The Role of Teacher Inquiry in Helping Prospective Teachers Untangle the Complexities of Technology Use in Classrooms

Kara Dawson

Abstract

The objective of this research was to explore how authentic technology use and teacher inquiry may coalesce during curriculum-based, technology-enhanced field experiences for prospective teachers. Thirteen inquiries were analyzed using qualitative analytic procedures (Rossman, 1998). Results suggest that teacher inquiry may serve a variety of roles during curriculum-based, technology-enhanced field experiences including (1) as a lens through which to consider student learning, (2) as a bridge between content learned in university courses and authentic practices and (3) as a light bulb for conceptual change. This study suggests the positive outcomes of merging teacher inquiry and curriculum-based, technology-enhanced field experiences warrant further study. As such, the article proposes development of a codebook or heuristic designed to provide a coordinated analysis of multiple inquiry results.

Introduction

Nearly a decade of research supports the importance of providing prospective teachers authentic opportunities to use technology in classrooms (Cooper & Bull, 1997; Strudler & Wetzel, 1998; Dexter & Riedel, 2003; Grove, Strudler, & Odell, 2004; Jacobsen & Lock, 2004; O'Bannon & Judge, 2005; Ryan, 2003). The ProTeach (Professional Teacher) program at the University of Florida has offered curriculum-based, technology-enhanced field experiences for prospective teachers since 2001. The goal of the experiences has always been to merge experiences with reflective activity to promote professional growth in technology integration. During the first two years of the experiences journaling was used to promote reflective activity. Research overwhelming showed that prospective teachers in the field experiences failed to synthesize the integration of technology with the inherent complexities of teaching (Dawson, 2006; Dana & Dawson, 2005; Dawson, 2005). In fact, their reflective activity often epitomized criticisms of teacher reflection such as focusing on logistical and classroom management issues, ignoring contextual factors, supporting individualistic thinking rather than collaborative sharing and facilitating shallow thought unaccompanied by action (Zeichner, 1996). In addition, they failed to consider how or if technology integration influenced student learning, a key criticism of our field (Oppenheimer, 2003).

Given that if prospective teachers merely "do [a] field experience without thinking deeply about it, if [they] merely allow [their] experiences to wash over [them] without savoring and examining them for their significance, then [their] growth will be greatly limited." (Posner, 2005, p. 21) modifications to the reflective component of the field experiences were essential. During the past two years teacher inquiry, a strategy for helping educators through a systematic, intentional study of their own professional practice, has been implemented during the field experiences. This exploratory study examines the roles teacher inquiry can play when used by prospective teachers during curriculum-based, technology-enhanced field experiences.

Context

The curriculum-based, technology-enhanced field experiences are developed in conjunction with leaders in the local elementary schools. During these experiences each prospective teacher is assigned to a practicing teacher based on an application form completed by both parties that outlines curriculum interests, technology skills, and goals for the experience.

The relationship between prospective and practicing teacher is based on the notion of collaboration rather than on an expert/novice relationship. Each pair pools their experiences and knowledge to develop activities, projects, and strategies that support student learning and that improve both partners' ability to integrate technology into the curriculum. Prospective teachers and their inservice partners are encouraged to consider a variety of ways in which technology may be used in the classroom. Table 1 (page 6) is provided to prospective and practicing teachers as a catalyst for conversation and planning. The university instructor (who has experience as a K–12 teacher and teacher educator) and leaders within the local elementary schools provide guidance, support and advise at this stage as well. The level of involvement within the elementary schools varies by context, but each school has a contact person who interfaces with university faculty. On average, prospective teachers are in the field six (6) hours per week and schedule their work based on their inservice teachers' schedule.

Since 2004, teacher inquiry has been used to support prospective teachers as they systematically and intentionally study their own practice during these experiences. In addition to their fieldwork, students attend a series of three 3-hour seminars/workshops designed to support and guide their teacher inquiry. The first seminar provides an overview of teacher inquiry. After approximately four weeks in the field, the second seminar focuses on helping the prospective teachers finalize their plans for technology implementation, and define a question or wondering to guide their inquiry. The third seminar is offered in a workshop format, allowing each student to fine-tune their wondering and develop an inquiry plan including strategies for data collection and analysis and a time-line for completion. Finally, when prospective teachers complete data collection and begin analysis, the course instructor meets individually with each course participant to help support their analysis. A text entitled *The reflective educator's guide to classroom practice: Learning to teach and teaching to learn through practitioner inquiry* (Dana & Silva, 2003) is used to help reinforce the process. Table 2 (page 7) provides an overview of the recursive steps followed during the inquiry process.

