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Technology-Mediated Critical Literacy in K-12 Contexts: Implications for 21st Century Teacher Education

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Introduction

One of the foremost challenges for contemporary educators is acquiring proficiency with instructional technology and the conceptual frameworks that support its meaningful integration into classroom practice (DeGennaro, 2008; Keeler, 2008; Schrum & Levin, 2009). Without the experience and expertise needed to effectively engage with technology, pre-service and practicing teachers, if they use technology at all, tend to use it in superficial, low-level ways (Doering & Veletsianos, 2008). The resultant absence of meaningful technology integration in classrooms has led to a deep disconnect between the current generation of students who have spent their formative years immersed in technology (*digital natives*), and their teachers (*digital immigrants*) whose experience with and knowledge of the digitized world may be underdeveloped (Prensky, 2001). The research presented here examines the instructional possibilities afforded by technology-mediated, critically oriented subject matter instruction, and how those possibilities aligned or collided with conventional paradigms of teaching within K-12 educational settings.

Multimodal Literacy Practices

The role of mass media, communication technologies, and popular culture in the lives of children and adolescents cannot be overstated. For digital natives, technology use is a naturalized and unthinking process that has always been part of their life experience. In non-formal, everyday environments young people constantly engage with a multiplicity of information and multimedia technologies to "process, interact and use information …[to] communicate in fundamentally different ways than any previous generation" (Jukes & Dosaj, 2006, ¶2). Yet the daily work of teachers and students in classrooms seldom includes youths' social practices and

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popular culture interests. This is not surprising, given that the onus for rendering them as feasable tools for instruction rests solely on teachers. This includes everything from aligning each tool with subject matter content to gauging whether or not the tool will stimulate student interest without becoming a distraction; from identifying the appropriate tool(s) for each learner in a roomful of students with diverse linguistic and ability levels, to maintaining order in the classroom. All this must happen, of course, at the same time that teachers are responsible for boosting test scores, covering massive amounts of information while adhering to a prescriptive curriculum, and contending with irate parents. Moreover, teachers usually begin teaching with what they already know or have learned through experience - with their own knowledge, which may or may not include technology - rather than the knowledge that students bring with them to school (Zull, 2002). As a result, children and adolescents sometimes experience a clash of cultures when they arrive at school, a milieu where popular culture is frequently dismissed as "mindless drivel" (Hagood, 2001, p. 254), and technology is often an add-on that is routinely misused, underused, or completely absent from classrooms (Cuban, 2001; Lankshear & Knobel, 2006). Time and again technology-related discussions center exclusively upon ways to keep students from using it during the school day, rather than on the potential of technology to motiviate learners and enhance instruction. Hence, the social practices students engage with in out-of-school spaces are frequently overlooked or discounted within educational settings because they are not considered relevant to the curriculum (Ajayi, 2009; Knobel & Lankshear, 2009). The resulting fracture between school life and children's everyday experiences can make classrooms seem like "places where one cannot engage in anything real or important" (Lewison, Leland &Harste, 2000, p. 14).

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Fortunately, there is growing recognition of the need to take seriously the literate practices of the "Millennial generation", those students who were born in or after the year 1982 (Oblinger, 2004; van Horn, 2006), and how those practices potentially connect with learners' academic lives (Alvermann, 2008; Dewey, 1902). Web-based learning, electronic communications, and a plurality of other digitally-mediated aspects of life that were once largely outside the realm of education are increasingly being incorporated into it (Black, 2009; Knobel & Lankshear, 2009). To date, however, there is limited professional literature focused on how the technologized social practices of digital natives can be used to scaffold their academic learning (Black, 2009; Knoester, 2009; Marsh, 2006).

Review of Literature and Conceptual Framework

Sociocultural theory (Vygotsky, 1978; Wertsch, 1998) underpinned this study and provided a lens for analyzing the data. Critical multimedia studies (Alvermann, Moon, & Hagood, 1999; Lemke, 2006) and critical pedagogy (Freire, 1993) shaped the research questions and the instructional approaches utilized by the participants in this investigation. Critical theory asserts that power relations are socially and historically constructed, and that in every social context there are certain groups who are privileged over others. Central to the notion of critical pedagogy is the development of critical consciousness: an awareness of how socially and culturally constructed discourses and practices empower or disenfrachise individuals or groups (Freire; Wink, 2004). Critical literacy is a form of emancipatory education intended to help learners develop a sense of agency and empowerment through the recognition that messages produce, reproduce, and/or intensify social inequities (Marsh, 2006; Young, 2001). McDaniel (2004) and Comber (2001) have pointed out that critical literacy theory is an overall philosophy

and attitude, rather than a set of methods and techniques. Shannon (1995) describes critical literacy this way:

> Critical perspectives push the definition of literacy beyond traditional decoding or encoding of words in order to reproduce the meaning of text or society until it becomes a means for understanding one's own history and culture, to recognize connections between one's life and the social structure, to believe that change in one's life, and the lives of others and society are possible as well as desirable, and to act on this new knowledge in order to foster equal and just participation in all the decisions that affect and control our lives (p. 83).

In other words, development of a critical perspective entails learning to read the world by enacting the "knowledge, skills, and values needed to negotiate and transform the world" (Giroux, 1993, p. 376). Becoming critically literate involves the analytical and skills-based competencies needed for active participation in a democratic, participatory culture (Hobbs, 2007).

Sociocultural conceptions of literacy espouse that meaningful learning is tightly interwoven with the everyday experiences of learners' as they engage in social, civic, and economic life (Freire, 1993; Tisdell, 2008). These practices and processes are contextual and intertextual in nature. That is, they form the basis for understanding and making meaning not only from words on a page, but also through learners' perceptions of and interactions with the world. From a sociocultural standpoint, literate processes involve the traditionally recognized skills associated with reading, writing, and speaking, but they also include broader forms of knowledge construction that emerge during social interactions (Gee, 1996, 2003). In other words, social practices, which are mediated by actions, objects, tools, ideas, values, and spaces, are in

fact literate practices (Gee, 2003). Researchers in the fields of new literacies, multiliteracies, and critical literacy (Alvermann, 2008; Knobel & Lankshear, 2008) seek to understand the interrelations between literacy, technology-mediated social practices, and inquiry-oriented learning.

Miller (2007) examined the use of multimodal literate practices for English education, drawing on data from a digital-video composing project with secondary English classroom teachers. According to Miller, awareness and engagement with multiple media are essential components for preparing learners to locate, filter, and produce media. Similarly, in her work with online fan-fiction spaces, Black (2009) found that 21st-century skills, including technological proficiency and semiotic forms of communication (van Leeuwen, 2005) were crucial to understanding how technology can inform teaching. Studies such as these point, at the most basic level, to the recognition that the 21st century world is media saturated, technologically dependent, and globally connected (National Council for the Social Studies, 2009). Life in the multimedia age demands the development of the skills needed to access, analyze, manipulate, and distribute messages and information.

The current research draws from the framework of Technological Pedagogical Content Knowledge (TPACK), which refers to understanding and negotiating the relationships between technology, pedagogy, and subject matter (Mishra & Koehler, 2006). TPACK is concerned with "representation and formulation of concepts, pedagogical techniques, knowledge of what makes concepts difficult or easy to learn … [and] how subject matter is transformed by the application of technology" (Mishra & Koehler, p. 134). For this study, TPACK was the unifying strand for weaving together the conceptual frameworks of technology integration, critical literacy, and engaged, meaningful learning. TPACK has been used as a framework to examine how social

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studies teachers' pedagogical aims influenced their choices of technology. Hammond and Manfra looked at connections between classroom instruction and research on effective uses of educational technology. Like researchers before them (Shulman, 1987; Thornton, 2001), Hammond and Manfra found that pedagogy, as opposed to technology or content, most heavily influenced teachers' classroom practices. While not new, the relevance of critical analysis, media literacy, and TPACK for content learning in general and literacy education in particular is more salient than ever (O'Brien & Scharber, 2008).

The research presented here is an initial exploration of the complex manner in which critical theory, technology integration, and content area instruction complemented, constrained, and sometimes conflicted with each other (Harris, Mishra & Koehler, 2009) in K-12 settings. This qualitative study adds to the small field of socioculturally-situated research examining the appropriation or rejection of technology-supported critical analytical frameworks by pre-credentialed and in-service teachers. The following research questions guided this study:

1. What epistemological and practical opportunities and challenges did the participants encounter in their attempts to integrate critical literacy and technology-enhanced instruction into classroom teaching?

2. What local, institutional, and larger sociopolitical influences shaped teachers' decisions to take up, modify, or reject technology-supported critical frameworks?

3. How might teacher educators assist pre-service and practicing teachers in carving out pedagogical space for the meaningful integration of technology and critical practice within the constraints of a standards-driven curriculum?

Several dimensions of participants' efforts to incorporate technology and critical practice into their instruction are portrayed in the four selected vignettes that follow. The first vignette

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describes an activity by a participant who used instructional technology with her middle school students but failed to reap the results she was hoping for. The second and third vignettes describe circumstances where the participants made conscious decisions to avoid critical approaches to their instruction. In the fourth vignette, technology and critical literacy were logically and coherently integrated into content teaching, resulting in benefits for the teacher as well as for the students. Instructional implications and limitations are discussed next, followed by recommendations for teachers and teacher educators.

Method

Research Design

This case study (Yin, 2004) is a phenomenological exploration of pre-service and practicing teachers' attitudes, beliefs, and experiences as they endeavored to integrate technology and critical literacy into their instruction. Phenomenology emphasizes discourse and interaction in context in order to understand the social practices of a particular group from their point of view (Moustakas, 1994; van Manen, 1999). Because phenomenology is predicated upon the assumption that research and practice are intertwined rather than separate activities, sociocultural scientists and critical theorists consider it a valuable tool for conducting human science inquiry (Cresswell, 1998; Willis, 2007).

Setting and Participants

The graduate-level instructional technology course framing this study was a requirement for pre-service and practicing K-12 teachers seeking either a master's degree with licensure or certification in their teaching field. It was designed to familiarize teachers with an array of digital tools and new media practices for supporting and extending their classroom instruction. The class focused on cultivating generative, discursive spaces for the participants to examine their

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own praxis, and the larger apparatus of education, through a digitally-mediated critical lens. The researcher was the instructor for the course. Participants were 27 preservice and in-service elementary and secondary teachers enrolled at a large, urban university in the southwestern United States. The class was comprised of 19 females (70%) and eight (30%) males. Fourteen participants were full-time teachers, and thirteen were student teachers. The mean age of the participants was 24.3 years, with an average of 3.5 years of teaching experience. Participation in the study was voluntary. All names used here are research pseudonyms.

Data collection and analysis

Data sources included field notes, transcribed recordings of participants' conversations, and artifacts created by the participants as part of their coursework. Data were also collected from an archive of online, asynchronous discussions using Web CT course management software. In addition, the participants and some of their students kept reflective journals, which they shared in online and face-to-face discussions. The researcher kept a detailed journal to record and contextualize the events of each class session and to reflect on questions, concerns, and issues that emerged during discussions. Researcher notes included talk and/or action by the researcher and participants, methodological notes, theoretical notes, and personal reflections (Spradley, 1980).

Discourses and artifacts from these multiple sources were examined, re-examined, and compared for patterns and themes (Erickson, 1986; Spradley, 1980) using three analytic tools: content analysis (Silverman, 2001), positioning theory (Harre & Moghaddam, 2003), and critical discourse analysis (Gee, 1996; Fairclough, 1995). Data analysis included consideration of what was said, what was not said, how it was said, who said it, and in what context. The researcher scrutinized the data carefully several times before inductively coding initial themes related to the

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research questions. Subsequent readings of the data served to refine the coding categories to more precisely reflect the perspectives of the participants (Stake, 2000). To establish interrater reliability, two other qualified researchers who were familiar with the study also read the data; they and the researcher met on several occasions to negotiate 100% coding agreement (Merriam, 1998). To further enhance reliability the data were triangulated across sources using the constant comparative method (Cresswell & Miller, 2001). Member checks were conducted with several participants to clarify and correct, if necessary, interpretations of data patterns and themes (Yin, 2004). Member checking, sometimes referred to as respondent validation (Silverman, 2001) is a mechanism for enhancing the reliability of qualitative research (Erickson, 1986). Excerpts from journal entries, transcribed audio recordings, classroom conversations, and online discussions are included in what follows to trace the shifting perspectives of the participants and to support interpretations of the data.

Procedure

The aim of this research was to describe, through contextualized, thick-rich descriptions (Merriam, 1998), the participants' attitudes, beliefs, and experiences as they integrated technology and critical literacy into classroom instruction. As part of their coursework, the participants designed three original, comprehensive lesson plans. They had autonomy regarding the length and sophistication of each lesson, and in deciding whether the lessons connected to or built upon one another. Other coursework included digital video production, creation of stop-motion animation sequences, participation in online social networking spaces (e.g., Facebook, MySpace), and critical analysis of film, television, and educational videos on You Tube and Teacher Tube.

