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Information and Communication Technology Use by North Carolina School Library Media Specialists: Perceived Competencies and Barriers

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Given the interdisciplinary and information-rich nature of information and communication technologies (ICTs), many advocate for school library media specialists (SLMSs) to take a leadership role in promoting their integrative use across the K–12 curriculum. This article explores ICT use by North Carolina SLMSs. Specifically, it investigates their perceived competencies with Web 2.0 technologies, their use of Web 2.0 technologies in their own teaching, and the barriers they believe impede the use of Web 2.0 technologies in teaching and learning. Themes identified for discussion include the participants' age, the disconnect between perceptions of preparedness and perceived ICT competency, the evolutionary process of technology integration, factors that facilitate integration, and factors that inhibit integration. Concluding comments explore the ways SLMSs might take on the technology leadership role advocates propose.

Introduction

The world is quickly changing, and, without question, technology has altered the way we live, interact, and create. Information and communication technologies (ICTs) have become essential tools in modern society. Many experts see competency with these technologies as "a prerequisite for participation in society and the workforce" (21st Century Workforce Commission 2000; ACRL 1989; ISTE 2007; Partnership for 21st Century Skills 2007; Richardson 2006).

Over the past few years, public schools have significantly increased the number of instructional computers and technological equipment available to students (Bauer and Kenton 2005; Richardson 2006; Whitehead, Jensen, and Boschee 2003). The professional literature is overflowing with models and suggestions for integrating technology into instruction in meaningful ways (see Hart 2007; Hasselbacher 2007; Milson, Gilbert, and Earle 2007). However, the rate of instructional integration of these technologies and related skills—information and digital literacies—in K–12 education remains slow (Bauer and Kenton 2005; Cuban 2001, 2006; Evans and Gunter 2004; Moursund and Bielefeldt 1999; NCES 2000; Sandholtz and Reilly 2004; Shi and Bichelmeyer 2007). Leaders in the field of school librarianship have called for school library media specialists (SLMSs) to take a proactive role in

addressing this disconnect (Berger 2007; Geck 2006; Johnson 2006; Lackie 2006; Lamb and Johnson 2006; Valenza 2006).

Taking on a leadership role requires a command of the content of the new practice (Fullan and Stiegelbauer 1991; Lieberman 2001). This raises an important question: Do SLMSs perceive themselves to have adequate knowledge, skills, and support to integrate technology into instruction and thus to take on this leadership role? The following study explored this question by asking the following questions:

- How do SLMSs in North Carolina perceive their level of ICT competency?
- How are they integrating ICTs into their instruction?
- How prepared do they feel to do this?
- What barriers do they perceive exist to the integration of technology into their instruction?

Review of the Relevant Literature

Technology Integration in K–12 Schools

Over the past decade, K–12 public schools in the United States have dramatically increased Internet access and ICT availability in an effort to meet the demands of the rapidly evolving and technologically advanced work environment. A ten-year study conducted by the National Center for Education Statistics (NCES 2006) confirms this increase, showing an 85 percent growth in the number of instructional computers with Internet access in K–12 schools from 1995–2003. The study also shows a sharp decline in the ratio of computers per student over a seven-year span. In 1998, data reported one instructional computer for every twelve students, whereas by 2005 the ratio had dropped to one instructional computer for every four students (NCES 2006). Despite this increased investment in technology, however, reformers have watched in dismay as the machines continue to sit idle or to be "underused" in many schools (Bauer and Kenton 2005; Cuban 2001, 2006; Evans and Gunter 2004; Moursund and Bielefeldt 1999; NCES 2000; Sandholtz and Reilly 2004). Shi and Bichelmeyer (2007) found, for example, that while there are a number of teachers who are using intensive integration of computers in their classrooms, the primary use of computers for instructional purposes by teachers continues to be for word processing.

Several factors have contributed to the lack of technology use and integration by teachers. According to Cuban (2001), a primary flaw in effectively integrating technology into instruction has been that, more often than not, teachers are excluded from the discussion of instructional technology design, purchases, and policy deliberations in regard to the distribution process. A recent study by the National Education Association (NEA 2008) found that teachers still report a lack of involvement in planning for the technology innovations they are expected to implement in their classrooms. Technology decisions continue to be top-down decisions in many school systems, with a focus on acquisition rather than instructional implementation (McGrail 2006; NEA 2008; Shi and Bichelmeyer 2007).

Furthermore, research indicates that teachers feel largely underprepared to integrate technology into their teaching. A 2000 study by the NCES, for example, reported that nearly 70 percent of the teachers surveyed indicated not feeling well prepared to use computers and the Internet in their teaching. The NEA 's (2008) study found that eight years later, 50 percent of teachers still

report not feeling prepared to integrate technology into their instruction. Traditionally, inservice technology training has been software-based rather than curriculum-based (Ertmer, Conklin, and Lewandowski 2003; Gilmore 1995). Teachers leave these training sessions not knowing how to create or to implement small- or whole-group activities that incorporate meaningful uses of technology (Moersch 1995; Moursund and Bielefeldt 1999; Shi and Bichelmeyer 2007; Yildirim 2000).