Literature Review

Field experiences have been a hallmark of teacher education programs for decades (Conant, 1963; McIntyre, Byrd, & Foxx, 1996). The need for field experiences that afford prospective teachers opportunities to use

Table 1: Catalyst for Conversation and Planning

Possible Ways to Integrate Technology		
We created this table in an effort to ensure that technology is a part of what is already happening in the classroom instead of apart from it. Please note that these uses are NOT mutually exclusive and the same lesson, project, or activity may incorporate two or more uses simultaneously. Before making any decisions be sure to ask the "Is it worth it?" questions. That is, "does technology enable you to do something you could not do before?" or "Does technology enable you to do something you could do before but better?" (Harris, 1998) and be sure to start your planning with the curriculum.		
Using technology to support all students *	***Using technology in classroom instruction ****	***General uses ****
Support a struggling reader	Content-specific software in a whole group setting	Technology to improve teacher productivity
Support a struggling mathematician	Content-specific software in a small group setting	Technology to support teacher communication
Meet student needs with assistive technologies	Generic software in a whole group setting	Technology to support teacher planning
Meet the needs of students with differing "intelligences"	Generic software in a small group setting	Technology to improve delivery of instruction
Meet the needs of visual, auditory and/or tactile learners	Alternative assessment strategies	
Meet the needs of an ESOL student(s)	Whole class projects	
Meet the needs of a gifted student(s) in a regular classroom	Small group projects	
Meet higher levels of Bloom's taxonomy	Interdisciplinary projects	
	Authentic projects	
	Daily uses	
	Differentiated instruction	

**The technology may be used by teachers or by students.*

technology in authentic classrooms situations has received increased attention over the past decade from both scholars (Cooper & Bull, 1997; Strudler & Wetzel, 1998; Dexter & Riedel, 2003; Grove, Strudler, & Odell, 2004; Jacobsen & Lock, 2004; O'Bannon & Judge, 2005; Ryan, 2003) and educational organizations (NCATE, 1997; NCATE, 2002; Thomas, 1999; USDOE, 2001). Many states, including Florida, require that prospective teachers have firsthand experiences integrating technology in classrooms prior to graduation.

A variety of strategies have been implemented to provide such authentic experiences for prospective teachers including requiring technology integration in student teaching experiences (Strudler & Grove, 2002; Dexter & Riedel, 2003), working within existing Professional Develop Communities (PDCs) to integrate technology in pre-internship experiences (Yendol-Hoppey, Dawson, Dana et. al., 2006) linking field experiences to methods courses (Glazewski, Berg, & Brush, 2002), creating teams of university faculty, clinical faculty and preservice teachers to explore and develop effective uses of technology in K–12 classrooms (O'Bannon & Nonis, 2002), using microteaching experiences to simulate field experiences (Dawson, Pringle & Adams, 2003), changing semester-long educational technology courses to intensive school-based workshops (Hernandez-Ramos & Giancarlo, 2004), providing competitive grants for university faculty, classroom teacher and student teachers to collaboratively develop innovative uses of technology (Jacobsen & Lock, 2004), enabling vicarious field experiences via videoconferencing (Knight, Pederson & Peters, 2004), developing communities of technology-using teachers in urban schools (Radinsky, Lawless & Smolin, 2005), and creating separate technology-based field experiences within programs (Dawson & Nonis, 2000; Schmidt, 2001).