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The participants had little to no experience with the processes involved in deciding whether and how to utilize digital media and critical practice in the classroom. Thus, the course began with the participants reading a selection of contemporary articles (Bean & Moni, 2003; Cadiero-Kaplan, 2002; Hagood, 2002; Lesley, 2004/2005; Lewison, Flint, & Van Sluys, 2002; Stevens, 2001) focused on merging new media and critical perspectives into curricular practice. Initially the teachers deconstructed texts from popular media such as *Vanity Fair* and *People* magazines, music by artists such as U2, Kanye West, and Ludacris, and television programs such as *The Simpsons*, *American Idol* and *The Daily Show with Jon Stewart.* One important objective of the class was to ensure that the participants acquired the necessary skills to analyze texts and discourses, while simultaneously attending to how meaning is constructed through participation in reading, listening to, or viewing them (C. Luke, 2000; Myers & Beach, 2004).

Results and Analysis

Vignette One: A Missed Opportunity

Effectively integrating technology and critical approaches into standards-driven curricula proved to be a delicate balancing act, one that posed substantial challenges for the participants. A case in point was the first lesson created by Laura, a middle school language arts teacher who was beginning her first semester of student teaching. Laura's lesson centered on a Powerpoint presentation she created chronicling the life and career of the American pop icon/entertainer Jessica Simpson. The slide show included narration and photographs of Simpson, juxtaposed with outtakes of songs recorded by her and links to her online fan site. In the lesson Laura described how Ms. Simpson had struggled, persevered, and ultimately transcended obstacles to her success and happiness. The stated objective of the lesson was to launch a writing activity wherein students would identify three personal goals for themselves. After sharing the slide show

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with her students, Laura asked each of them to jot down one short-term, one five-year, and one lifetime goal. Afterward, in small groups, students were asked share their goals and to brainstorm about potential obstacles to achieving the goals and to consider possible ways of overcoming those obstacles. Responses from her students varied. Laura indicated that in some cases she was disappointed with the lack of depth and specificity in the students' writing. She noted:

> "I had fun creating this lesson, but … it didn't go very well. One negative comment [by a student about Simpson] and they started rolling their eyes … it was awkward and kinda weird…I guess they thought it was boring".

Laura noticed that some students used the entire half hour to simply list a few, non-specific goals, such as: "I just wanna get through today" and " My goal is lipgloss, lipgloss, lipgloss". In discussions with her peer group Laura was asked why she had not included a critical component in her lesson. She explained:

> You know, I wanted to use the Internet and popular culture … but all this stuff about war and starvation and racism, God, it's just so depressing. I wanted to it [technology] to make my students happy so they want to learn. If you use it to point out all that bad stuff it's just too depressing. Jess's life is a success story … and that's really the key… if we just focus on the hurt, the bias, and discrimination in society, that can be a real turn-off … besides, I wanted it [the lesson] to be simple and not so confusing.

Laura's remarks suggested an eagerness to engage her students in the writing process using a role model that, from her perspective, would inspire them to set goals. This was Laura's first lesson plan for the class, however, and her remarks indicated a limited understanding of critical pedagogy. Laura declined to adopt or have her students take up a critical questioning stance because at this point her understanding of critical pedagogy focused exclusively on the language

of critique, which, while an important consideration, was incomplete. According to Macedo (2006), "the discourse of democracy also needs a language of possibility, one that combines a strategy of opposition with a strategy for constructing a new social order" (p. 31). In addition to raising awareness of how people are positioned by structures of power, critical theory's concern with the social construction of experience makes it the "discourse of possibility" (Kincheloe & McLaren, 1994, p. 139) by giving voice to those who have traditionally been silenced, marginalized, or disempowered. The aim of critical pedagogy is to promote personal agency and democratic possibility within social contexts (Bean & Harper, 2008; Cochran-Smith, 2004; Freire, 1993). As Furness (2007) explained "the problem is that many educators feel as if the only way to empower students is to overwhelm them with information and statistics about … insumountable problems … without adequately discussing the ways in which people either challenge … power or create alternatives to it" (p. 188).

Laura's Powerpoint lesson failed to resonate with her students for several reasons. First, the lesson overlooked the matter of their teacher's positioning of Ms. Simpson, a member of the dominant culture, as the focal point of a goal-setting activity. This was a puzzling finding considering that a central tenet of the course was to design instruction specifically attending to issues of learner autonomy and the balance of power in the classroom. According to Laura, most of her middle school students were Latino/a or African American. Unaware of her own privileged status compared to her students, it hadn't occurred to Laura at the time to adjust the lesson to include suggestions for potential role models from her students.

Furthermore, to stimulate literate activity on the part of students a writing assignment must include some means for students to construct their own knowledge (Shor, 1986). This stands in sharp contrast to Laura's lesson, where students were given little room for the

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development of personal agency or to access or construct their own knowledge. Laura's activity essentially disempowered students because it failed to consider any potential contributions they might have made to it. Instead, the lesson hewed closely to the contours of traditional banking conceptualizations of education (Freire, 1993) characterized by the one-way transmission of ideas and information from teacher to passive audience.

Vignette Two: In-School versus Out-of- School Texts

The participants drew upon popular culture to learn about their students' lives, cultures, and everyday out-of-school experiences. Karina, a secondary social studies teacher explained, "they [students] couldn't believe they got to go home and watch TV for homework, they thought that was very cool … and they really did pick out some of the stereotypes, especially in the commercials on Comedy Central … like the beer ads". Roger, a secondary English teacher added, "some of them watched cartoons … like *Southpark* and *The Simpsons*. They noticed that shows they watched often referred to other television programs like *The Colbert Report* … and that the programs had all sorts of references to things like texting and Facebook". Through popular culture, students' everyday literacies and experiences were brought into the classroom, critically examined, and used to spur meaningful, culturally responsive learning. Yet not all of the participants were convinced that a critical questioning stance was applicable to all curricular topics and materials. Entries in their journals and online discussions indicated that 23 of the 27 participants (85%) considered the prospect of interrogating canonical texts such as basal readers, textbooks, reading software, and classical children's literature to be problematic. They enthusiastically engaged with their students in analyzing out-of-school discourses such as comic strips, television commercials and music videos. However, they had misgivings about subjecting standardized curricular materials to the same critical scrutiny (Fecho, 2000). This was not

surprising given that school-sanctioned texts are at the heart of traditional classroom instruction, with teachers generally guiding students in decoding and comprehending texts as opposed to critiquing them (Stevens, 2002). As several teachers pointed out on the online Web-CT discussion board: "I mean, how are we supposed to critique these [books]? It's not like we have any choice over the books we use for teaching or the books in the library. We're a Title I school, so we have to use the books. It doesn't make sense to do this [critiquing activity], just to get [ourselves] all upset about it". Another teacher added, "it's unnerving … it's like digging up trouble … maybe it's better to leave it alone. What happens if the parents complain? I'm new at my school and I don't want to start off on the wrong foot with the kids and parents". A third participant expressed concern that "this seems dangerous … besides, it might end up just being a big distraction. An experienced teacher responded with "I see why we're supposed to do this, but … in some ways it seems like a fool's errand …the incentive just isn't there to look at the books in our [classrooms] the same way we did TV".

The participants' discourse depicted mixed feelings about how or whether to enact the critical practices they were learning about. In particular, they were uncomfortable with taking up a critical stance if doing so seemed likely to conflict with the established curricula, especially scripted reading programs. As one student teacher pointed out, "there's no support for that. It's not considered evidence-based teaching. We'd be on our own with this … and I'm not ready to be on my own".

Understandably, the prospect of interrogating canonical texts held little appeal for the participants. As Marie, a secondary language arts teacher explained, " … that is all well and fine, but in the end, we are evaluated by the principal … and judged on our kids' test scores, not on how emancipating our curriculum is". Throughout the semester the participants returned to the

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thorny issue of enacting instructional practices that potentially ran counter to the prescribed curriculum or challenged the dominant political and ideological constructs in place at their schools. At times, it was clear that asymmetrical distributions of power at their schools influenced their willingness to conceptualize their teaching through the lens of critical practice (Bullough & Draper, 2004; Foucault, 1977). Most of the teachers adopted a submissive posture towards powerful sociopolitical influences even before they had become full-time teachers. In particular, the student teachers reported feeling reluctant to challenge the status quo because they were on placement, apprenticing under more experienced teachers. One participant remarked, "we expect the kids to have some attitude because the [reading] programs are kind of dry… but for us [teachers] to do this … to dissect them or hold a magnifying glass up to them might be seen as being out of bounds, you know, a little too in-your-face".

Vignette Three: Teacher Responses to Games for Learning

Seeking to learn more about their students' out-of-school lives in order to design relevant, motivating instruction for them (Alvermann, 2002) the participants asked their students to list the media they generally spent the most time with. Television, the Internet, cell phone use (particularly texting), and computer gaming consistently topped the students' lists. There was evidence that all 27 participants had incorporated critical analysis of the first three of these activities into their instruction. They displayed considerably less enthusiasm, however, toward the idea of scrutinizing video games. There were several instances where the participants expressed concern about feeling unqualified to critique the discourses, narratives, or representations within the games. As Susan, a fourth-grade reading teacher, explained,

> I don't know how to use one of those things [game controllers]. I don't even know how to hold it. My son has one, but I'd feel silly asking him how to play

> a game. I limit his computer time to an hour a day, but to be honest I don't even know what the games are about, or why he's so into them. It seems like a lot of noise and repetition to me … but he really likes the [car] racing games. It seems like he'd get bored with that, but so far he hasn't lost interest. That's what he always asks for at Christmas – another one [video game].

Marie, also a reading teacher, added "Yeah, I mean, I'm supposed to be the teacher. …what if the whole thing spins out of control? … how will we even know if they did the assignment right if we don't know anything about the games they're playing? We can't evaluate that because we don't have enough information". A first-semester student teacher offered, "… there's no way this would fly at our school … (laughs) ... we might as well ask for cotton candy while we're at it … they [school administration] wouldn't take us seriously". Seth, an experienced teacher who taught ninth grade algebra, felt somewhat comfortable playing video games, but he remained skeptical about asking his students to critically analyze them. He explained

> I grew up with Game Boy and some video games. But not like it is now … kids spend hours and hours playing these games with lots of different players fighting these huge battles that go on and on for days and weeks … and that sort of thing. I'm not familiar with those games, and I don't have time to learn … I do know that they [students] would definitely watch to see if I know what I'm talking about … and of course, I wouldn't [know], and they'd know that.

The participants readily acknowledged the centrality of games in their students' lives (Unger & Kingsley, 2006, 2007), but it was clear from their responses that several of them were uncomfortable with video games because they felt they lacked the credentials to critically examine the content of and procedures intrinsic to playing the

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games. Although they had read articles and discussed how digital games might be used to support content area instruction (Squire & Jenkins, 2003; Oblinger, 2004), many of the participants regarded games for teaching as potentially too difficult to manage (Alvarado, 2008). In one form or another, 25 of the 27 participants (93%) indicated that they believed they lacked the knowledge or skills to critique, or to have students critique video games. As Renee, a student teacher working in a fourth grade classroom stated, "There's already too much to cover, and we're testing [school-wide standardized tests] in a couple of weeks. I'm not writing off games completely here, but at this point there's no time to add them to the picture. I'm not sure it's worth all that effort. Technology should make teaching easier, not more complicated".

It is important to note that expertise with digital games is not a precondition for viewing them from a critical standpoint. Proficiency with game play may be useful, but a lack of experience with electronic games does not preclude the critical examination of themes embedded in a game's narrative. While it is true that many commercially produced games contain racist, misogynist, violent, vulgar, or other objectionable content, the last decade has seen a proliferation of digital games and simulations specifically designed for teaching, for therapeutic purposes, and for increasing social awareness (Hamlen, 2009; Hutchison, 2007; Michael & Chen, 2006). Recent research on the use of epistemic games for education has shown that through game play, learners engage in immersive, real-world related processes, such as working and thinking like innovative professionals in the workplace (Nodoushan, 2009). A serious game is defined as "a game in which education (in its various forms) is the primary goal, rather than entertainment (Michael & Chen, p. 17) and "use[s] the artistic medium of games to deliver a message, teach a lesson, or provide an experience" (Michael & Chen, p. 23). Of course, this does

not imply that learning and having fun are discrete, mutually exclusive activities. Rather, educationalists who are part of the Serious Games initiative seek to identify places where learning and enjoyment overlap, where each can use the tools of the other to achieve their goals (Abt, 1987; Beck & Wade, 2004; Gee, 2003).

