Information and Communication Technology

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:

- x Resources—a lack of technology, access to available technology, time, and technical support
- x 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
- x Institution—inadequate leadership, inflexible scheduling, and poor school planning
- x Attitudes and beliefs—teacher's beliefs about the value of technology and its relevance to teaching and learning
- x 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
- x 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 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 ut asnal(y)22(c)6(r)54 v̄y̆f um22(r)3(e)-6( )-2(m311(")]TJ1(n9-10(;)4 v)- Tc -1andrak-2/TT0.,ica204Tc -0EnDC Te[D 5ndrak-2/TT0.,i Ten Td r

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

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

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.

| Lack of resources | 29.97 | 23.17 | 18.64 | 14.36 | 9.57 | 4.28 |

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

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.

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.

Acknowledgements

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