This research is situated within curriculum-based, technology-enhanced field experiences for prospective teachers. The experiences are grounded in the concept of simultaneous renewal (Goodlad, 1994; Clark, Foster, & Mantle-Bromley, 2005). That is, practicing and prospective teachers function as both teachers and learners as they simultaneously improve their instructional practices via authentic tasks related to technology integration. They also embody the concept of situated learning in that they enculturate prospective teachers into a community of practice (i.e. the teaching professional) and epitomize learning through "legitimate peripheral participation in communities of practice" (Lave,Wenger & Pea, 1991, p. 31). Yet, regardless of the strategies used and theoretical frameworks employed, if prospective teachers merely participate in field experiences without carefully exploring them, their professional growth is limited (Posner, 2005).

Previous research related to these experiences substantiate Posner's claim and suggest that prospective teachers need scaffolding as they untangle the inherent complexities associated with integrating technology in elementary classrooms (Dawson, 2006; Dana & Dawson, 2005). Thus, the inquiry component of the field experiences builds on the belief that encouraging teachers to systematically and intentionally study their own practices leads to a series of benefits related to professional growth including improved practice, heightened professionalism and activism for positive educational change (Carr & Kemmis, 1986; Cochran-Smith & Lytle, 1993). Specifically, Dana and Silva's model of teacher inquiry (2003) is implemented during the field experiences to support prospective teachers as they systematically and intentionally study their technology integration practices.

Dana and Silva's model of teacher inquiry (2003) begins with prospective teachers defining a "wondering" or "burning question" that emerges from "passions" within practice. Most "wonderings" are derived from one of eight passions identified by Dana and Silva (2003) after their work with hundreds of prospective and practicing teachers. These passions occur at the nexus of the complexity of teacher's work and their real-world dilemmas and include inquiries related to (1) a specific child or group of children, (2) the curriculum, (3) content knowledge, (4) teaching strategies and techniques, (5) beliefs about practice, (6) personal/professional identities, (7) social justice and (8) context.

The next step in the process involves developing a plan for data collection through such mechanisms as journals, student work, interviews with students, and field notes. The key during this process is to make sure the data collection strategies are a part of rather than apart from daily teaching and learning. In addition, the inquiry process requires prospective teachers to collect data via relevant literature searches.

Next, the prospective teachers analyze their data in relationship to their wondering to develop a picture of their learning. This analysis encourages prospective teachers to synthesize a variety of data sources that may have previously been available but untapped in the classroom. Finally, prospective teachers take action to implement what was learned through their investigation, and share the results of their work with other professionals.

Teacher inquiry has long been recognized in the general teacher education literature (Carr & Kemmis, 1986; Cochran-Smith & Lytle, 1999; Hubbard & Powers, 1993) for its ability to support teachers as they intricately intertwine teaching experiences and systemic, intentional inquiry (Dana & Silva, 2003). Yet, its use in curriculum-based, technology-enhanced field experiences for prospective teachers is novel. This exploratory study focuses on the roles teacher inquiry may play when used by prospective teachers during such experiences.

Methods

The overarching research question for this exploratory study is "What roles can teacher inquiry play when it is used by prospective teachers during

Table 2: Overview of Inquiry Process—Modified from Dana & Silva (2003)

Step*	Description
Defining a wondering	Prospective teachers identify a burning question, concern or wondering that arises from participation in curriculum-based, technology-enhanced field experiences. The wondering is often described to prospective teachers as a passion or something about which they lay awake at night thinking. They describe their wondering and how it came about.
Developing a plan to collect data	Prospective teachers are guided to develop a data collection plan that fits with what is going on in the classroom. Inquiry should integrate with classroom happenings rather than become separate from them. The goal is to help prospective teachers think about the multiple forms of data available to them in their classroom. One data collection strategy must be a literature search related to the wondering. Other data often includes student artifacts, test scores, journals, informal interviews, and rubric-type assessments.
Analyzing data	Prospective teachers are supported as they develop a plan for making sense of the data collected. They are encouraged to use systematic strategies that directly relate to the wondering.
Presenting findings	Prospective teachers present their findings (often in terms of themes, pattern, categories, assertion, or metaphors) in written format and via a presentation at the annual Teaching, Inquiry and Innovation Showcase, a regional event recently recognized as an exemplary practice by the Florida Association of Staff Development.