The games-for-good movement is gaining traction, although a huge gap remains between the culture and ethos of contemporary mainstream education and young people's digitally-mediated experiences (Kingsley & Boone, 2008-2009; Rushkoff, 2006). More research is needed into the relationships between technology, popular culture, and academic learning (Alexander, 2008; Jolley, 2008). As Carol, a fifth grade teacher explained, "we have to reserve the [computer] lab months in advance … and then, sometimes it doesn't matter because we get kicked out [of the lab] anyway for testing or something or other. Besides you know you can't tell the lab guy and the instructional coach you need the lab so the students can play games".

Vignette Four: Technology and Critical Practice as Empowerment

In some cases the participants reported successful implementation of technology-supported instruction within a critical pedagogical framework. A case in point was Wayne, a participant who taught economics and business computing classes and served as faculty advisor for his high school's yearbook. Wayne's students designed projects that included a spreadsheet-driven budget and an accompanying report incorporating text, images, animation, sound and/or other media. Two of his eleventh grade students based their project on the MTV television show *Pimp My Ride* to plan how they wanted their car to be "pimped" (customized). They created a detailed budget for the customization features they wanted for a 1970 Chevrolet Nova, e.g., glitzy chrome rims, a television/stereo system, mp3 player, Internet access, video game console with plasma screen, a racing motor with a high-performance carburetor, sophisticated radar

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detection equipment, global positioning system, etc. The boys went online to research how people are selected to be on the show to have their car customized. The fact that they were not old enough at the time to be on the show (the age range being a very narrow 18-24 years) did not dampen their enthusiasm for the project. The boys journaled extensively about their dream car, cutting and pasting images from the Web and from car magazines to illustrate the features they were writing about. They even downloaded a sound clip from the Web of the noise they wanted the car's horn to make.

The boys made several astute observations in the process of analyzing themes represented in the program. They noted that cars are an important aspect of identity formation (Norton, 2000) as well as a means for expressing individuality. They pointed out that people drive cars for a variety of reasons: some want fuel economy or low carbon emissions, while others look for affordability or room for a family. Some crave speed, while still others insist on luxury or high safety ratings. Cars can be a status symbol, a way to attract women, or a mechanism for appearing dangerous. They also noticed that in the excitement over the countless accoutrements for automobiles featured on the program, it was easy to lose sight of the fundamental premise that cars are intended to transport people from one place to another. Furthermore, the boys pointed out that some of the customization features showcased on the program stretched beyond extravagant to the point of being absurd or even hazardous (e.g., a fountain in the back seat, a DVD player on the sun visor). They continued to dig deeper to uncover why the representations in the program were created, by whom, and what their intended effect was on audiences.

Wayne described watching *Pimp My Ride* for the first time after his students created their project, and how he had believed up to that point that "rappers and gang-bangers were the same thing. I mean, I thought if you were one, you were the other too … but my students informed me

that Xibit [the host of the show] is not a thug, he is a member of hip-hop culture … so I learned something. I enjoyed the program because I've always liked cars … and I think they [students] got a kick out of the idea of an old coot like me watching a show called *Pimp My Ride*. My wife thought that was really funny".

In this lesson Wayne's students assumed ownership of the meaning-making process because they had voice and choice in deciding which texts to create and analyze. Wayne recognized that in order for this to happen, a trade-off of sorts was necessary: in pursuit of the larger goal of allowing students to venture into and construct their own spaces for learning, he relinquished control over certain aspects of the lesson. While he was delighted by his students' projects, Wayne acknowledged that time and effort would be needed for him to retool his curriculum to integrate technology-mediated critical literacy activities. He added, "… boy, sometimes I wish I hadn't learned all this stuff … because now I have to redo it [the curriculum]. But the kids love it …and it's fun for me too".

Discussion

Technology and Media Literacy in Action

On a practical level, the participants' reluctance to take a critical stance toward canonical texts, as well as their skepticism of bringing popular culture into the classroom made sense. Overall, the participants were both optimistic and pragmatic about the process of acquiring new digital literacies and translating them into effective instruction. The participants expressed anxiety about encountering unexpected messages in literature and curricula that they might not intend to convey to their students, and they felt powerless to do anything about those messages if they were uncovered. They didn't want to cause trouble, as one teacher explained.

By definition, both technology integration and critical literacy involve movement away from familiar instructional approaches toward the less certain sphere of educational change (Lewison, Flint, & van Sluys, 2002). The participants were aware of this, and they were candid about their fears regarding technology use and critical pedagogical practice, activities they repeatedly described as potentially problematic and dangerous (Hagood, 2002). Further analysis of the data revealed an interesting pattern in the participants' discourse: potential peril or discomfort on the part of students with regard to either technology or critical pedagogy was apparently not an issue. All the fears and possible dangers expressed by the teachers were strictly teacher-oriented; that is, dangerous only for them.

In follow-up emails and conversations several participants were asked for their thoughts about the possibility of problems or negative consequences for their students learning to use technology and critical literacy. Typical responses included comments such as "the kids will be fine [with] whatever we do. Games, books, whatever. It's the parents and the principal that I worry about" or "They love this stuff. They have no fear" and "of course we care about the kids. But the problem is mainly for us because they know how to operate in that culture and how to behave in that context, and we don't". One teacher summed it up this way: "In the end, we're the ones who need help with this. We have to guide them … but the kids are alright".

Participants in this study were contending with institutional pressure to behave in certain ways: to maintain control of their classrooms, to implement a curriculum that reflected the interests of the dominant culture, to cultivate relationships with parents and school administrators, and to raise student scores on standardized tests. They reported feeling overwhelmed with trying to juggle this heterogeneous mixture of concerns, even without bringing technology and critical inquiry into the milieu. With little time to practice with

technology and criticality, the magnitude and immediacy of the participants' concerns related to curricula, parents, and administrators appears to have taken precedence all other considerations. As one participant explained, "It's not logical to try to do this right now. We've got to stick to the scope and sequence or we won't cover it all [subject matter]. And then they won't be ready for testing".

Othering of Popular Culture Texts

Researchers have consistently found that game play and other social practices that take place outside the realm of school are frequently "othered" (A. Luke, 2003; Scheurich, 1997) by teachers and "are therefore excluded as unthinkable" (Bourdieu, 1990, p. 54). At the same time, significant efforts are being made to tap learners' out-of-school funds of knowledge by connecting subject matter and classroom instruction to digital culture such as video sharing, text messaging, game play, and social networking (Black, 2009; Miller, 2007). Educators are continually exploring instructional models, subject matter, assessment practices, and pedagocial approaches that facilitate knowledge construction through technology-mediated communications (Alvermann, 2008; Lankshear & Knobel, 2006). But to date, these efforts have been piece-meal and underfunded. The historical inattention to critical literacy and technology within programs of teacher education has resulted in a disjuncture between teachers who have grown up and worked in a print-centric world, and learners who have never known a world without technology.

Possibilities for change

Clearly, teacher preparation programs must be reconceptualized and reformulated to reflect the increasing relevance of multimodal approaches to student learning, and to incorporate the corollary critical analytical skills needed to pose probing questions about the torrents of information students encounter on a daily basis. This represents a formidable challenge for

teacher educators because it will require large-scale, systemic change. If media literacy and critical literacy are to become integral aspects of teacher preparation, movement in two directions is needed: a horizontal expansion and a vertical deepening (Hobbs, 2007; National Council for the Social Studies, 2009, ¶ 10). The horizonal movement involves broadening the definition of what is considered school-appropriate text for analysis, to include multiple forms of information, including popular culture texts. Vertical movment is also needed to help pre-service and inservice teachers deepen their understanding of the inextricable links between information, knowledge, and power (¶ 10). In their Position Statement on Media Literacy (2009) the National Council for the Social Studies notes that although the US is the world's leading producer of media, it is far behind in teaching the skills needed for "accessing, analyzing, evaluating, creating, and distributing messages within a digital, global, and democratic society" (¶ 2).

Limitations and Future Research

This study has several limitations, including the small number of participants and the disparate levels of teaching experience among them. Some limitations relate to issues that, while important, were necessarily beyond the boundaries of this article and for that reason they are recommended as avenues for future research. First, detailed examination of the societal, institutional, and local nuances of every interaction and discursive exchange recorded throughout the course of this study would have been impossible. Data analyses were finite due to space limitations, leaving some aspects of the data to be analyzed at a later time. Moreover, because this study was an interpretive examination of situated texts and interactions (Fairclough, 1995) that were constructed and practiced by teachers in particular contexts (Gee, 1996), the results do not necessarily generalize to all similar settings. In the future, it might be worthwhile to solicit

students' responses to technology integration and critical literacy activities, and then juxtapose them with the perspectives of their teachers in the same classroom.

Another avenue for future research would be to explore ways that technology-enhanced principles of critical literacy directly align with recognized evidence-driven approaches to classroom instruction and assessment. Electronic texts offer new supports as well as new challenges for teachers, and officially sanctioned curricula aren't necessarily antithetical to critical practice, although the two are commonly viewed as disparate (Apple, 1998). If critical perspectives and technology are to be meaningfully integrated into instruction, more research is needed into ways for educators to effectively blend them into everyday teaching, as opposed to keeping them walled off and set apart from officially sanctioned forms of knowledge. A final area of potential research would be to turn a critical reflexive lens inward in order to examine whether, and to what extent, researchers' participation in studies of this sort might construct, change, reproduce, or disrupt the very processes being investigated (Rogers et al., 2005).

Implications and Conclusions

According to the 21st-century Workforce Commission (2000), "the current and future health of America's 21st century economy depends directly on how broadly and deeply Americans reach a new level of literacy – 21st-Century Literacy" (p. 4). In a world where information is the currency of power, proficiency with technology, as well as the competencies needed to seek out and critically evaluate information are indispensible tools (Kingsley & Kingsley, 2009; Palfrey & Gasser, 2008). Yet there is scant research focused specifically on the nexus of learners' technology-enhanced, multimodal literacy practices and K-12 instruction (Hagood, 2002; Knobel & Lankshear, 2009). In fact, Evans, Avery, and Pederson (1999) have

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suggested that "the closer to students' lives, the more meaningful [texts are], the more likely the topic is to be taboo" (p. 222).

Closing the Gap

Navigating the milieu of technology, popular culture, and critical practice within the constraints of today's culture of academic accountability can be a confusing, chaotic process yielding nebulous benefits. There are insights to be gleaned from the current study that may be helpful for educators endeavoring to integrate media-rich activities and critical frameworks into their existing curricula. The following recommendations are described from the perspective of a teacher educator; however content area teachers across disciplines and grade levels may also find them instructive.

First, it is important to understand that research in the fields of educational technology and critical pedagogy are still in their infancy. As such, both areas are essentially a patchwork of shifting actions that must be continually constructed, negotiated, and renegotiated across time, space, and context (Groenke, 2008). There is no specific step-by-step, one-size-fits-all formula for approaching either of them. McLaughlin and DeVood (2004) have pointed out that teachers do not just become critical. Rather, the acquisition of technology skills and the taking up of a critical stance unfold gradually in unpredictable ways through learning, unlearning, reflection, evaluation, and changing over time. Teachers can become overwhelmed by the complexities of trying to learn media literacy while at the same time trying to teach it in their classrooms.

Second, teachers need guidance in formulating critical approaches that will fit with the culture and context of their schools, while at the same time acknowledging content-related learning that takes place outside of school (Lewison, Flint, & van Sluys, 2002). Some questions teachers might consider asking about media representations include, but are not limited to: Who

is responsible for creating this message or media production? What ideologies are behind the production? What manifest messages are included in the presentation? What latent messages are embedded in this presentation? Who is the message intended for, and who stands to benefit from it? Who stands to be silenced, or even hurt by it? Who is missing from this media representation? How might an understanding of life be limited by this representation? Of course, asking these sorts of questions cannot ensure that teachers or students will automatically develop a critical understanding of their own life experiences. Nonetheless, such questions can provide space in the curriculum for critical discussions to emerge.

There are reputable, comprehensive Web sites, such as the Media Awareness Network, and the Media Education Foundation, as well as documentary films (see Trier, 2006) that can provide a quick but thorough overview of critical literacy using multiple media in educational contexts. The Partnership for 21st Century skills provides tools and research on how educators can integrate 21st century skills into the curriculum. In addition to providing interesting information on media awareness and 21st-century skills, the Web sites include study guides, online resources for educators and parents, and research bibliographies.

Rogers and colleagues (2005) have suggested that the extant research focused on multimodal, participatory texts within educational settings is underdeveloped. Nonetheless, digitally-mediated information and electronically distributed data have transformed, and will continue to transform, the design and delivery of instruction, how academic outcomes are measured, and the way learning itself is conceived, represented, and studied (Kingsley, 2007; Kingsley & Boone, 2008-2009). This study adds to the research literature emphasizing the importance of preparing teachers and teacher educators to empower learners by giving them the tools and agency needed for engaged, critical, self-actualized learning. In programs of teacher

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education, courses in instructional technology and critical pedagogy tend to be stand-alone, prescribed classes that do not necessarily attend to the complex realities of teaching in PK-12 schools. Such programs frequently turn out teachers who are unprepared for the difficult work of transforming 21st century classrooms into participatory, democratic spaces. The promise of innovative technology and the transformative power of fostering an informed, critical disposition cannot be realized until both are embraced as crucial elements of teacher education coursework and student teaching experiences. Critically-informed multimodal learning practices and the literacies that flow from them aren't obstacles to classroom teaching; they are a vital part of it. Hence, they need to be fully integrated into all aspects of teacher preparation (Miller, 2007). For this to happen, teacher educators will have to make the quantum leap from teaching old things in new ways to teaching new things in new ways.