Even teachers who self-identify as highly educated and skilled in the use of technology use it inconsistently and infrequently (Bauer and Kenton 2005). Six broad categories of barriers have been identified:

- Resources—a lack of technology, access to available technology, time, and technical support
- Knowledge and skills—a lack of specific technology knowledge and skills, technology-supported pedagogical knowledge and skills, and technology-related classroom management knowledge and skills
- Institution—inadequate leadership, inflexible scheduling, and poor school planning
- Attitudes and beliefs—teacher's beliefs about the value of technology and its relevance to teaching and learning
- Assessment—an emphasis on high-stakes testing, which gives teachers little time to learn and use new technology and shifts the use of technology from teaching and learning to facilitation of assessment
- Subject culture—a belief that technology is not appropriate for a specific content area (Hew and Brush 2007, 226–31)

Ertmer defines these and other barriers that contribute to a lack of technology integration in the classroom as "first and second order barriers" (1999, 47). First order barriers relate to extrinsic obstacles, which are mostly outside the teacher's control. Examples include inadequate funding, equipment, and time. Second order barriers refer to intrinsic obstacles, which prohibit change, such as underlying beliefs and attitudes toward technology and its use to support teaching and learning. Teaching, organizational, and management styles, as well as assessment procedures, also influence the decision to incorporate technology into one's teaching repertoire. Ertmer, quoting Cuban, states, "It is a belief system, not an economic or empirical warrant, that determines failure or success" (52). Ertmer identifies the development of a shared vision of how technology can be used to affect teaching and learning as an essential step in overcoming both first and second order barriers. According to Ertmer, "A vision gives us a place to start, a goal to reach for, as well as a guidepost along the way" (54).

The Library Media Program and Technology

Twenty-first-century literacy skills—information literacy, collaboration, critical thinking, and technology—are essential components of effective school librarianship. *Information Power: Building Partnerships for Learning*, the national guidelines for quality library media programs published in 1998, emphasized this belief in beginning statements:

> Information literacy—the ability to find and use information—is the keystone of lifelong learning. Creating a foundation for lifelong learning is at the heart of the school library media program. Just as the school library media center has moved far beyond a room with books to become an active, technology-rich learning environment with an array of

> information resources, the school library media specialist today focuses on the process of learning rather than dissemination of information. (AASL and AECT 1998, 2)

Given the interdisciplinary, collaborative, and information-rich nature of school librarianship,SLMSs are in a prime position to make significant and meaningful contributions toward the integration of twenty-first-century literacy skills. In addition, advancements in collaborative technology (for instance, wiki and social networking tools) bring about exciting possibilities for greatly enhancing the learning environment. Students use e-mail, online forums, blogs, wikis, and chat rooms to communicate and collaborate with contacts around the world (Harada, Kirio, and Yamamoto 2008). They participate in simulations or virtual worlds and work together to accomplish tasks online. Students also archive their electronic products for others to review and critique, employing technology as a tool for assessment and evaluation (Harada, Kirio, and Yamamoto 2008).

Many advocate for SLMSs to take the lead in the use and integration of ICTs in the classroom (Berger 2007; Geck 2006; Johnson 2006; Lackie 2006; Lamb and Johnson 2006; Valenza 2006). In November 2006, more than two hundred professionals connected to the profession of school librarianship—librarians, university professors, technology specialists, administrators, publishers, and vendors—gathered at *School Library Journal*'s annual Leadership Summit in Chicago to share knowledge and ideas on how technology can enhance student achievement and to identify "critical opportunities" for school librarians to affect teaching and learning through technology (Kenny 2006). Opportunities involved increasing collaborative efforts with teaching colleagues, taking a leadership role in learning and applying new technologies to enhance interactions and instruction, and meshing "library-added value" (information and digital literacy, lifelong learning, and critical thinking) into the learning environment. This conference represents just one of many efforts by leaders in the school library field to encourage SLMSs to take on a leadership role in technology integration.

Procedures

Research Site

North Carolina was chosen as the research site because it has a number of initiatives in place to support technology integration. *IMPACT: Guidelines for North Carolina Media and Technology Programs* (North Carolina State Board of Education 2000, 2005) provides guidelines for SLMSs and technology facilitators in North Carolina, including recommendations for programs, personnel, budgets, policies, resources, and facilities to guide media and technology programs "as they support a resource-rich, technology-rich learning environment" (3). Personnel recommendations include a full-time SLMS, technology facilitator, media assistant, technology assistant, and technician for each school as well as district-level personnel to provide leadership in the integration of technology.

In 2005, North Carolina became the first state to join efforts with the Partnership for 21st Century Skills to develop a center focused on assisting students in the acquisition of skills to succeed in today's global economy. Such skills include a focus on core subjects and twenty-first-century themes as well as life and career skills, learning and innovation skills, and information, media, and technology skills, including ICT literacy (Partnership for 21st Century Skills 2007). "As the first state in the nation to implement the Partnership's framework for 21st century

education, North Carolina will help lead a nation-wide movement toward a new model for teaching and learning" (Market Wire 2005).