curriculum-based, technology-enhanced field experiences?" This question is exploratory in nature (Krathwohl, 2004) and the data sources were final inquiry papers completed by 13 prospective teachers participating in curriculum-based, technology-enhanced field experiences in six elementary schools. The inquiry papers were approximately 15–20 pages in length and included sections related to the background or context of the inquiry, personal experiences leading to the "wondering" or inquiry question, a plan for gaining insight into this wondering (including a brief literature review and data collection and data analysis strategies), findings from the inquiry and a conclusion in which prospective teachers assessed the outcomes and made plans for future work. The following inquiry abstracts are provided to give readers a feel for these inquiries. Stake's concept of instrumental cases (2000) has been used in a previous article to take a more in-depth look at specific inquiries (Dawson & Dana, 2007). The purpose of this research is to identify the roles teacher inquiry may play in curriculum-based, technology-enhanced field experiences.

> Example 1: Project-based learning is said to have positive influences on student learning through increased involvement, motivation, and achievement. However, how do we know students are truly making strides that could not be achieved by more traditional teaching strategies that require less planning, time, and hands to implement? My inquiry project began by looking at the influence of project-based learning (with integration of technology) on different levels of Bloom's taxonomy and extended itself into how group dynamics influence the learning of its students.

> Example 2: My goal as a teacher is to meet the challenges of students with diverse needs. I believe that in many situations technology can be used practically and meaningfully to support curricular goals while simultaneously meeting the unique needs of students. My inquiry involves what I learned about a first-grade student with autism and how technology can enhance and support one of his greatest challenges: communicating with others academically and socially.

Data were analyzed using qualitative analytic procedures (Rossman & Rallis, 1998). First, each inquiry was read in its entirety to establish familiarity. Then, the data were organized in a three-column table to make the data more manageable (See Table 3, page 8).

Next, themes within the inquiries were preliminarily identified and data from the table were initially coded. Evidence within each data source was reviewed again and appropriately coded. Finally, the data was read in its entirety again to extract salient "snippets and segments of data" (Rossman & Rallis, 1998, p. 180) supporting (or disconfirming) each theme.

Results

Data analysis suggests that teacher inquiry may serve a variety of roles during curriculum-based, technology-enhanced field experiences including (1) as a lens through which to consider student learning, (2) as a bridge between content learned in university courses and authentic practices and (3) as a light bulb for conceptual change.

Teacher inquiry may serve as a lens through which to consider student learning

Eleven of the 13 inquiries analyzed gave specific attention to issues related to student learning as a result of technology integration efforts. This is significant given that student learning was rarely considered by prospective teachers during pre-inquiry field experiences (Dawson, 2006). Table 4 (page 9) provides a break down of these inquiries based on the primary "passions" identified by Dana and Silva (2003).

The majority of inquiries focused on student learning in whole class settings. For example, 5th grade students participated in a project-based learning activity in which they were responsible for creating a field guide and documentary about plants and animals on the school's campus. The project, appropriately titled *Overhead and Underfoot*, required students to identify plants and animals on the school's campus and create brochures and a video documentary about them. In addition, students were to identify an important environmental message they learned during the process. A variety of technological resources such as digital microscopes, the Internet, word processing programs, digital cameras and camcorders, digital video editing software and DVD burners were used in combination with more traditional resources such as library books, hand drawn storyboards and journals to complete this project-based, authentic learning experience.

Students' work was highlighted to authentic audiences at the school's Curriculum Fair and at a conference at our local museum of natural history.

On the surface this learning experience would receive praise from most administrators and parents; however, this prospective teacher's passion for knowing whether the experience really made a difference in student learning led her to explicitly explore student learning during this project-based activity. Interestingly she traced this passion back to her days as an elementary student. Her inquiry opens with the following paragraph:

> … During my elementary school years I remember being the "ideal" student—well behaved, intelligent,

