developers, policy makers, and administrators and indirectly to researchers who could inform their efforts. Again, it would be useful to further explicate these barriers in future studies. For example, might teachers believe that a lack of incentives to integrate ICTs into instruction include the known fact that few high-stakes tests include an evaluation of students' abilities to use ICTs (Leu, 2006)? The finding that curricular integration is perceived as a barrier also suggests that professional development may need to provide more explicit guidance about how ICTs can be integrated into the language arts curriculum including perhaps developing generic instructional and curricular models aimed at specific goals and standards.

Other barriers that literacy teachers identified, but that were not identified in previous studies, support the previous conclusions. For example, literacy teachers identified the following as barriers: lack of school support for ICT integration, lack of means to assess students in that area, controlling access to information online (e.g., the necessity of using firewalls to prevent students from accessing inappropriate content), lack of professional development, lack of time to integrate due to high stakes testing, and a lack of understanding about how to integrate technology specific to literacy instruction. These barriers all imply the need for administrative support. However, many literacy teachers also perceived the difficulty of texts on the Internet to be a barrier to integrating ICTs into instruction, which suggests a topic for further research. Is the uncontrolled difficulty of texts on the Internet, as defined traditionally (e.g., by readability formulas), a barrier to engaging students with

activities aimed at integrating ICTs into literacy instruction? Does the concept of defining texts as at a student's frustration, instructional, or independent levels apply to instruction involving ICTs? If not, how might teachers' perceptions be changed? These are topics for future research.

However, these interpretations, conclusions, and speculations must be tempered by the fact that they are based solely on survey data that only solicited teachers' perceptions and opinions, although, given our theoretical stance, perceptions are clearly important. Nonetheless, more systematic and detailed research is needed to determine if those perceptions are supported by observational data and if they are consistent with the views of administrators and policy makers. It would be informative, for example, to survey a national sample of educational administrators and policy makers involved in shaping literacy instruction to compare their views on integrating ICTs into literacy instruction. Such an approach would be consistent with multiple realities perspective cited as supporting the rationale for and methods of this investigation (Labbo & Reinking, 2000). Further, this study was conducted only with teachers who are members of the International Reading Association. Because the IRA has issued a position statement about the importance of integrating literacy and technology in the curriculum, teachers who are members of this organization may be more likely to integrate technology than teachers who are not IRA members. Thus, this sample may not be reflective of all literacy teachers.

It would also be informative for researchers to investigate interventions aimed at helping literacy teachers integrate ICTs into their instruction. Nonetheless, we believe the present study provides national data in the U.S. that can inform those efforts. We also believe that the present study highlights the need for more focused and systematic research and development aimed at furthering the integration of ICTs into literacy instruction.

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