Demonstrating further commitment, in 2006 the North Carolina State Board of Education adopted technology standards for new school construction and major renovations. These guidelines include recommendations for technical infrastructure (i.e., wiring, wireless, and switching and routing equipment), equipment (i.e., communications systems, closed-circuit television, white boards and other specialized equipment, video-on-demand systems, workstations, etc.), and bandwidth considerations.

Finally, among the strategies recommended for overcoming a lack of technology is the creation of hybrid technology setups in classrooms that make use of cheaper computer systems, such as thin-client computers (Hew and Brush 2007). Thin-client computers consist of only a monitor and a device that provides access to a network and no hard or floppy drive. These computers can be purchased at a fraction of the cost of traditional personal computers. Sandholtz and Reilly (2004) found that the use of thin-client computers not only allowed school districts to stretch limited budgets, but it also presented fewer maintenance and technical problems for teachers and reduced space-management issues. In North Carolina, this option is particularly viable because of North Carolina State University's (NC State) Virtual Computing Lab (VCL) project, which provides remote access to expensive software packages like 3D modeling tools and advanced statistical programs for NC State students and professors (Young 2008). Currently, the VCL is exploring opportunities to expand their services to K–12 public schools in North Carolina (Stein 2008).

Participant Recruitment

Participants were recruited at the 2007 North Carolina School Library Media Association (NCSLMA) Conference. The survey, with an accompanying letter that explained the purpose of the study, was distributed to attendees as they entered the first general session of the conference. Attendees were given two days to place completed surveys in boxes located throughout the conference center.

Survey Design

The survey contained seventeen questions regarding the participants' knowledge, understanding, and curricular integrative use of technology tools and applications. A list of technology tools and applications was generated from multiple sources in the field of educational technology (Lamb and Johnson 2006; Richardson 2006; Valenza 2006).

Communication and Collaboration Technologies—blogs, e-mail, live chats, threaded discussion forums, video conferencing, voice-over Internet protocol, virtual conferencing, and wikis.

- Production and Design Technologies—digital camera, digital imaging tools, digital video production tools, GIS, electronic white boards, podcasts, portable media players, presentation tools, streamed video, and web design tools.
- Virtual Modeling Technologies—animated narrative vignette, computer simulation, and online gaming.
- File Sharing Technologies—audio file sharing tools, peer to peer, photo file sharing tools, RSS feeds, and video file sharing tools.
- Social Networking Technologies—social book marking, social networks, and virtual social networks.

In addition, participants were asked to provide examples of successful and unsuccessful attempts to integrate technology into their teaching and learning. Demographic information was collected as a means for comparison. Response to each question was not mandatory to participate or complete the survey. The survey, adapted from a study of preservice SLMSs' ICT competency (Hanson-Baldauf and Hughes-Hassell 2009), was field tested with students enrolled in the school library media certification program at the University of North Carolina at Chapel Hill.

Analysis of Data

A total of 420 participants completed the survey. The quantitative data were analyzed using SPSS descriptive analysis capabilities and SPSS nonparametric, cross-comparison analysis capabilities (the Mann-Whitney Test). NVivo software was used to analyze the qualitative data.

Limitations of the Study

A number of limitations in this study should be noted. Administering the survey at NCSLMA's conference only provided access to a portion of North Carolina's more than two thousand SLMSs, and not all conference attendees chose to participate. Additionally, conference attendees may not be representative of a "typical" SLMS in North Carolina. District-level financial support, encouragement, and release time have been found to affect conference attendance (Vega and Connell 2007).

Findings

Sample Demographics

A total of 420 participants completed the survey. Survey participants were not required to complete each question; therefore reported totals do not always equal 420. For example, only 414 of the participants answered the questions about age and gender.

Most (96.8 percent) of the respondents were female; only 13 (3.13 percent) were male. A total of 212 (51.21 percent) were fifty years of age or older; 99 (23.91 percent) were in their forties; 92 (22.2 percent) were in their thirties; and 13 (2.7 percent) were between twenty and twenty-nine years of age. A total of 367 respondents (88.4 percent) were National Board Certified SLMSs, while 43 (10 percent) were currently working as SLMSs while completing certification requirements. A total of 87 (21.2 percent) were National Board Certified in library media. A total of 323 (79.36 percent) were members of NCSLMA, while only 39 (10 percent) were members of the American Association of School Librarians (AASL).

Perceived Competence with ICT Tools

The first section of the survey was designed to determine participants' perceived competency with ICT technologies. For each technology, participants were asked to rank their level of competence using the following scale:

- Level 0—Am unfamiliar with this technology
- Level 1—Know what it is but rarely use it
- Level 2—Use this technology occasionally
- Level 3—Use this technology on a regular basis
- Level 4—Am able to teach others to use this technology

Survey respondents indicated the highest level of competency (levels 3 or 4) with e-mail, presentation tools such as Microsoft PowerPoint, and digital cameras (see table 1). In regard to aggregated demographic data, a disparity between the age of the participant and self-reported competency level was anticipated, as revealed in a recent similar study of technology competency levels of preservice school library students (Hanson-Baldauf and Hughes-Hassell 2009), though no such significant findings arose.