Table 3: Example of Data Organization

Name	Wondering	Findings
Laura	What similarities and differences emerge when integrating Hotlists, Scavenger Hunts and student-directed Internet searches into the curriculum?	**Teacher Goals and Lesson Objectives** Internet strategies must be varied based on teacher goals and lesson objectives **Student Characteristics & Preferences** —Internet strategies must be varied in order to meet the individual needs of each student -Student motivation and on task behavior increase when Internet strategies match their personal preferences **Skills** —Internet search strategies vary in the skills they require of students. **Safety** —Internet strategies range in the amount of safety they provide students —Teachers must be prepared with alternative lessons for students who cannot participate in Internet searches. **Time considerations** Time allotment is a factor in selecting the most effective Internet strategy Some strategies demand more skills of students than others and require teachers to spend time teaching these skills
Crystal	What happens to students' learning experiences when they begin to use technology as a tool versus a toy?	**Time** The overall feeling gained from the students was specifically that through using the Internet for research their projects would be completed faster **Collaboration** I found that the interactions by the students were promoted by the use of technology **Student Learning** —The effectiveness of the learning is dependent upon the activity. As a tool, technology is most effective when technology assignments are geared toward the higher levels of Bloom's Taxonomy —Technology can be used as a motivator for learning —Student responsibility, exploration and authentic learning were also increased through the use of technology **Scaffolding** —Using technology created time and space for teachers to observe students learning and to work with students one-on-one —Scaffolding provided students with a chance to share their progress toward completing the assignment at different phases with their teacher and prove their quality of work in a meaningful way **Bias** There were three types of bias frequently noted: gender, at-home computer use, and language

> and always on task. I would complete all my work, study hard, and pass every test. However, looking back to those years I can only remember isolated instances of learning. I can remember making waves and tornadoes using soda bottles, participating in the Tropicana Speech Contest, and learning about Native Americans and dressing up in costumes and sitting in tents. Did I learn as much about concepts centered on these topics as I did through traditional forms of learning? Of course I did, but do I remember them as vividly as I remember these instances? Clearly I remember these encounters with active learning more than the many hours I spent doing seat work and taking tests.

She continues to describe her own experiences and integrate literature on the impact of project-based learning. Her introduction ends in this way:

> My only concern about this unit centers on whether or not students will learn as much with this project-based method as they would with the more traditional methods. This concern, which can be seen in my reflections of my own elementary school days and my years as an undergraduate student, is what sparked my interest and led me to the following wonderings:
>
> *Will this project-based learning produce a significant impact on students' learning at various levels of Bloom's taxonomy?*

She then collected data from a variety of sources from within her classroom environment including a teacher journal, student journals, digital pictures of group work, a project rubric and informal interview with the students. As she analyzed her data she developed a coding system to help her organize her data. Her primary finding was that "Sophistication of student knowledge increased as students progressed through stages of project development." For example, during an early stage of the project students took the following notes on the white stokesia. The inquiry notes that the group "had four bulleted points, none of which pertained to why plants are important. They simply stated facts." (See Figure 1)

Yet, by the time the documentary was filmed the student had moved beyond the mere facts through several iterations of their storyboard and created an environmental message to accompany the facts about the white stokesia. (see Figure 2)

Through this and numerous other in-depth analyzes of student work, the prospective teacher concluded that

> Throughout the process of this inquiry I have realized that project based learning has the potential to be a positive experience for all involved. Students are actively involved in learning and are participating in experiences that in fact do allow them to transfer their knowledge to various levels of Bloom's taxonomy… However, this is not to say that traditional teaching methods are never appropriate, because there are areas of content that are perfectly suited to the more traditional learning environment. It is the teacher's responsibility to determine when and if project based learning will benefit his/her students, and in the case of my inquiry it was clearly a beneficial instructional method.

She concludes the inquiry paper by highlighting another "passion" she has developed during this process:

> … within the completion of this wondering a new wondering has begun to develop. Project based learn-

Table 4: Inquiries Addressing Student Learning

Focus of inquiry ("Passion")	Inquiry Title
Teaching Strategies/ Techniques	What happens when a Webquest is integrated into a second grade curriculum?
Teaching Strategies/ Techniques	What similarities and differences emerge when integrating Hotlists, Scavenger Hunts, and student directed searches into the curriculum?
Teaching Strategies/ Techniques	Project-based learning: What do they really learn?
Teaching Strategies/ Techniques	What happens when 3rd graders become teachers utilizing Power Point to instruct classmates about the solar system?
Teaching Strategies/ Techniques	How can cooperative groups with individuals of varying academic skill be supported by technology integration?
Curriculum	Creative projects and accountability: A look at the integration of academic skills, technical skills, creativity and empowerment issues in terms of assessment in the modern classroom.
Curriculum	What is the impact of technology when it is integrated in the curriculum and when it is not?
Curriculum	What happens to students' learning experiences when they begin to use technology as a tool versus a toy?
Curriculum	What is the relationship between students creating their own Web-based activities and their learning of content?
A Child	Technology and autism: How can technology support the communication skills of a first-grade student with autism?
A Child	Can the implementation of basic technology improve reading comprehension?