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Evaluating Teacher Readiness for the Implementation of One-to-One Computing Based on National Educational Technology Standards

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Abstract

This study of teachers in seven Early College High Schools depicts readiness for using laptops at the implementation phase of one-to-one computing based on how well they met and addressed standards for teachers in intensive technology environments (ISTE, 2000). Key findings suggest teachers entered the pilot with mixed expertise and leveraged each other and students to address knowledge deficiencies. Teachers were occupied with classroom behavioral monitoring to deny students access to undesirable material, and they utilized system-based professional development to adopt new practices and increase classroom efficiency. Transitions to student-centered projects and collaborative work were anticipated and occurring in a third of classrooms observed, but independent seatwork was more frequent at implementation. Curriculum-based professional development was desired as were networks of teachers collaborating to share resources and lessons. Study findings are relevant to school leaders, technology facilitators, and staff developers supporting new one-to-one computing initiatives and to teacher educators whose graduates may require advanced preparation to meet the technology literacy demands of ubiquitous computing placements.

Keywords: one-to-one computing, ubiquitous computing, laptops, technology standards

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Introduction

One-to-one computing and ubiquitous computing are popular phrases used to denote educational technology programs where every student in a given institution has consistent access to a personal computer. The phrases are best differentiated by the level of access provided with "ubiquitous computing" used to describe programs where technology is pervasive but not necessarily one-to-one and "one-to-one computing" used to describe programs where every student does indeed have their own computer. One-to-one computing programs further vary in the details with some providing computer access only during school hours through labs and mobile laptop carts and others providing 24/7 computer access with laptops checked out to students for both school and home use.

In 2007, an evaluation contract was awarded by the North Carolina Department of Public Instruction to study a one-to-one computing pilot initiative in seven Early College High Schools (ECHS). Affiliated with the Bill and Melinda Gates Foundation, the ECHS program has established more than 200 alternative schools in 24 states emphasizing small class sizes and academics. The program targets students who are not likely to attend college, places them in buildings situated near or on community college campuses, and allows them to attend both high school and community college courses. A typical program of study allows students to graduate in five years with both a high school diploma and an Associate's Degree, aiding the transition to four-year universities.

With over 40 schools in the ECHS program, North Carolina provides an ideal location to study the ECHS model and layers such as one-to-one computing that may provide an added effect. In 2007, the Golden Leaf Foundation and SAS Corporation provided funds to purchase

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laptops for students and teachers in seven pilot schools. Since Golden Leaf's mission is tied to transitioning rural counties out of a tobacco-based economy, seven sites were selected in rural counties around the state to receive this benefit. Additional ECHS and traditional schools have been added to the one-to-one pilot initiative each year after the initial rollout. The pilot has expanded into what is now known as the "North Carolina 1:1 Learning Technology Initiative," or a public-private partnership seeing to the necessary organization, policy, funding, community engagement, technology, professional development, and pedagogy "as necessary components of a sustainable model for supporting future-ready students in North Carolina" (Friday Institute for Educational Innovation, 2008). While the initiative has become better organized, the pilot schools detailed in this study did not receive a standard professional development or software package prior to implementation. Rather, they were primarily district dependent in terms of the training and software tools received to begin their programs. These are distinguishing characteristics of this sample worth noting.

A three-year evaluation was planned to answer three broad evaluation questions about the pilot initiative. In year one, to what extent are school leaders, teachers, students, and parents ready to utilize laptops in instruction, and what implementation issues impact their readiness? In year two, is classroom instruction changing? In year three, what are the achievement outcomes of the initiative, and is the environment sustainable? This paper discusses qualitative findings related to the year one implementation question, with a focus on teacher readiness for one-to-one computing and associated implementation issues. The presented study is situated in a larger, longer-term, mixed methods evaluation.

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Conceptual Framework and Related Literature

This section outlines the conceptual framework for the study in the form of recommended technology competencies and practices for PK-12 teachers, followed by a summary of one-to-one computing literature that illustrates how well teachers working under one-to-one computing conditions typically demonstrate or struggle to meet each of the standards.

The conceptual framework for this study is based on the International Society for Technology in Education's (ISTE) National Educational Technology Standards (NETS) for PK-12 Teachers, or ISTE NETS-T (ISTE, 2000). The NETS-T represent technology competencies and practices for effective technology integration that can be used to help prepare pre-service teachers or evaluate in-service teachers' technology use. In this study, the standards are used as indicators for evaluating teachers in one-to-one computing environments (i.e., Does data show teachers were meeting standard X during the implementation phase of one-to-one computing?).

The 2000 NETS-T cover six areas of expertise (see Table 1). After collecting data in spring 2008, ISTE updated the NETS-T with modified standards (ISTE, 2008). It should be noted, however, that the old standards used to frame findings in this study closely correspond to the new standards that reference "digital age" language (see Table 1 for a comparison of topics).

Table 1

National Educational Technology Standards for Teachers (ISTE, 2000; ISTE, 2008)

Original NETS-T (2000)	New NETS-T (2008)
I. technology operations and concepts	III. model digital-age work and learning
II. planning and designing learning	II. design and develop digital-age

environments and experiences	learning experiences and assessments
III. teaching, learning, and the curriculum	I. facilitate and inspire student learning and creativity
IV. assessment and evaluation	II. design and develop digital-age learning experiences and assessments
V. productivity and professional practice	V. engage in professional growth and leadership
VI. social, ethical, legal, and human issues	IV. promote and model digital citizenship and responsibility

Research into one-to-one computing has helped to inform how well teachers teaching in these programs meet the NETS-T, as well as potential barriers they may encounter in meeting suggested competencies. Teachers have directly self-reported that one-to-one computing helps them improve experience with overall NETS skills (School Board of Broward County, 2006). And as noted in the following paragraphs, other studies suggest one-to-one computing may support an understanding and attainment of specific NETS skills.

Historically, teachers in ubiquitous computing conditions have been shown to progress through several stages of technology use on a path to truly changed instructional practice (Sandholtz, Ringstaff, & Dwyer, 1997). The path begins with a basic understanding of "technology operations and concepts," the first NETS-T. Teachers new to technology often begin by enhancing their existing teaching practices, perhaps using the internet to find external resources, or using email to communicate with parents and absent students. Teachers new to one-

to-one computing specifically may seek knowledge of technology operations that allow them to manage and minimize distractions laptops may bring to their classroom.

In terms of the second NETS-T, "planning and designing learning environments and experiences," one-to-one computing has been shown to help teachers individualize and customize instruction (Anastos & LaGace, 2007; Rockman, 2007). Laptop programs have also been found to increase opportunities for project-based learning (Rockman et al., 1998), although adapting to student-centered instruction is not immediate and takes some time (Rockman et al., n.d.; Sandholtz et al., 1997).

One-to-one computing may change how teachers address the third NETS-T of "teaching, learning, and the curriculum." Research has shown teacher communication with students may increase with new software tools that support such features as screen sharing and document markup (Anastos & LaGace, 2007). Opportunities to leverage student-to-student communication in teaching have also been shown to increase under ubiquitous computing conditions, as students have regular access to responsive technologies such as chats, messaging, blogs, and wikis (McHale, 2006; Oliver & Corn, 2008; Rockman et al., 1998). Teachers can also engage students in increased research and writing activities with positive effects shown on skills (Rockman et al., n.d., 1998; Russell, Bebell, & Higgins, 2004).

The nature of the fourth NETS-T, "assessment and evaluation," may also change in laptop settings, if students indeed are tasked with more projects scored with rubrics. Caution is warranted, however, since researchers have observed one-to-one computing can decrease formalized small group or pair work in lieu of more independent work with one's own laptop (Oliver & Corn, 2008; Russell et al., 2004). It is possible a teacher may begin to implement more

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self-paced worksheets and quizzes in laptop settings that could be detrimental if students lose opportunities to work with and learn from peers as advocated by social constructivists.

One-to-one computing no doubt places new demands on teacher training to help them meet the fifth NETS-T of "productivity and professional practice." Researchers have reported teachers will need external support to achieve full productivity with new laptop tools, including technology trainers and technicians at school sites, teacher professional development, and administrative leadership that meets regularly to develop logistical plans for implementation (Bonifaz & Zucker, 2004; Zucker & McGhee, 2005). Teachers in immersive technology environments have been reported to use technology more often for their own professional productivity (Texas Center for Education, 2007) and to increase their professional productivity (Zucker & McGhee, 2005). Regular access to technology may help teachers access additional professional development from a distance.

Teaching in a ubiquitous computing environment places new demands on teachers to be aware of the sixth NETS-T, "social, ethical, legal, and human issues." Appropriate policies must be in place and enforced by teachers with regard to appropriate use of the laptop and internet. With new software tools that allow students to develop videos and other multimedia productions that may find their way onto the public Web, teachers must be aware of and teach copyright rules and less restrictive options such as creative commons licensing. Given that laptops increase student responsibility, teachers must also have plans and appropriate consequences that preferably don't academically penalize students who forget their laptops at home, misuse and break their laptops, or fail to prepare their laptops for classes with charged batteries or required peripheral devices.

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Method

This study seeks to answer a readiness question about how well teachers are prepared to meet recommended technology standards during the critical implementation phase of one-to-one computing with potential implications for better preparing, training, and supporting future teachers facing similar conditions.

Design

As noted previously, the study detailed in this paper is one part of a larger evaluation using a mixed methods concurrent triangulation design with both quantitative and qualitative data sources toward a goal of expanding quantitative results with qualitative data (Creswell & Clark, 2007). The qualitative portion of the evaluation detailed in this paper follows a case study design where the primary unit of analysis is an individual school.

Participants

An evaluation team collected data for this pilot study of one-to-one computing, including university faculty, research associates, and graduate research assistants. Seven ECHS participated in the study. Schools did not volunteer for the pilot, but rather were granted laptops by The Golden Leaf Foundation without much choice to opt out of the program. At each school, participants included all students (grades 9-12), all teachers, the technology facilitator, and the school leadership team (i.e., principal, counselor, and district technology staff). Tables 2 and 3 list the number of students and teachers responding to surveys in year one along with gender and racial demographics of respondents to provide a snapshot of participating schools. Again, the overall number of students enrolled in each school is small by design of the ECHS program. Female students outnumber male students at all but one school. Also, white students outnumber other races at all but one school, although four of seven schools have a diverse racial mix.

Female teachers strongly outnumber male teachers at all but two schools, and a majority of teachers at each school are white.

Table 2

Student survey respondents and related demographics by school

School	Student Total	Survey Response Total	Gender		Race			
			Male	Female	African-American	Hispanic	White	Other
1 dav	113	89	33	56	2	4	75	6
2 edg	124	90	40	50	27	6	44	13
3 mac	107	78	31	47	0	3	71	4
4 nash	222	134	53	81	62	4	43	25
5 ruth	145	83	42	41	6	8	57	12
6 sand	152	93	38	55	24	8	26	35
7 way	170	167	71	96	64	9	73	21

Table 3

Teacher survey respondents and related demographics by school

School	Teacher Total	Survey Response Total	Gender		Race			
			Male	Female	African-American	Hispanic	White	Other
1	5	4	1	3	0	0	4	0
2	10	10	5	5	1	0	8	1

3	4	4	1	3	0	0	4	0
4	12	8	1	7	2	0	6	0
5	6	6	3	3	0	0	6	0
6	9	6	0	6	1	1	4	0
7	10	9	3	6	1	0	5	3

Data Sources

While multiple data sources are used in the overall evaluation (test scores, surveys, classroom observations, and interviews/focus groups), this paper is based on the qualitative observation and interview/focus group data that best informed the question of teacher readiness. Forty classrooms were observed during spring 2008 site visits across all seven schools, or an average of 5.7 classrooms per school. *Looking for Technology Integration* (LoFTI) was selected as the observation protocol based on its development in North Carolina with an emphasis on key factors promoted by the state technology integration model (SERVE, 2008). The instrument captures information on the classroom environment and student grouping, student engagement, hardware and software tools in use, how teachers are using technology (e.g., activating prior knowledge, demonstrating, providing feedback), and how students are using technology (e.g., discussing, testing hypotheses, problem-solving, project-based activities).

An original interview/focus group protocol was designed for the study with questions to inform school infrastructure, teacher alignment with ISTE (2000) technology competencies, and the influence of laptops on instructional practices, student achievement, and student 21st century skills. Question topics were informed by previous one-to-one computing studies (e.g., Muir, Knezek, & Christensen, 2004) and driven by interests of partner agencies.