Table 1. ICT Tools and Applications with Which Participants Reported the Highest Levels of Competency

Technology	Percent Level 3 (Use this technology on a regular basis)	Percent Level 4 (Am able to teach others to use this technology)	Total
E-mail	28.50	69.16	97.66
Digital cameras	21.45	62.00	83.45
Presentation tools (i.e., PowerPoint, Key Note)	19.26	60.56	79.82

Although the number of female respondents (407) was notably higher than male respondents (13), gender analysis (accounting for the discrepancy in sample sizes) yielded a number of significant results, revealing that male respondents tended to perceive themselves as having higher levels of competency in the use of more emergent technologies, including live chats, podcasting, video- and photo-file sharing, video conferencing, peer-to-peer networking, and RSS feeds.

As a group, respondents indicated unfamiliarity (level 0) and the lowest level of competency (level 1) with emergent technologies such as social-networking and file-sharing tools (see table 2). They also reported unfamiliarity and low levels of competency with virtual modeling tools such as Animated Narrative Vignette and computer simulation. Although podcasts, wikis, blogs, Web design tools, and electronic whiteboards have been identified as potentially transforming teaching and learning (Richardson 2006; Valenza 2006; Warlick 2005), the majority of the respondents only rarely or occasionally used each of these technologies (see table 3).

Table 2. ICT Tools and Applications with Which Participants Reported the Lowest Levels of Competency

Technology	Percent Level 0 (Unfamiliar	Percent Level 1 (Know	Percent Level 2 (Use	Total

	with this technology)	what it is but rarely use it)	occasionally)	
Animated narrative vignette (ANV)	87.47	10.21	1.86	99.54
Virtual social networks (i.e., Second Life)	70.00	26.05	3.49	99.54
Peer to peer (i.e., Bit Torrent)	76.69	17.25	4.20	98.14
Virtual conference or meetings (i.e., hitchhikr, or EdTechTalk)	47.93	42.86	6.68	97.47
Computer simulation	45.94	41.30	9.74	96.98
Voice-over Internet protocol (i.e., Skype, Gizmo project)	60.65	28.94	6.02	95.61
Audio file-sharing tools (i.e., LimeWire, Morpheus)	61.48	26.22	7.89	95.59
Social bookmarking (i.e., Del.ic.ous, Blinklist)	67.21	22.09	6.05	95.35
GIS (Geographic Information System)	48.03	36.80	9.98	94.81
RSS feeds	64.49	17.99	9.58	92.06
Social networks (i.e., MySpace,	17.17	59.86	14.85	91.88

Facebook, Friendster)				
Wiki	31.18	40.18	20.09	91.45
Podcasts	28.01	51.39	11.81	91.21
Photo file sharing tools (i.e., Flikr, Zoto)	50.46	23.61	15.51	89.58
Blogs	15.44	59.91	12.21	87.56
Electronic or interactive white boards (i.e., SmartBoards)	8.58	35.03	22.74	66.35
Web design tools (i.e., Dreamweaver, FrontPage)	13.69	27.84	20.19	61.72

Table 3. ICT Tools Used in Instruction

Technology Tool	Percent	Technology Tool	Percent
Presentation tools (i.e., PowerPoint, KeyNote)	87.15	Photo file sharing (i.e., Flikr, Zoto)	13.08
Digital cameras	86.92	Live chats	10.98
E-mail	80.37	Video file sharing (i.e., YouTube, Metacafe)	10.28
Electronic or interactive white boards (i.e., Smart Boards)	56.31	Computer simulation	9.81
Web design tools (i.e., Dreamweaver, FrontPage)	39.49	Video conferencing	9.81
Digital imaging tools (i.e., Photoshop)	38.79	RSS feeds	6.07

Digital video production tools (i.e., Production Studio)	23.83	Social bookmarking (i.e., Del.ic.ous, Blinklist)	6.07
Blogs	21.50	Social networks (i.e., MySpace, Facebook)	6.07
Portable media player (i.e., iPod, MP3)	21.26	Audio file sharing	3.74
Threaded discussion forums/message boards	21.03	None of the above	1.87
Video games	20.56	Animated narrative vignette (ANV)	1.64
Wiki	20.33	Peer-to-peer networking (i.e., BitTorrent)	1.17
Instant messaging	16.36	Voice-over Internet protocol (i.e., Skype, Gizmo)	1.17
Podcasts	15.65	Virtual social networks (i.e., Teen Second Life)	.47

Instructional Use of ICT Tools

The second section of the survey focused on the instructional use of ICT technologies in library media programs. Participants were first asked to identify (from a list) technologies currently or previously used in their instruction (see table 3). Respondents ranked presentation tools (87.15 percent), digital cameras, (86.92 percent), and e-mail (80.37 percent) highest in instructional use. These results paralleled self-reported levels of high competence in both using and instructing others to use these same tools: e-mail (97.66 percent), presentation tools (79.82 percent) and digital cameras (83.45 percent). Emergent technology tools and applications were less frequently used. Again, their use paralleled self-reported levels of low competency in using and instructing others to use these tools.