> ing is a wonderful tool for teachers, but I have noticed throughout this experience that although students learned more than I could have ever imagined, not all my students learned the same thing. Therefore, my future wondering stems from this inconsistency with exact concepts learned and how we, as teachers, can find a way to compensate for this phenomenon. Project based learning clearly provides benefits in learning and enhances the learning experience, but is there a way to be sure every student is gaining the exact knowledge every other student is gaining?

For this prospective teacher and others, teacher inquiry served as a lens to explicitly consider student learning via a process that involves analysis of data readily available within their classrooms.

Teacher Inquiry May Serve as Bridge Between Content Learned In University Courses and Authentic Practices

The process of teacher inquiry requires prospective teachers to synthesize what they have learned from the experience based on the data collected within their classrooms. Many of the findings presented in these inquiries paralleled concepts addressed in our university-based teacher education courses. Table 5 (page 10) provides examples of such findings.

Many educational technologists will look at the data in Table 5 and mumble "of course." Does it mean coursework at our university

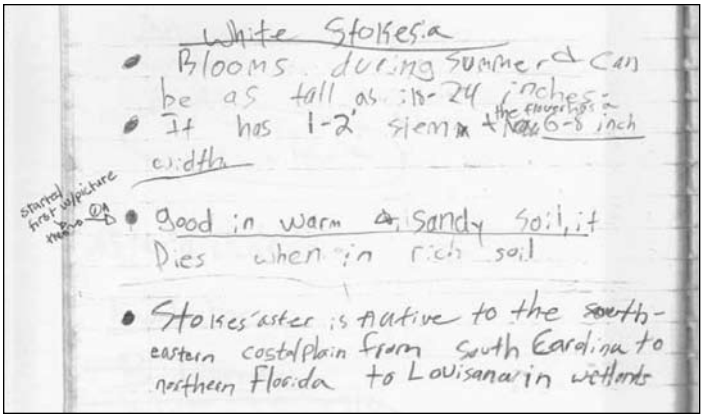
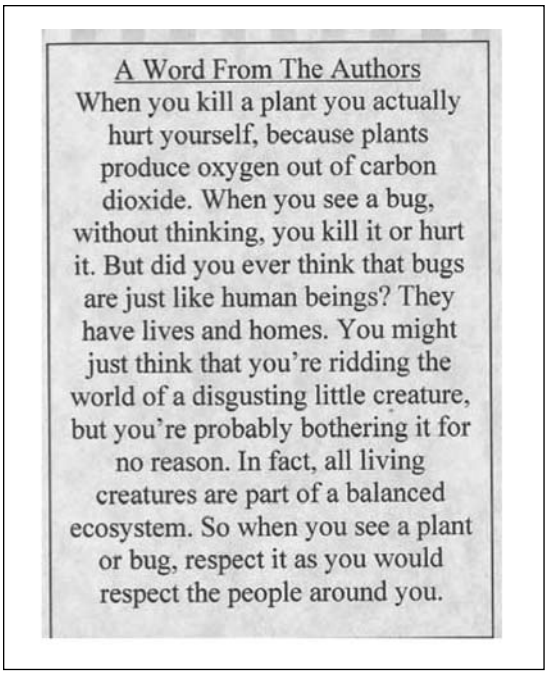


Figure 1: Data from student work early in project


A Word From The Authors

When you kill a plant you actually hurt yourself, because plants produce oxygen out of carbon dioxide. When you see a bug, without thinking, you kill it or hurt it. But did you ever think that bugs are just like human beings? They have lives and homes. You might just think that you're ridding the world of a disgusting little creature, but you're probably bothering it for no reason. In fact, all living creatures are part of a balanced ecosystem. So when you see a plant or bug, respect it as you would respect the people around you.