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Procedures

ECHS pilots received laptops in early winter 2008 and held mandatory orientations with both students and parents. Site visits were conducted at the seven pilots for the first time in April, and included classroom observations, an interview with each school's technology facilitator, and separate focus groups with each school's teacher and leadership teams. Each site visit was conducted by at least two members of the evaluation team, with a senior member of the team on every visit. Follow-up site visits will be conducted every semester throughout the three-year evaluation.

Observations coincided with announced site visits, so teachers were aware observers were coming to their classrooms, but were not asked to prepare any special lessons. One observer visited every content area teacher in the pilot at least once during implementation, with each observation lasting 30 minutes. While different members of the evaluation team conducted observations, the protocol was discussed at team meetings in advance of data collection with definitions of key terms compiled, discussed, and carried by observers to classrooms to clarify terms as needed (e.g., what constitutes "cooperative learning"). *SurveyMonkey* was used to place the LoFTI instrument online in a form that observers accessed wirelessly to complete their reviews.

At each of seven schools, two focus groups were held with the leadership and teacher teams, and one interview was conducted with the school technology facilitator for a total of 21 recorded sessions. During each focus group and interview, participants were asked the same set of questions, including questions designed to inform how well ECHS teachers met ISTE's NETS-T at the implementation stage of one-to-one computing (see Table 4 for sample questions). The

length of focus groups and interviews varied according to participant responsiveness, but most sessions lasted 30-60 minutes during available planning periods. While different members of the evaluation team conducted the focus groups and interviews, they were trained to maintain the integrity of the protocol and ask the same questions in the same order to all groups. Conversations were audio taped, transcribed through external contract, and finally imported into *Atlas.ti* software for qualitative analysis.

Table 4

Sample focus group and interview questions aligned with ISTE's NETS-T

ISTE Standard	Teacher Focus Group Questions	Related Technology Facilitator Interview Questions, and Leadership Team Focus Group Questions
I. technology operations and concepts	Do you feel comfortable operating a laptop and helping your students do the same?	Do you feel that your teachers are comfortable operating a laptop and helping their students do the same?
II. planning and designing learning environments and experiences III. teaching, learning, and the curriculum	How do you feel the laptop program will change the learning environments and experiences you design?	How do you feel the laptop program will change the learning environments and experiences your teachers design?
IV. assessment and	Do you think a laptop program	Do you think a laptop program will

evaluation	will improve student learning and achievement at your school?	improve student learning and achievement at your school?
V. productivity and professional practice	What added professional development will you need as a result of the laptop program?	What added professional development will your teachers need as a result of the laptop program?
VI. social, ethical, legal, and human issues	How does continual student access to a laptop concern you with regard to legal, ethical, or safe practices?	How have you addressed teacher and student knowledge of social, legal, ethical, and safe practices with regard to using laptops?

The quantity of data generated by the overall evaluation necessitates dividing quantitative and qualitative analyses among the evaluation team with different researchers focusing on different topics of interest, such as the teacher readiness question addressed by this paper. Weekly team meetings allow researchers to compare themes during the analysis phase toward a goal of reporting overall results to partner agencies.

Credibility and Dependability

The following procedures were employed to ensure the data collected were credible and dependable:

- Triangulation of Human Sources: The interview/focus group protocol asked the same teacher-focused questions to three separate groups at each school to determine if there was agreement on teacher challenges and opportunities within a school, rather than relying solely on teacher self-report. While no agreement on teacher readiness was assumed across schools,

cross-case analysis was employed to define common challenges and opportunities recurring at multiple pilot sites.

- Peer Debriefings: The evaluation team meets weekly to discuss project matters such as instrumentation and analytical needs. Consistent with investigator triangulation (Denzin, 1978), members of the evaluation team returning from a site visit share data trends and preliminary hypotheses with members who did not go on the site visit to determine if their assumptions are reasonable and if they offer deviant cases or match findings from other sites. Weekly meetings also allow the team to review procedures and clarify definitions of terms on the observation and interview/focus group protocols to ensure consistency in data collection.
- Prolonged Engagement: While the study described in this paper does not meet the definition of prolonged engagement, ongoing site visits are a key component of the overall evaluation plan, with members of the evaluation team budgeted to spend a day at each school every semester throughout the three-year evaluation period.

Analysis

Analysis began by open-coding the teacher focus group, technology facilitator interview, and leadership team focus group for the first school with *Atlas.ti* software. This was followed by a comparison and coding of the data from each subsequent school in turn, with initial codes collapsed into categories as patterns emerged (e.g., concerns about the laptop program and benefits of the laptop program were two categories that emerged from lower-level, singular issues such as increased cheating and differentiation). Categories emerging from the initial cross-case analysis were then sorted into conceptual themes of interest (i.e., ISTE's six NETS-T) to illustrate teacher alignment with standards based on their knowledge of issues and plans for using laptops at the implementation stage of one-to-one computing.

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Given that each school's staff was small and highly collaborative, the primary unit of analysis was the entire school (i.e., teachers, leaders, and technology facilitator). The cross-case analysis procedure, therefore, did not attempt to differentiate comments by school role (i.e., teacher versus facilitator), but rather to accumulate evidence for how many schools were experiencing similar or divergent issues at the implementation stage.

Limitations

While multiple data sources were analyzed in this study, student perspectives were not considered for how well teachers incorporated laptops into instruction during the implementation of the pilot. In year two, the evaluation team acknowledged the need to gather student perspectives and added a student focus group to every site visit, but the question of teacher readiness in year one was addressed primarily by data from adults.

Study findings are based on a cross-case analysis of seven ECHS in North Carolina, helping to identify similar or divergent issues during the implementation of one-to-one computing in these related organizations. While study findings may be generalizable to similar ECHS, findings lack generalizability to other settings particularly given the unique nature of ECHS that emphasize small school and class sizes with a very limited number of teaching faculty.

Findings

Teacher Readiness for Standard I: Understanding Technology Operations and Concepts

When asked if teachers were comfortable operating their new laptop and helping students do the same, most schools indicated their teachers had a mix of expertise from basic to advanced. Four schools discussed teachers progressing in their use of laptops and becoming more comfortable and willing users over time, as noted by one technology facilitator:

> I saw a lot of resistance when we started putting the computers in the classrooms, from a lot of teachers--they were just like, what am I going to do with this? Some of those same teachers now can't teach their class without it, they really are upset if their computer doesn't work....

Administrators at two schools indicated teachers at more basic levels had learned it was okay to ask for assistance when needed:

> Our teachers here, the majority of them are willing to ask questions. Miss X is not afraid to say, "Hey, how do you do this?" and get a student to come over and to show her how to do that. So I think that's invaluable, where the teachers are willing to be students as well. And that's an important lesson for the students to learn, is that when they leave us, they don't know it all, and that's okay.

Teachers who needed technical assistance at the implementation stage received it primarily from their own students and peers. The most common form of teacher assistance was help from students, discussed by a full six of seven schools. Student help was leveraged both informally as well as formally by a few schools that had implemented student technology teams to provide technical support to teachers. Two administrators noted:

> I think the teachers are comfortable on a baseline, they have a baseline of knowledge, but there are students here that are way on the other end of the spectrum. They're teaching us!

> The digital learning club has helped with troubleshooting, when there's something real immediate and the technicians are off-campus. That's something the teachers feel like they can go to. For the most part, it's made up of kids that maybe traditionally would not have an active role in helping, so it gives them a sense of pride almost.

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Three schools discussed teachers collaborating to provide technical help to one another, which may not be uncommon in an early college environment where only 4-6 teachers are employed per site and may be more collaborative in general than at larger schools. One administrator noted:

> One good thing is, as all of our faculty learn things, we help each other. I mean, we're the lead, but we'll show somebody how to do it, and later another teacher may have a question, and they'll jump in and they'll teach what they have learned, so it's very collaborative....

Comments from several technology facilitators and teachers revealed that one focus at the implementation stage of one-to-one computing was on increasing classroom efficiency. In terms of technology operations and concepts, teachers were first learning to leverage the new technology to make their existing instructional practices more efficient by distributing notes and collecting assignments electronically, not necessarily more effective with changed instructional practices:

> More time in the classroom, now they can submit their work electronically, so you don't have to go around and collect a paper, hand stuff out, just e-mail it to them and boom they are working.

> [Teachers at regular schools] are used to having the first 30 to 35 minutes of students taking notes off the whiteboard, or using you know their projector, so this opens up so much more time, because you prepare the notes, you send it to them, have them, tell them where to look, and so it's making the students use it more.

> Like instead of using construction paper, they can just go on paint. I was just sitting here today, an activity I can do, instead of cutting shapes out, just go on to the paint thing or whatever and just make the shapes.

> I do most of the day-to-day staff development.... This teacher may still be using a Promethean like a chalkboard. The next teacher... how can we incorporate it more interactively, how can we make the students more involved, instead of you standing up there writing the day's announcements on it, or using it as a video projector. ... Efficiency is our big focus at this point... as we move on, becoming more effective.

Teacher Readiness for Standards II and III: Planning and Designing Learning Environments, Teaching with Technology

When schools were visited in April, personnel were asked if laptops were changing or might change the lessons that teachers design and teach, covering two of ISTE's NETS-T. While it was not expected teachers would have substantially changed their lessons at implementation, responses to this question helped to inform schools' beliefs about how laptops were expected to change classroom teaching.

Across the seven schools, over 23 different suggestions were made for how laptops were changing or might change instruction. Only seven suggestions, however, were made by three or more schools. Leading the list, five schools suggested laptops would significantly reduce actual teacher lecturing and place teachers more in the role of facilitator. Observation data supported this assertion with facilitation and questioning observed in 26% and 37% of classrooms visited

respectively, compared to lecture observed in only 11.6% of classrooms visited. Two administrators noted:

> The teachers are just going to have to step off the stage.... The 45 minute lectures just won't work anymore with all the information. They're not the container of knowledge. Knowledge doesn't flow from them. All they can do is help students find the best information and gather the knowledge from all these various sources.

> When you have such a tool where students can direct their own learning, then it's going to have to change how a lesson is presented or how a lesson is planned. You don't know what the student is going to find out, so you have to be willing to release some of the control, which is awfully scary.

Complementing the prediction of increased facilitation, four schools indicated laptops would enable or enhance project-based work, with the caveat that projects take considerably more class time. Project-based activities were observed in 28% of classrooms visited. One teacher noted:

> It would be very easy to turn everything into a project now, and sort of have the pendulum swing the other way where you're totally constructivist and totally facilitating, but then that takes sometimes four times as long as the traditional style of us delivering content, so there's a lot of decisions to be made.

Given the requirements of student-directed, project-based work, it is not surprising that three schools each suggested laptops would allow teachers to give more responsibility to the students

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for their own work, and students to conduct more independent research. Indeed, observation data indicates students used technology as a tool for research in 33% of classrooms visited, and the most commonly observed tools in use were Web browsers in 40% and search engines in 32% of classrooms visited. Surprisingly, however, no teachers suggested laptops would support student communication, since projects are often collaborative in nature. One teacher mentioned a wiki as a tool that could possibly support collaboration, but she admitted a lack of knowledge about strategies to help students collaborate through technology:

> Right now we are doing projects with the kid and the computer and that's it. I would like to involve the whole class on the project... maybe with the wiki idea.... I need to really figure out how to get the kids involved with each other, so I know for now it's just the computer-kid, and that's it.

Observation data indicate the most common instructional grouping across the pilot schools was independent work in 53.5% of classrooms observed, followed by whole group activity in 46.5% of classrooms observed, and finally small group work in 30.2% of classrooms observed. Collaborative work did occur, but was not as frequent as independent and whole group activity. Laptops may help to increase collaboration around projects as suggested by one technology facilitator:

> We've been working at becoming more project-based... I think it's going to be easier... they've been lacking the tools to make it as cooperative as it possibly could have been in terms of projects.

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Five schools suggested having laptops would increase teacher versatility, allowing them to better leverage Internet resources and software in the classroom, as with this teacher quote:

> Being English, the Scarlet Letter hasn't changed in the last couple hundred years, but what has happened is I had some students that found the audio version, and what they really wanted to do was listen, and I encouraged them to read along as they listened, learn that vocabulary.

With increased access to a greater variety of resources and tools, four schools suggested laptops would allow teachers to better individualize and differentiate instruction as represented by the following teacher quotes, although differentiation was only observed in 9% of classrooms visited:

> When we would do differentiated lessons in the past, you're lugging carfuls of materials for this kid who wants to do something visual, this kid wants to do something paper, this kid wants to do a packet. This way, you have Moviemaker, you've got Word or OneNote or Powerpoint, those tools are there, those materials are there....

> It gives me an opportunity for differentiation, and I didn't do it as much before, because before I would have to make physical copies, set up five or six different centers, but with the laptops I can just say, "OK, you're going to this place, you're going to this place."