Participants were then asked to report whether their school district offered learning opportunities on how to use technology and, if so, to rank their effectiveness. A total of 299 (69.86 percent) respondents indicated that there were learning opportunities in this area, and 187 (63.82 percent) participants reported that these learning experiences were "effective." Only 4 percent felt the experiences were "ineffective."

Respondents were next asked to indicate whether their school district offered learning opportunities on how to integrate technology into instruction. A total of 233 (55.34 percent) survey participants reported "yes," with 65.15 percent reporting these opportunities to be "effective."

Respondents were also asked how they prefer to learn to use new technology tools and applications. "Attending a professional development workshop offered by my school" was preferred by 26 percent, 19 percent preferred "learning from a colleague," and 15 percent preferred "teaching myself." Several respondents commented that "it doesn't matter as long as it's hands-on" and "ongoing." Age seemed to play a role in dictating preferred learning opportunities. Respondents over the age of forty significantly differed in response to this question when compared to the respondents between the ages of twenty and thirty-nine ($p = .004$), preferring professional development offered at their school (54.43 percent) as opposed to their younger counterparts who preferred learning technology skills independently (71.54 percent).

When asked to share examples of how they effectively integrated technology into their instruction, most of the examples focused on the use of PowerPoint, digital cameras, Smartboards, and Discovery Education streaming (United Streaming). Examples included:

> I have encouraged teachers to use digital storytelling in their lessons. Requiring students to create a multimedia project uses more of the higher-level thinking skills than just asking them to "write a report." It is also more appealing to our visual learners.
>
> At an elementary school grades K–2 with more than 50 percent Hispanic children, I use PowerPoint as much as possible. This breaks down the language barrier by providing pictures associated with vocabulary. Each presentation is adjusted to fit the language and interest level of the class and is age appropriate.
>
> Recently, fourth- and fifth-grade students completed a clay animation project. Students made background, clay figures, and then used digital photography to record the "movements."
>
> I am a Holocaust Educator. We use United Streaming to preview interviews with Holocaust survivors.

There were a few examples that highlighted emergent ICT tools and applications:

> I taught two AP literature classes how to construct wikis. They worked in groups and constructed Web spaces about different literature movements and time periods. It was highly successful and could not have been done without the technology.

> [We watched a] podcast of Saudi Arabian eleventh-grade girls talking about the hijab (head scarf) and abaya (black robe) they wear and about their feelings on American dress. This fit into a seventh-grade unit on the Middle East. Each pair of students had different research areas. The students were given two pictures, one of [non-Muslim] American girls and one of Muslim girls. They were to listen to the audio file and analyze the perspectives of Saudi girls and the perspective of [the non-Muslim] American girls and the reasons behind both. They were to draw a conclusion to present to the class. The use of the audio of real girls talking about dress was much more powerful than anything I could have said to explain why the Saudi girls did not mind wearing the abaya and hijab. The Saudi girls gave their reasons in the audio and discussed what they thought of American dress.
>
> I teach a six-week long unit on media literacy to fifth graders. Part of this program is to educate students about commercials and other messages and how to evaluate them. Having the ability to access much of this material via the Internet, and to make the Internet itself, along with its many features (blogs, MySpace, wikis, etc.) a part of that discussion, helps students more fully realize the fact that they are bombarded with this stuff no matter where they look and that they need to learn how to assess what they see. Being able to project the screen, utilize interactive websites, show streaming video, etc., enhances the entire process . . . particularly when I point out that the entire lesson was one great big message.

Need for School Librarians to Integrate Technology into Instruction

Overwhelmingly, survey participants agreed on the importance for school librarians to integrate technology into their instruction; 239 (57.04 percent) reported that they felt it is “extremely important,” and 142 (33.89 percent) reported that they felt it is “very important.” When asked how prepared they feel to integrate technology into their own instruction, 34.84 percent responded that they feel “well prepared,” and 57.52 percent responded that they feel “somewhat prepared.”

Perceived Barriers to Integration

Finally, participants were asked to rank on a scale of 1–6 how important the most commonly identified barriers to technology integration were to their ability to integrate technology into their instruction (see table 4). Lack of time and lack of resources were identified as the largest. Other barriers identified in open-ended questions included fixed scheduling in the elementary schools, the emphasis on end-of-year testing, district policies that include the use of Internet filters and firewalls, a lack of technical support, a lack of collaborative planning time with teachers, and a lack of support within the library media community. Several of the participants indicated that their district had eliminated central office media staff, which meant a reduction in professional development for SLMSs.

Table 4. Barriers to Use of Technology in Instruction

Barrier	1 (most important) (Percent)	2 (Percent)	3 (Percent)	4 (Percent)	5 (Percent)	6 (least important) (Percent)
Lack of time	38.25	23.00	15.25	9.50	7.00	7.00

Lack of resources	29.97	23.17	18.64	14.36	9.57	4.28
Lack of knowledge about how to use technology myself	9.85	12.88	15.91	17.93	18.18	25.25
Lack of knowledge about how to use technology as an instructional tool	5.57	12.15	15.95	24.05	29.87	12.41
Lack of administrative support	6.35	11.68	10.41	20.05	18.27	33.25
Lack of teacher interest	10.97	17.60	23.98	13.27	16.35	17.86

Participants reported that they felt that the least important barriers were a "lack of knowledge about how to use technology myself," a "lack of knowledge about how to use technology as an instructional tool," and a "lack of administrative support."

Discussion

Several key themes of interest emerged from the data analysis. Each will be discussed below.

Participant's Age

The largest percent (51.21 percent) of survey participants was fifty years of age or older. Another 23.91 percent reported an age of forty to forty-nine. Prensky (2002) refers to people in this age group as "Digital Immigrants." According to Prensky, while Digital Immigrants may use technology, they use it differently. For example, they turn to the Internet second rather than first for information, they print out their e-mail to read it, or they bring people into their office to show them interesting websites rather than just sending them the URLs. They also learn to use it differently. Rather than assuming that the program or technology itself will teach them to use it, they want to be taught step-by-step, one thing at a time. The majority of the participants in the study seem to be Digital Immigrants—they report competency with more traditional technologies, unfamiliarity with emergent technologies, and a preference for workshops or working with colleagues to learning technology by themselves. If the general population of SLMSs falls into this age range (forty years old or older), consideration of instructional models that best meet their technology learning needs is critical in designing professional development opportunities, especially if we expect SLMSs to take a lead in integrating technology across the curriculum.

Disconnect between Perception of Preparedness and Perceived ICT Competency

Despite findings of overall low perceptions of their own ICT competency, especially with emergent technologies, when questioned about their preparedness to integrate technology into their instruction, 34.84 percent of the respondents indicated that they felt "well prepared," and 57.52 percent reported feeling "somewhat prepared." Only 7.64 percent believed they were "not prepared at all." Additionally, they did not seem to view a lack of knowledge about how to use technology as an important barrier to their ability to integrate technology into their instruction. Preservice SLMSs reported similar feelings of preparedness despite self-reported low levels of ICT competency (Hanson-Baldauf and Hughes-Hassell 2009).

There are several possible explanations for these contradictions. Perhaps their vision of technology use and integration is limited by what they have observed in the schools in which they currently are employed. If they have primarily seen technology use confined to computer labs, drills and practice, tutorials, writing, and electronic presentations—which is common in many K–12 schools (Hare, Howard, and Pope 2002; Shi and Bichelmeyer 2007)—it follows that they would *feel* prepared to use it in their instruction. These are the technology tools and applications with which they reported the highest levels of competency. These are also the tools and applications that do not require them to contend with school district firewalls, Internet filters, and school district policies, which prevent the use of many Web 2.0 technologies.

On the other hand, perhaps their feelings of preparedness reflect a feeling of empowerment and self-efficacy as well as a sense of responsibility for their own learning. When asked how they prefer to learn to use technology tools and applications, 41 percent chose methods that indicate that they are self-motivated ("teach myself," "learn from a colleague," and "complete an online tutorial"). This was particularly true for the younger participants. Additionally, in open-ended responses, a number of them indicated that they were willing to learn technology on their own time, but that what they needed to make integration successful was time to collaborate and technical support to handle problems. There is substantial evidence to suggest that teacher's beliefs in their capacity to work effectively with technology—that is, their self-efficacy for technology integration—may be a significant factor in determining how they use computers for instructional purposes (Ertmer, Newby, and Wang 2004; Oliver and Shapiro 1993). Further investigations in this area are needed.

The Evolutionary Process of Technology Integration

The Apple Classrooms of Tomorrow (ACOT) project found that teachers who work to integrate technology into their classroom instruction move through a five-stage process of instructional evolution:

- Entry—teachers are learning the basics of using technology
- Adoption—teachers are exploring technology and investigating how to integrate it into their daily instructional plans
- Adaptation—teachers are integrating technology into traditional classroom practice
- Appropriation—teachers understand technology and are using it effortlessly as a tool to accomplish real work
- Invention—teachers are experimenting with new instructional patterns and ways of relating to students and to other teachers. (Sandholtz, Ringstaff, and Dwyer 1997)

The majority of the survey participants seem to be at the adaption or appropriation stage with more traditional technology tools, such as PowerPoint and digital cameras, but are still at the entry stage in their familiarity and competency with emergent Web 2.0 technologies. To move beyond this stage, they need opportunities to explore, reflect, collaborate with peers, work on authentic learning tasks, and engage in hands-on, active learning (Sandholtz 2001). Process-oriented professional development models have been found to be particularly effective. These models include: (1) awareness of what technology can offer, (2) opportunities to explore technology integration, (3) time to learn technology, (4) application of technology to teaching, (5) reflection on teaching, and (6) access to the human and physical resources needed to support technology use and sustained learning (Howland and Wedman 2004).

Factors Inhibiting the Use of Technology

Despite the support for instructional technology demonstrated in North Carolina by the Board of Education and the Department of Public Instruction, many of the barriers identified by previous studies (Cuban 2001; Ertmer 1999; Hew and Brush 2007; NEA 2008) continue to affect the use and integration of computers by SLMSs in the state.