Teacher Readiness for Standard IV: Applying Technology to Effective Assessment and Evaluation Strategies

During interviews and focus groups, several comments hinted at teacher understanding for how laptops might be leveraged to assess students. These comments generally fell into two categories--monitoring and alternative assessment.

Most schools in this initiative were implementing the classroom monitoring software *DyKnow* (2008), which allows teachers to view any student's computer screen to monitor what they are working on, distribute materials, and also set up electronic feedback mechanisms to gauge student understanding at any point in a presentation. At implementation, most teachers wanted to use monitoring software to monitor student activity. Only a few schools discussed the value in assessing student understanding on the fly to alter the pace and direction of instruction. Teachers at four schools asked for professional development to implement the tool more effectively:

> We have a DyKnow person coming next week, so for us a lot of how do we use it to monitor? But being able to go to that next professional step, how do you really meet those best instructional practices using the technology?

In discussing how laptops would change classroom instruction, a few schools indicated they expected more student-directed projects, group work, and presentations, which would serve as fodder for alternative forms of assessment, as represented by the following teacher quote:

> It's surprising the information they can get about other countries... that changed the way I think about assessment, because I use the list on Blackboard, so at least now they can see what all the kids are doing.... It used to be that you just give it to me, and I give it back to you, now they can see everybody else's [work].

Two schools requested professional development on helping students set up portfolios, suggesting some schools were thinking about how to collect and score artifacts, as with this teacher statement:

> One of the things... is the electronic portfolio, and kind of that next step... they've got their notebooks in one project, Moviemaker, how do we start gathering that so that the kids have this picture of their high school education? ... haven't really gotten past the idea of how do we start collecting that instruction.

Teacher Readiness for Standard V: Enhancing Productivity and Professional Practice through Technology

ISTE suggests teachers use technology to enhance professional practice, including accessing professional development. All schools reported providing teachers with some form of professional development at the beginning of this initiative, however the subject of this professional development varied widely. Over 21 different professional development offerings were described, but only two were discussed by three or more schools--training on SAS in Schools' *Curriculum Pathways* software in four schools (a partner in the initiative) and training on the *DyKnow* classroom management software in three schools.

Other trainings discussed by one or two schools included training on laptops and wireless connectivity, operating systems, classroom Promethean or Smartboard systems, *Moodle* or other course management systems, *Microsoft Office* software, multimedia software such as *iPhoto* and *iMovie*, and the "big three" Web 2.0 tools--wikis, blogs, and podcasts. Web 2.0 is a term given to

Web-based software applications that allow groups of users to collaborate around the production of some knowledge product (e.g., an article, a concept map, a comic strip, etc.).

Five schools described three or four trainings, while two schools described six and nine respectively, suggesting the depth of professional development by site may vary as widely as the topic areas covered. No attempt was made at the rollout of this initiative to standardize the training provided by school technology facilitators or external agencies, although a one-to-one Learning Collaborative for one-to-one schools in North Carolina was formed after rollout which is now providing some standardized training attended by pilot school teachers (Friday Institute for Educational Innovation, 2010).

Schools also listed 23 professional development sessions they would like to have offered. This list of desired trainings fell into similar categories as the offered trainings, suggesting an opportunity exists to share expertise if teachers at one school have already been trained on and implemented a tool that teachers at other schools wish to use. The most desired professional development offering was *DyKnow* classroom management software, requested by six of seven schools, which might suggest schools at the implementation stage of one-to-one have more concerns about managing student behavior than modifying instruction. Four of seven schools, however, also requested training on planning lessons with their new laptops, including interdisciplinary and differentiated instruction, so there was good acknowledgment of the opportunity to modify instruction through the new laptops (e.g., three schools desired training on *Geometer's Sketchpad* software).

Schools discussed different strategies to address professional development needs. Five schools suggested it was very important for teachers in a subject area to communicate with and share lessons with other teachers of their subject, and four schools recommended establishing a

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professional learning network for pilot teachers to communicate and share lessons. One teacher noted:

> I'd like to get all the science teachers in this program, and set up a way of compiling lesson plans or websites that are good for this topic, because I've got some that were good and some that weren't.

Five schools also described the importance of building on teachers' expertise, with different suggestions for how that could be accomplished--asking teachers what professional development they need, requiring teachers to develop and teach a lesson with tools on which they are trained, and providing follow-up and one-on-one support in the classroom after professional development, presumably by the technology facilitator.

Teacher Readiness for Standard VI: Understanding Social, Legal, and Ethical Issues Related to Technology Use

School personnel were asked to describe how they planned to address social, legal, and ethical issues pertaining to laptop use. Comments from schools indicated they were aware of a range of issues with considerable advanced planning to protect students and teachers. Five of seven schools discussed the importance of acceptable use policies and parent orientations to inform everyone of both the risks and consequences of inappropriate laptop use.

The biggest concern discussed by four schools was students accessing questionable items on the Internet. Questionable items included social networking sites which three schools found particularly troublesome with regard to student privacy and safety, copyright-protected music and video students might illegally download, and resource materials students might plagiarize to cheat on assignments. Some teachers were relieved their schools had adequate filters to block

certain web sites, while other teachers were afraid filters might be blocking too much information, and schools should rely more on student responsibility, school policies, and parental oversight to manage appropriate use. How much to block remains a topic of debate. One teacher on the side of giving students more responsibility noted:

> We could worry ourselves gray... we just decided we would let them do what they do, and we'll deal with the consequences. We have in place rules and regulations in terms of what they're supposed to do and what they're not supposed to do... it's probably going to cause some frustrations, but you have to give the kids responsibility to fall or stand.

How to penalize students who break rules was another issue discussed by schools with potential academic ramifications. At least two schools had experimented with taking away students' laptops in school for a day, week, or month, depending on the offense. One of these schools also discussed collecting troublesome students' laptops at the end of a school day, not allowing them to take their laptop home. One teacher stated:

> I had this conversation with my kids yesterday, the laptop is not a right, it is a privilege, and if you abuse it, it's not guaranteed that you're going to keep it.

Discussion

In this section, findings are compared to prior one-to-one computing research, partially illustrating the results seen are not unique to early college settings. Teachers' initial focus on management issues and adopting technology to support existing instructional practices at implementation was mixed with some advanced uses of laptops aimed at improving classroom efficiency and increasing student-centered activities. Continuing data collection will define the extent and speed of teachers' transitions to more advanced uses of laptops.

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Teachers expressed great interest in classroom management and monitoring software at implementation. *DyKnow* monitoring software was the most commonly requested professional development session by six of seven schools, and one of the most commonly offered professional development sessions in three schools. Although there was some acknowledgement that monitoring software could be used for assessing student understanding during a lesson, additional professional development and practice were needed to encourage monitoring for formative assessment purposes. Most teachers were interested in monitoring student behavior initially, with four schools expressing concerns over students accessing social networking sites, illegally downloading copyrighted media, or copying and plagiarizing work. Some teacher concerns are legitimate, since prior studies have shown laptops may lead to off-task behavior by high school students such as listening to music or sending notes during class, and accessing inappropriate material (School Board of Broward County, 2006). Early teacher concerns on management and monitoring fit within the first management stage Sandholtz, Ringstaff, and Dywer (1990, p. 4) proposed for ubiquitous computing environments--"survival." When teachers are unfamiliar with new technologies and can't anticipate what problems might occur, their initial focus is on misbehavior, technical problems, and changes in classroom dynamics such as increasing noise levels.

At implementation, teacher training was most commonly focused on laptop usage, troubleshooting technical problems, operating systems, wireless networks, monitoring software, course management systems, and peripheral systems such as Smartboards. With so much to learn up-front, it's not surprising that researchers have found laptops increase the planning time needed for teachers (Zucker & McGhee, 2005). The drain on time is likely highest at implementation when it would be difficult for teachers to focus on changing lessons while simultaneously trying

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to learn to use new hardware and management software. The evaluation team anticipated this lag by pushing to year two the overall evaluation question, "Is classroom instruction changing?"

Incidentally, teachers weren't the only ones overly focused on the technical start-up of the project. Most of the technology facilitators in this pilot described being called upon to perform technical support duties and process laptop repairs, rather than their primary job of working with teachers to effectively integrate technology into the curriculum. The lack of adequate technical support at implementation is another issue that inevitably slows the transition toward curriculum integration by distracting facilitators and teachers from their primary roles. This factor cannot be overstated, since ECHS with small enrollments around 100 students were significantly taxing the time of competent technology facilitators with technical support issues at implementation. The need for technical support at a traditional school with 1000+ students and laptops would only be exponentially higher. One partial solution may be to leverage student expertise in providing technical support. Teachers with less technical expertise in this study reported receiving much help from their own students, as reported by other studies as well (Fairman, 2004).

To help speed the integration of laptops into teaching at implementation, teachers recommended establishing networks of colleagues to share ideas, and also leveraging one-on-one support from the technology facilitator in the classroom. In one Florida study, an unexpected rate of change with a laptop program quickly transitioning to maturity was attributed largely to selecting sites for the program based on prior teacher involvement in technology training academies (School Board of Broward County, 2006). Some districts recommend providing intensive training on laptop use in content areas prior to implementation (Owen et al., 2006). A different approach was applied in this pilot, with schools selected to receive laptops by partner agencies, rather than by application, expressed interest, or advance teacher preparation.

Several years of studying Apple's Classrooms of Tomorrow with ubiquitous computing led to the development of "stages of evolution" in teachers' instructional practices (Dwyer, Ringstaff, & Sandholtz, 1990, p. 4). At the adoption stage, teachers still rely on familiar methods such as lecture and individual seatwork, and incorporate technologies such as drill and practice software that "tell" students what they need to know. In this study, teachers spoke of technology increasing the efficiency of their existing instructional practices by distributing and collecting assignments electronically. Some of the benefits teachers proposed for their new laptop program also hinted at the adoption mindset. For one, teachers suggested laptops would benefit them with more Internet resources and increased versatility. Better teacher access to new instructional content is a commonly suggested benefit of laptop programs (Zucker & McGhee, 2005). For example, one of the most common professional development sessions offered at four schools in this study was the Web-based *Curriculum Pathways* software that teachers were excited to use as a curricular supplement. While this software merges multimedia-rich presentations with "interactivities" that engage students with questions, problems, and writing exercises, it could be considered a bridge to the purely "tool" software discussed by Jonassen (2000) which is less about presenting specific content and more about providing students with various functionalities to process and make sense of any content (e.g., analyzing with spreadsheets, testing hypotheses with simulations, relating with concept maps, synthesizing with social bookmarks). Students were observed using traditional "tool" software in 33% of classrooms visited, including word processing, spreadsheets, and databases--second only to Web browsers in 40% of classrooms. Schools overall were not promoting Web 2.0 tools at implementation, with only one school providing training on blogs, and one other school providing training on wikis and podcasting.

Although all classrooms were not at advanced stages of Dwyer et al.'s (1990, p. 6) model, teachers discussed and anticipated several transitions to more student-centered uses of the technology over time that were more consistent with the "appropriation" stage. This notion of transitioning is supported by results of prior one-to-one computing studies. Five schools indicated the laptops would change the role of their teachers from lecturers to facilitators with such activity already observed in a quarter of the classrooms visited. Prior studies support this assertion, including Owen et al.'s (2006) study of the Irving Independent School District's laptop program where the most frequently used instructional strategy was facilitating student learning. Four schools anticipated more project-based work by students, and this transition from a textbook-based to project-based classroom is precisely what other one-to-one computing pilots have reported (Greene County Schools, 2007; School Board of Broward County, 2006). Three schools indicated laptops would increase student responsibility for their own learning, which is what Fairman (2004) reported in Maine where student-centered and inquiry-based approaches shifted the role of the student to one of increased responsibility. Three schools also anticipated laptops would allow their students to conduct more online research. Observations provided evidence for research activities, with other one-to-one studies reporting this is how a majority of teachers and students report spending their time (Owen et al., 2006). Four schools suggested laptops could better support more individualized instruction, which is supported by research conducted in Maine where laptops provided students with more freedom to pose their own research questions and to research topics of interest (Fairman, 2004). Another potential benefit of laptops is increased student-student and student-teacher communication (Bebell, 2005; Fairman, 2004; Levin, 2005-06), although there was little evidence of laptop-supported collaboration occurring in this study.

As shown by other one-to-one studies, change in instructional practice does take time (Owen et al., 2006). As one teacher discussed, participation in one-to-one computing pilots may progress in "phases" with a lot of information to digest initially and various "hurdles" to overcome:

> I feel like I'm in phases. The first phase was just trying to wrap my brain around, OK, I have this new Promethean board, and now I'm beyond that and I'm into how can I use my existing notes with the Promethean board, and we talked about that with the trainer we had last week. So we're constantly adapting and changing ourselves, and as that changes, our lessons, like I'm looking forward to next year, because I've got a real feel for how I can incorporate everything we have, like the Promethean board and the DyKnow, and my notes with [Curriculum Pathways software], so it's all coming together eventually, but we have to jump over one hurdle at a time. It's just too much for my brain to wrap around.