A Lack of Time and Resources

A lack of time and a lack of resources were identified as the toughest barriers to technology integration. The lack of time ranged from time to learn and experiment with new technologies to time to plan. The lack of resources included a lack of personnel and technology. Comments included the following:

> Time is the biggest issue. With no assistant, and a fixed schedule for 50 percent of the week, I do not have enough time during the business week to do adequate planning and collaboration. I am willing to learn to use technology on my own time, but working with others to develop lesson plans needs to happen during the business day.
>
> We lack technical support and my knowledge is not always sufficient to problem solve when the technology doesn't work.
>
> Our school system is still having a hard time acquiring basic computers. Approximately 50 percent of our workstations are ten years old. Optional hardware and software is hard to come by when there are more pressing needs.

It seems that, despite the policy and financial support provided for educational technology by the North Carolina Department of Education, disparities still remain. An NEA (2008) study found similar concerns in their national survey. Teachers reported that the number of computers was not adequate to use them effectively for classroom instruction, technical assistance was unreliable, and time to plan was limited. This was especially true for teachers who taught in rural and urban communities. The NEA report pointed out that "for technology to become a reliable tool for teaching and learning, and to integrate technology fully into the instructional process, educators and students must have adequate access to computers" and technical assistance and support in using the equipment and software (12).

A Lack of Adequate Technology Infrastructure

Connectivity and bandwidth issues were identified by a number of survey respondents as critical barriers. One participant noted that "poor infrastructure at my school is a problem and

experiencing technical difficulties, like the server going down. I learn something new then the parts that need to work won't. So why bother? My teachers are frustrated, too."

Again, this finding is consistent with recent national data. Although by 2005 almost all (93.6 percent) public schools in the United States had an Internet connection specifically for instructional use (NCES 2007), Hinson, LaPrairie, and Heroman (2006) note that, with closer inspection of individual schools, the likelihood of reliable Internet access is much less.This is especially true since the decline of E-Rate funding began in 2003 (Wells and Lewis 2006).

A lack of technology infrastructure and technical support have been found not only to contribute directly to nonuse, but also to negatively affect the retention of knowledge gained from professional development. Hinson, LaPraire, and Heroman (2006) found, for example, that these two barriers negated most of the training teachers had received during summer workshops.

Restrictive School District Policies and Procedures

School district policies and procedures were also cited as key barriers, especially to the use of Web 2.0 technologies. One respondent explained, "Our district filter blocks blogs, wikis, chats, social bookmarking, podcasts, etc. Some links sent to me from NCSLMA and the Department of Public Instruction are even blocked when I try to access them."

It is not unusual for school districts to restrict the use of social-networking tools. A National School Boards Association study (2007) found that fewer than 29 percent of school districts believe social networking can help their students improve their reading or writing, and that almost every school district restricts student Internet access. Of the 250 school districts surveyed,

- 84 percent had rules against online chatting in school;
- 81 percent had rules against instant messaging in school;
- 62 percent prohibited blogging or participating in online discussion boards at school;
- 60 percent prohibited sending and receiving e-mail in school; and
- 52 percent prohibited any social networking sites in school.

Stephens reminds us that "new resources demand new . . . policies" (2007, 70). Safety policies remain important, but teaching students about online safety and responsible online expression while they are using social-networking tools may be more effective in protecting them.

A Lack of Professional Development

Despite research that shows professional development is critical to technology use and integration by teachers, not all of the participants in our study reported that their school districts provided technology-related professional development opportunities. Only 69.86 percent reported receiving professional development on how to use new technology tools and applications, while only 55.34 percent reported receiving professional development on integrating these tools into their instruction. It appears that, while many professional associations, such as AASL, NCSLMA, and the North Carolina Department of Public Instruction, have incorporated Web 2.0 technologies into their professional development opportunities (i.e., conferences, journals, and online courses), many school districts have not made the transition. Or, if they have, perhaps they are not making these professional development opportunities readily available to SLMSs.

Factors Facilitating the Use of Technology in Instruction

It is important to note that the SLMSs did not perceive a lack of administrative support or a lack of teacher interest as significant barriers to the use of technology in their instruction. This finding is consistent with Shi and Bichelmeyer's study (2007) of teachers' experiences with computers. Unlike other researchers who found that inadequate administrative support and teachers' beliefs remain barriers to technology use (Hew and Brush, 2007), Shi and Bichelmeyer found that the teachers and administrators they studied perceived computers to be important tools of the educational process and wanted to learn how to fully integrate them into their daily activities. This represents an important milestone for SLMSs who want to take a leadership role in the integration of technology into instruction. Rather than having to spend their time convincing teachers and administrators of the efficacy of technology, they can concentrate on working with teachers and administrators to increase their ICT literacy, develop strategies to more effectively incorporate Web 2.0 technologies into their instruction, and overcome the barriers that are preventing them from using technology effectively.