Recommendations

This study depicts teacher readiness for using laptops at the implementation phase of one-to-one computing based on how well they met and were prepared to address standards for teachers in intensive technology environments (ISTE, 2000). Findings allow evaluators to compare pilot schools to other one-to-one studies at implementation, and to track changes in teacher knowledge, skill, and focus in years two and three of the evaluation.

Further, findings inform recommendations to help teacher educators, school leaders, technology facilitators, and staff developers expedite a teacher's transition from a management-oriented to a student-centered laptop classroom:

- Supporting Teacher Readiness for Standard I--Understanding Technology Operations and Concepts: Plan for adequate technical support and formalize a plan to leverage student technical expertise in response to teacher and peer technical support questions. Promote a collaborative environment where teachers are encouraged to ask their peers and students questions.
- Supporting Teacher Readiness for Standards II and III--Planning and Designing Learning Environments, and Teaching with Technology: While initial professional development may focus on new tools and processes that make classroom management more efficient, teacher training must also include strategies for curriculum integration. One specific focus of laptop professional development should be on supporting project-based and collaborative student work with appropriate tool software and online research, since independent seatwork tends to be more common with students accessing teacher-distributed materials. Differentiation is another suggested benefit of laptop programs that may be easier discussed than applied in practice without training on concrete approaches and tools that support divergence.
- Supporting Teacher Readiness for Standard IV--Applying Technology to Effective Assessment and Evaluation Strategies: If professional development includes training on monitoring software such as *DyKnow* (2008), train teachers to use the software for formative assessment in addition to its more common use for behavioral monitoring. Since laptops may lead to more project-based and collaborative work, train teachers to alternatively assess these non-traditional artifacts of understanding through such mechanisms as rubrics and portfolios.
- Supporting Teacher Readiness for Standard V--Enhancing Productivity and Professional Practice Through Technology: Ask teachers what professional development they need, but realize early concerns will be on managing classrooms and school leaders may need to push

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curriculum integration training. Ideally, teacher professional development on curriculum integration strategies would precede laptop program implementation, and teachers would have access to a technology facilitator and network of peers teaching in their subject area to share and collaboratively plan new lessons.

- Supporting Teacher Readiness for Standard VI--Understanding Social, Legal, and Ethical Issues Related to Technology Use: Teachers have legitimate concerns about students accessing illicit and unsafe material on the Web and using copyrighted and plagiarized material in their work. Establishing expectations through student-parent orientations and acceptable use policies is one approach, although contingencies must be in place for rule breakers. Teachers and school leaders should carefully consider the academic ramifications of punitive actions such as blocking Web sites and taking away laptop "privileges" before establishing penalties.

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Incorporating Technology within Classroom Literacy Experiences

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Abstract:

Educators are challenged to consider ways that Information and Communication Technologies (ICT) can be included within classroom contexts. Such challenges often require the adoption of whole school, team and individual focus as technology is examined in connection with the needs of the learners within the school and the pedagogical understandings and beliefs of the educators.

In this paper we describe an elementary school-based project that focuses on ways that computer-based technology and associated peripherals can be incorporated within classroom literacy experiences. As we examine the planning, implementation and our reflections upon this process some key findings emerged. The need for teachers to work towards shared goals as they refine their ability to manipulate technology in connection with their pedagogical understandings became paramount. So too, was the need to closely observe the response from the students to the experiences and the evidence of learning that emerged. Specific inquiries within the scope of this project will be examined.

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Introduction

Within educational research literature, educators at all levels are challenged to modify and modernise their practice to more accurately reflect work and leisure activities of today (for example, Labbo, 2005; Leu & Coiro, 2004; Dearman & Alber, 2005). Technology is identified as integral to the out of school lives of children and young people (Gee, 2004) and, combined with the ability to 'multi-task', many are exposed each day to the equivalent of more than eight hours of 'media messages' (Roberts, Foehr, & Rideout, 2005). This technology use is embedded within a user's social context and fulfills their need for building networks and reaching new understandings, rather than existing outside their normal routines and activities - a key understanding for educators to acknowledge.

ICT increases the volume and sources of information available, forcing a change in literate practices and what is valued as 'literacy' and challenging the notion of 'text' and its associated language features (Cope & Kalantzis, 2000). In engaging students for deep learning in classrooms, Oblinger (2003) and Dede (2005) argue that teaching must be supported by the technology to which students are accustomed. In contextualising the task, teachers are challenged to design open learning experiences that authentically reflect real world problems (Lombardi, 2007) and that value their students' cultural practices (Nixon & Comber, 2006) in an effort to develop in students the ability to flexibly apply knowledge and skills outside the classroom. The role of ICT in this classroom setting is to *support* the learning rather than to *be* the learning; ICT should not be an 'add-on' to the curriculum (Durrant & Green, 2000), but an integral part of a broader learning goal.

Although it is recognised that many teachers have some way to go in incorporating ICT in their regular teaching practice, it is vital that they are acknowledged for the considerable

knowledge they have about their profession – what constitutes 'good' pedagogy, the nature of learning and ways to engage students in the classroom. Roblyer (2006, p. v) describes technology as "… above all, a channel for helping teachers communicate better with students. It can make good teaching even better, but it cannot make bad teaching good". Technology is no substitute for informed lesson design and good classroom practice. It is vital, therefore, that educators articulate a clear rationale and purpose for the integration of technology to support learning in connection with curriculum goals, student learning gains and teachers' personal philosophies.

The literature focuses on the ways that technology can be meaningfully incorporated within the classroom (for example, Dede, 2005; Herrington & Kervin, 2007; Leu, Mallette, Karcher, & Kara-Soteriou, 2005) and teachers need to be supported as they develop professional understandings and applications of this to their professional identity and subsequent practice. School-based projects are identified as one way to challenge practice as new alternatives are considered. It is undisputed that teachers' learning is continuous throughout their professional experience, with professional development and professional growth being interrelated, one unable to occur without the other (Danielson, 1996; Mevarech, 1995). However, to reconceptualise practice with the vision to transform it, change grounded not only within theoretical understandings but also classroom practice is critical (Larson & Marsh, 2005). Teachers need opportunities to test if something works through a carefully planned process of action and reflection.

Embedding a project within the specific school context is acknowledged as a powerful approach (Beaudin & Grigg, 2001; Kervin, 2007). Identifying and responding to the specific contexts in which teachers and students work provides understanding of how literacy is shaped

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as 'literacy practices' (Street, 1995) and 'literacy events' (Heath, 1983) are carefully considered. While our knowledge of schools and anecdotal evidence tells us that there are many school-based projects focused on technology and literacy, few are reported within the literature. Some examples we have located include:

- Reid's (2006) experiences of developing a whole school approach to information literacy,
- Maugle's (2006) description of the challenges for teacher-librarians in integrating ICT, and
- Jeffrey, O'Bryan and Phelp's (2007) description of learning experiences focused around virtual stories.

Each of these examples identifies the importance of having a carefully defined project with opportunities for collaboration, sharing and ongoing learning. In this paper we examine a series of inquiries within a school-based project focused on ways that computer-based technology and associated peripherals can be incorporated within classroom literacy experiences.

Methodology

This article reflects data collected in an independent elementary school in metropolitan New South Wales, Australia. At the time of the inquiry, 230 students, most of whom identify English as their first language, were enrolled in the school. The school is classified as a one-stream school (that is, one of each grade) with a 'bubble' of two streams in two grades, the result of a large residential development in the area. There are nine classes in the school.

The school identified the regular and integrated uses of computer-based technologies in all classroom programs as a learning priority. At the time of the school-based project reported herein the teachers and students had access to: 15 iBook computers with airport connection to the internet and intranet, 3 or 4 desktop computers in each classroom, 7 digital cameras and 4 data

projectors (one for Kindergarten, Grades 1 and 2, Grades 3 and 4, Grades 5 and 6). Throughout the year of the project a number of different structures was tried as the teachers considered how equitable access to the technology could be provided to best support teaching and learning experiences. For example, initially the laptops were timetabled so that all students received equal access to the technology in their classrooms. This was then restructured to break the laptop bank into groups of 5, which were then distributed across the stages (Grades 1 and 2, Grades 3 and 4, Grades 5 and 6). The classroom teachers met regularly to share ideas and teaching approaches in an effort to successfully integrate computer-based technologies into daily literacy learning experiences for their students.

This paper reports on a school-based project that evolved over a school year. To explicate this project, three inquiry examples are analysed and reported on; these are summarised in Table 1. Our analysis draws these inquiries together as we comment upon the overarching themes within the project looking at how technology can support classroom literacy experiences.

Table 1: Overview of inquiries with a School-based project

	Project focus	Context	Participants	Inquiry timeframe
Inquiry 1	Creating non-linear text with PowerPoint	Grades 1 and 2	6 students, 2 classroom teachers and an academic partner	6 x 90 minute sessions
Inquiry 2	Conducting research using	Grade 4 class	30 students, 1 classroom	10 x 90 minute sessions

	computers		teacher and an academic partner	
Inquiry 3	Enriching talking and listening experiences through Podcasts/Vodcasts	Grade 5 class	28 students, 1 classroom teacher and an academic partner	20 x 90 minute sessions

Each inquiry within the school-based project presents example of ways that technology can be incorporated within classroom literacy experiences. Data were collected from a variety of sources in an effort to examine and convey the richness and complexity of the learning environment and to contribute to the credibility of this qualitative inquiry (Cohen, Manion & Morrison, 2007). Observations of and interviews with students and teachers formed primary data sources and were ongoing throughout the inquiry. Video footage and still images were used to capture interactions between the participants, the learning experiences and the technology. These data were used to support the analysis of interview transcripts and field notes. Further triangulation was achieved through analysis of artefacts such as student work product, teacher programs and systemic policy documentation in connection with the primary data sources.

Analysis occurred as each researcher coded data from each source, that is: transcripts from interviews, field notes, visual footage and artefacts. Codes were compared between the researchers and emerging themes identified. Subsequent connections back to the primary data sources enabled rechecking of these themes. The following elements were adopted as criteria for

analysis of the data: teacher planning for learning, student interpretation of the task and evidence of achievement of the focus of each inquiry (both literacy and technology).

The analysis enabled the researchers to respond to the guiding question and sub-questions:

- How can a school-based project support the inclusion of technology in classroom literacy experiences?
    - What are the specific activities for teachers in planning and implementing the experiences?
    - What response and learning gains emerge for students during the experiences?

Limitations

This qualitative inquiry was conducted within a single bound site and set timeframe. Whilst the interpretive nature of qualitative research can be perceived a threat to reliability and validity (Cohen, Manion & Morrison, 2007), the design of this inquiry supports the development of trustworthiness and credibility in three ways. Multiple sources of data were gathered within the setting, findings were triangulated both within and across data sets, and peer debriefing was utilised throughout data analysis process to ensure the researchers were not simply 'finding out what he or she expects to find' (Merriam, 1998, p. 202). Subsequently, it is expected that the findings emerging from this research in classrooms in will resonate with the experiences of other classroom based researchers and practitioners, allowing connections to be drawn to pedagogy, practice and future research.

Inquiry 1: Creating non-linear text with PowerPoint

Table 2: Overview of inquiry 1

Literacy focus:	*Supporting students to:* - Locate, examine and synthesise information from a range of sources - Author texts using new genre emerging from computer technology
Technology focus:	*Supporting students to:* - Use PowerPoint to create non-linear texts

The Grade 1 and 2 teachers in this inquiry identified a focus group of six students as needing 'extension' with literacy. These students were provided with a differentiated task to meet their learning needs. To begin the period of inquiry, the students explored the notion of non-linear texts. To do this, time was spent exploring different web sites with particular emphasis on how they were organised. A number of examples were deconstructed through explicit modeling to identify key navigational and design features. The students demonstrated awareness of the genre of digital texts.

When presented with the challenge of creating a non-linear text using the PowerPoint application, the students demonstrated ability to transfer their understandings of digital texts to the task. Some of the students were less familiar with PowerPoint and a guided approach was employed to see the process that emerged as the students created the 'text'. Over a period of six weeks, the teacher and students worked together weekly for an average of ninety minutes. During this time teaching and learning experiences arose from the perceived 'needs' from the

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students and through negotiation between and among the group members. Such experiences encapsulated learning about the technology in connection with literacy experiences. For example, the need to revisit the original deconstructions to examine technique and gather ideas for text construction occurred.

The students story-boarded their ideas to plan how their text was to look. Their diagrammatic representations of their text demonstrated understanding of the genre, while also acting as a 'plan' for text construction. Throughout the authoring process, the students shared their ideas with each other and the teachers to develop a plan for how their text could look. Working through this process appeared to enable the students to see the different 'parts' that would make up their text, how the reader would view these and to also think about what each of their 'pages' may look like.

The students saw the technology alone as insufficient for the creation of the text. They identified a need for 'information' to be included in the presentation, and this became a key priority. The students used resources such as the search engine "Ask Jeeves", books within the school library, previous classroom learning experiences and 'experts' they identified to support the gathering of information. The technology became one of a range of tools used by the students to create the text. The need to include access to and opportunities for the students to choose their reference tools became essential.

The students worked either independently or with a partner and identified sections during the process of text construction. As the students planned and researched information to be included in the text, opportunities were needed for the students to share their plans and sample information to be included within the text. Interestingly, all students decided to construct their text in their books, which they edited and proofread before entering it into PowerPoint.

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Throughout this process of writing 'information' for their text, each of the students took the opportunity to conference their writing with the researcher, and other class members. Once they were satisfied with the composed text, they then moved to the available technology to create 'slides'.

Once the students had written their text and created slides, they revisited their initial plan. This enabled the students to begin to work on the ordering of slides, but also the navigation within them. At this point, the language of 'webpages' became apparent as the students began to talk about having a "home page with links", the need for a "back or home button" and a "next button for when the information was spread over lots of slides". Structured sessions focusing on the affordances of the technology were needed to explicitly demonstrate the process of creating action peer mentoring became evident as the teaching of these skills spread between students.

Inquiry 2: Conducting research using computers

Table 3: Overview of inquiry 2

Literacy focus:	*Supporting students to:* • Identify topics of interest and construct open questions for exploration • Critically examine information from a range of sources • Locate, identify and summarise relevant information • Analyse and synthesise information to construct text • Deliver an oral report supported by a visual presentation
Technology focus:	*Supporting students to:* • Conduct key word searches

	• Operate between 'windows' on the desktop • Select and use appropriate publishing software for the task

This inquiry investigated the use of ICT to support students as they researched and constructed texts for presentation to their peers. The teacher had pre selected a range of topics from NSW Syllabus Documents and located a range of websites and library resources for the students to use in gathering their data. The topics were drawn from the NSW Board of Studies Science and Technology (BOS, 1993), Human Society and Its Environment (BOS, 1998) and Physical Education, Health and Personal Development (BOS, 1999) Syllabus Documents and addressed topics such as Solar System, personal health and fitness, the transmission of sound and lifecycles. Digital resources were housed on the school's intranet system, which the students could access at school and in their homes. The students worked on their reports during the literacy block in independent task time for 3 days each week for the course of the term. As the students worked on their projects, the teacher conducted conferences and small group sessions focused on their reports.

The students examined the topics presented by their teacher and selected one of interest. Working in self selected groups (or alone) the students posed a 'big' question and 2 contributing questions. The teacher and students worked in conference to ensure the questions were 'answerable' and to identify likely sources of information (print, screen and oral). Finally, they worked together to identify suitable key words for effective searching

The students researched their area of interest using the sources and strategies identified from the teacher/student conference, with the expectation that they would read with a critical eye; not all information was 'good' information. Text considered relevant was summarised in

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one of 2 ways; some students recorded notes and utilised the copy/paste function in Word to transfer text from digital sources into a Word document, while others conducted interviews and took notes by hand in their exercise books. These notes formed the data from which the students constructed both their oral and visual presentations.

Next, the teacher and students conferred again to identify appropriate software for presenting the report. The popular choice was PowerPoint, however, Dreamweaver was also used to create a webpage where the 'home' page posed the big question while the links provided answers to the contributing questions. Interestingly, iMovie was selected by some students and later rejected; reasons for this included its complexity in creating the file as well as the inappropriate nature of the software for the task:

> *"...first I was going to do an iMovie but then I decided it takes too long and I don't really know what I was going to record..."*
>
> *"...we started off doing iMovie but we couldn't figure out how to do it and it took ages to load."*

In the publishing stage, the students used their draft notes to construct an oral report and a supporting visual presentation. They engaged in the recursive stages of the writing process as they composed, proofed, edited and published both documents. In publication of the visual presentation, issues of spelling and punctuation became a focus as the students considered their audience, as did the modality of the text; *"if I say "well" it's like I'm talking in conversation. In speeches you normally... cut out the "well", because you are talking to the audience, you're not just talking to one person"*. Another focus was the layout and presentation of the PowerPoint slides or Dreamweaver frames. It was at this stage that consideration of the audience, their

interest, comfort and preferences impacted the choices the students made. For example, the choice of background colour was important in *"making the writing stand out"* and *"easy to read"*, while the choice of animations and transitions was impacted by the desire to engage their audience, *"we've got a few funny pictures here…it gets the people's attention, so they actually listen and don't get bored"*. The students presented their reports to the class and their teacher for assessment.

Inquiry 3: Enriching talking and listening experiences through Podcasts/Vodcasts

Table 4: Overview of inquiry 3

Literacy focus:	*Supporting students to:* - Talk about language features and text organization in oral texts - Identify the different purposes for oral language - Describe the effects different audiences can have on a speaker - Examine the differences between informal and formal oral language - Use oral texts as a way of planning for more extended written texts
Technology focus:	*Supporting students to:* - Use technology to listen to oral texts - Use technology to plan, create and edit oral texts - Access oral texts to inform written texts

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Classroom assessment and the teacher's anecdotal evidence suggested a need for in-depth focus on the talking and listening strand of the English syllabus. The class teacher was interested in the use of iPods and podcasting/vodcasting technologies to facilitate talking and listening and made contact with an existing project coordinated by the academic partner to facilitate this. Involvement with the project meant that the class had access to 6 video iPods (with microphones) in addition to the technology resources already available within the school. A range of experiences was offered over the period of two terms (20 weeks) that incorporated the technology and identified area for literacy learning.

To begin the period of inquiry, the students and teacher took time to listen to a range of podcast oral texts. Audio stories were accessed and downloaded to individual iPods for students to engage with during 'reading' opportunities in the classroom. These were positively received by the students and acted as examples of 'exemplary' oral reading. Connections to websites where podcasts were available for download were made in the course of classroom study (for example, the UNICEF site was used to support a focus on social justice). These texts provided clear models for the students and demonstrated examples where the impacts of audience and purpose could be examined. Opportunities to listen to these texts enabled the students to identify characteristics of language features and grammatical structures within oral texts.

The initial focus on deconstruction, reconstruction and interaction with audio texts appeared to equip the students with a range of skills and strategies centred on talking and listening. To expand upon the process of authoring oral texts, students were given opportunity to work in teams to create podcasts on a variety of topics; for example, personal interest topics and curriculum themes. During these opportunities the students demonstrated their understanding of the construct of oral texts as they planned, recorded and edited their constructions to share with

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their peers. The process of creating these oral texts was multifaceted and required a number of 'steps'. Tim described the process:

> *"...if you want to make a podcast you have to find the information you want to talk about ... you have to have GarageBand 3, when you've got that you click on it and go to podcast when you're there record your information into the computer. Then find some pictures related to the information – this can take a long time to get your meaning right. Then drag the pictures in order to where it matches your recording and there you go! Then you might make some music like a sound track ... the best thing about it is it's so fun..."*

The video capabilities of the iPod technology were explored in this inquiry. The teacher selected appropriate movie trailers from the Internet and moved these onto the iPods (in this example 'Zathura' was used from apple.com/trailer). These oral and visual texts (Vodcasts) were viewed by the students in groups. Using the trailer the students were able to compile word banks and phrases to describe key contributors to the narrative genre (such as setting, characters, audience and atmosphere).

Time spent examining the Vodcast was then used to stimulate the writing of a narrative text. The movie trailer provided example of a high quality introduction to a fictional story – it provided a synopsis of the story line, but left many specific details open for interpretation. The time spent deconstructing this as a group provided focused opportunity for discussion about the possibilities within the text as the narrative genre was explored. Each student used their

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experience with the trailer and subsequent group discussion as a plan for their own written narrative. Jonathon wrote:

> *"It was a cool and quiet evening. Mickey was creeping through the back streets of Quirkyville. He was trying to keep quiet because in Quirkyville no one was ever out after dark. He didn't want to make anyone suspicious. He jumped with a start as something moving caught his eye. Luckily it was only a stray cat. It was getting cold and scary. He pulled his jumper on tighter and trudged on."*

Jonathon's story continued for 720 words. His narrative was in clear response to the narrative genre and his use of language included much of the vocabulary within the movie trailer and group planning. The opportunity to engage with the vodcast (oral and visual text) with time to discuss it in a group situation appeared to support the majority of students within the class to connect the language modes of talking, listening and writing.

Findings from the Project

In each inquiry the class teacher was working within the whole school vision focused on how technology could support classroom literacy learning. Each teacher responded to this focus quite differently. What remained consistent though, were the connections they made between and among technology use, their teaching philosophy, aptitude with technology and the needs of their students. For example, within the first inquiry, the teacher supported construction of 'new' literacy supported by commonly used software in an innovative way, while the teacher in the third inquiry enriched the development of talking and listening within the classroom with the support of relatively unknown (to the school) technology with some external support. Both these

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examples profile ways that technology can be meaningfully incorporated in classrooms (Herrington & Kervin, 2007; Leu et al., 2005).

Literacy learning within each inquiry classroom remained at the forefront of the teaching and learning focus. While each teacher had vision for how technology could be used, they also clarified the literacy learning they hoped the students would achieve during the experiences. The description of the literacy and the technology focus for each inquiry provides example of this, supporting Durrant and Green's (2000) assertion that technology should support rather than become the learning.

The interrelationship between the language modes became evident in each inquiry. No single inquiry was able to be located as just writing, just reading or talking and listening. As example, in the third inquiry, while the focus was on the development of talking and listening, powerful writing experiences also emerged. Walsh, Asha and Sprainger (2007) remind us that literacy users engage the language modes simultaneously when interacting with technology (for example, digital texts).

In each inquiry classroom, episodes typical to a regular literacy block were evident. The familiar routines, with the purposeful incorporation of technology enabled unique innovation of learning experiences. For example, the language of typical classroom routines bound the description of teaching and learning activities provided in inquiry 1 as episodes of modelling, joint construction and guided experience are described. The literacy learning is shaped by the literacy practices (Street, 1995) and literacy events (Heath, 1983) within the classroom.

Each teacher within the inquiry designed learning experiences that afforded students opportunities to direct their own learning. As the students engaged with the tasks, their interpretations informed subsequent teaching decisions. For example, throughout the first

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inquiry, the teaching and learning experiences arose from the students' perceived needs as the learning pathways were negotiated. In the second inquiry, teacher and student conferencing throughout the process informed students' decisions about text construction. The partnerships evident between teachers and students in each inquiry demonstrate the value placed on the unique experiences and practices that each student brings to the classroom (Nixon & Comber, 2006).

Concluding Reflections

The educators involved with the different inquiries embedded within this school-based project were challenged to consider ways that technology can be included within classroom literacy experiences. From our findings, the inquiries demonstrate how individual teachers have worked within a whole school focus as technology is examined in connection with the needs of the learners within the school and the pedagogical understandings and beliefs of the educators. The students in these classrooms negotiated their learning pathways with the close attention of their teacher, providing evidence of learning and direction for teaching.

The findings of this inquiry provide interesting challenges for teachers supporting literacy learning in a range of settings.

- Each teacher in this inquiry interpreted their challenge differently in their classroom, but literacy learning remained at the fore. For teachers working with younger children, or in culturally diverse settings, this interpretation will need to take into consideration the specific and unique needs of these learners to suit both the teacher's philosophy and the context of the classroom.
- Drawing on one's own beliefs and the needs of the children provides teachers with opportunities to embrace the out of school practices of their students in creative and

imaginative ways and to embed them in the pedagogically sound literacy block practices enacted within the classroom.

- This inquiry confirmed what is known about the interrelated nature of reading, writing, talking and listening and the ways that learners use the modes simultaneously. For those working with very young children, those with English as a Second Language or children with diverse needs, other considerations must be taken into account in order to capitalise on children's strengths in each of the modes and to develop areas of need.
- The technologies used in this inquiry are accessible (in our experience) in most educational contexts. We argue that it is not the technology alone that is powerful; rather it is the ways it is embraced within classroom pedagogies. In these instances, it is the teachers' literacy beliefs and philosophy that drives practice.

In meeting the needs of learners today, the challenge becomes being able to conceptualise how technology may look in classroom learning experiences. The inquiries show that it is insufficient to focus on technology alone, rather, the focus needs to be grounded within 'good' literacy practice with a vision of how it can be supported by technology. Educators are challenged to modify and modernise their practices (Labbo, 2005). Although technology may be old, outdated or even superceded (for example, the ideas or the software applications available), the reality for schools is that this is often the technology they have access to. The inquiries show that of greater importance is the ways available resources are accessed, manipulated or even reinvented to complement pedagogical understandings. Our challenge as educators is to find 'new' ways of using technology, rather than falling into the trap of using 'new' technologies in 'old' ways.

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