The SLMSs' feelings of preparedness to integrate technology into their teaching and learning, as discussed above, can also be seen as a facilitating factor, especially if these feelings reflect a feeling of empowerment, self-efficacy, and responsibility for their own learning. While clearly their knowledge of Web 2.0 technologies needs improving, the SLMSs who completed the survey seem ready to increase their ICT literacy, even on their own time.

Implications for Practice

The need for SLMSs to take a leadership role in technology integration is real. Only one-third of the survey participants worked in schools that employed instructional technology facilitators. But what might that role look like? From the results of this survey a number of possibilities emerge.

First, competency with the technologies is critical; however, not all technologies are appropriate for meeting the needs of students in a particular school. Cuban (1986) pointed out more than two decades ago that, unlike instructional technologists, who are interested in the integration of technology into classrooms for technology's sake, educators are interested in making sure the needs of their students are met and judge the value of any technology by its ability to facilitate student learning. As technology leaders, SLMSs can collaborate with teachers to identify their real instructional problems and authentic needs and to identify the specific technologies that will foster learning and achievement. They can then work with school district–level personnel, school administrators, and teachers to design professional development opportunities that target a subset of technologies.

Second, SLMSs can provide leadership in overcoming many of the barriers that are frustrating educators, including a lack of resources, technical support, and time, as well as inadequate infrastructure and restrictive school district policies and procedures.

To overcome the lack of resources barrier, SLMSs might encourage administrators to explore the use of thin-client computers to create a hybrid technology setup similar to the VCL initiative at NC State (Young 2008), to invest in mobile laptop carts that can be brought to the classroom or used in the library on an as-needed basis, or to explore the use of wireless technologies that are not bound by school infrastructures. All have been shown to increase access and the degree of technology integration (Hew and Brush 2007; Hoffman 2007; Russell, Bebell, and Higgins 2004). Working with teachers to introduce technology into one or two subjects at a time, rather

than trying to integrate it across all subject areas at once, might also ensure that the teachers and students have adequate technology and training to use the technology (Hew and Brush 2007; Tearle 2004). Finally, SLMSs might agree to pilot the use of the $200 XO laptops available through the nonprofit One Laptop Per Child initiative.

To overcome the lack of technical support, SLMSs might consider training students to handle simple hardware and software problems. Lim et al. (2003) found that using student helpers is an effective way to increase the time educators have to focus on conducting and managing instructional activities involving the use of technology.

To overcome the barrier of time, it is important for SLMSs to continue to advocate for collaborative planning with classroom teachers. Research in technology integration has shown that, when teachers plan collaboratively, they are better able to produce technology-integrated lessons and materials (Hew and Brush 2007; Lim and Khine 2006). The IMPACT model and the accompanying professional development resources not only provide guidelines for creating collaborative planning times but also offer suggestions for how administrators can rethink school budgets and schedules to make planning time a reality.

Second-order barriers, such as inadequate technology infrastructures and restrictive school district policies, are more difficult to address or change (Ertmer 1999); however, they too offer SLMSs the opportunity to act as agents of change. There are a number of proactive steps SLMSs can take.

- Become informed. Look for and talk with other school districts of similar size and economic conditions that have successfully tackled connectivity and policy issues.
- Assume an active role on district-level technology committees. Encourage the prioritization of exploring bandwidth consumption within schools to better determine ideal capacity. Advocate developing a district-wide action plan to address inadequate bandwidth issues.
- Seek out grant funding opportunities to assist in the cost of updating infrastructures and systems.
- Garner support by educating administrators, teachers, parents, and the community about the value and potential of Web 2.0 technology and the need for reliable Internet access.
- Work with school district IT personnel, including network administrators, to discuss concerns about security, privacy, and safety, and to develop policies and procedures that allow greater online access.
- Revise the school district's acceptable use policy to include Web 2.0 technologies.
- Educate teachers, administrators, parents, and the community on the critical issues surrounding Internet safety.
- Teach students to be safe and ethical users of information.

Conclusions

As the school library profession continues to advocate for SLMSs to take a leadership role in the integration of information and communication technologies in education, it is important for leaders in the profession to turn to educators in the field, as this study did, to learn about their experiences with technology and technology integration. While many of the findings of this study may not be new, they are nonetheless important because they reinforce the fact that, despite expenditures of more than $40 billion in K–12 education for infrastructure, professional

development, and technical support in the last decade (Dickard 2003), barriers still exist to technology integration in schools. This study shows that many SLMSs still face similar barriers faced by educators in the 1990s—a lack of resources, time, technical support, infrastructure, and professional development. Additionally, competence with technology continues to be challenging, not because SLMSs, teachers, and administrators do not recognize that computers are an important tool of the educational process, but because professional development remains inadequate. Leaders in the school library profession would do well to note this sameness. While encouraging, even expecting, building-level SLMSs to take on leadership roles in technology integration is appropriate, leaders in the field cannot overlook the need to continue to provide SLMSs with creative strategies for overcoming the barriers that are preventing their schools from using technology effectively and to work with education associations, nonprofit organizations, and parent groups to advocate at the state and national level to improve technology access and increase Internet access.

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