Figure 2: Data from student work later in project

is inadequate? Does it mean we fail to cover important concepts? Probably not. More likely, it gives credence to the importance of authentic experiences coupled with opportunities to systemically and intentionally study the experiences. In many ways, knowledge gained in university-based teacher education courses can be likened to the knowledge gained in the classroom portion of a scuba diving certification class as articulated by one prospective teacher:

> … I took many classes which included many projects; however, it has all really been theory until now. I have compared it to my S.C.U.B.A. lessons. I learned all the statistics and how to stay down, come up, etc.—the book work. Actually putting on the suit and getting in the water, it was a whole different story. They don't talk about peripheral vision being cut off, how cold the water is, how huge the barracudas look, how hard it is to actually not touch the reef with your foot etc. I had to dive over and over to finally become accustomed to the whole process; only then was I finally able to enjoy the dive for what it was.

Until given an opportunity to experience and inquire about technology integration in actual classrooms, technology integration is a theoretical concept to most prospective teachers.

Table 5: Inquiry Findings Related to University-Based Coursework

Student	Sample of finding related to content of university-based course
CM	The effectiveness of the learning is dependent upon the activity. As a tool, technology is most effective when technology assignments are geared toward the higher levels of Bloom's Taxonomy.
MD	When students have an opportunity to construct their own knowledge they can show an increase in excitement and enthusiasm for learning.
LS	Internet strategies must be varied based on teacher goals and lesson objectives
LF	Technology use should always relate directly to the curriculum
HD	Technology integration is a process that takes time.
LF	Take time to thoroughly plan in the beginning, this will prevent many problems later on.
LP	The role of teacher in cooperative groups is very important. [in technology-supported activities]

Teacher Inquiry May Serve As a Light Bulb for Conceptual Change

The process of systematically and intentionally studying their own practice led some prospective teachers to question deeply held (and sometime subconscious) beliefs about teaching with technology. For example, one prospective teacher realized through the inquiry process that:

> At the beginning of this project technology was leading me around by my nose, I felt out of control and vulnerable… [but now I understand the need to] to establish a vision of technology and purpose to adhere to.

This student moved from a technology-centered to a curriculum-centered view of technology integration. Her inquiry highlighted strategies she used to deal with the technical issues while keeping the focus squarely on the curricular goals. She notes that technical problems oftentimes push teachers' concerns about student learning to the "wayside" and thus they view technology integration "as more of a headache than a blessing." She vows to maintain a curriculum-centered focus as a practicing teacher and to provide support for her future colleagues to do the same.

Current research (Dawson & Dana, 2007) is taking a more in-depth look at teacher inquiry's role in promoting conceptual change for prospective teachers using the Cognitive Reconstruction of Knowledge Model (CRKM) (Dole & Sinatra, 1998). This model claims that conceptual change occurs via engagement that "involve[s] deep processing, elaborative strategy use, and significant metacognitive reflection" (p. 121). Initial analysis suggests teacher inquiry may be a viable tool to support conceptual change in some prospective teachers.

Summary of Findings

Teacher inquiry appears to serve a variety of different roles for prospective teachers participating in curriculum-based, technology-enhanced instruction. These roles include: (1) as a lens through which to consider student learning, (2) as a bridge between content learned in university courses and authentic practices and (3) as a light bulb for conceptual change. Each role contributes to prospective teachers' development as technology-using educators.

Discussion

The themes derived from this study, coupled with previous research demonstrating that teacher inquiry counters common criticisms about teachers' reflective activity (Dawson, 2006) and current research suggesting teacher inquiry supports conceptual change related to technology integration, (Dawson & Dana, 2007) suggest it is a topic worthy of continued research. As such, it should have a place in the conversations about a "proactive research agenda" (Schrum, 2005) designed to "develop acceptable evidence in educational technology" (Schrum et. al., 2005).

For example, one proposed topic for this new agenda is to explore "the relationships between the preparation of preservice teachers to use technology and the improvement of student achievement" (Thompson, 2005, p. 335). Of course, some of this exploration will relate to standardized test scores, however, preparing prospective teachers to explore this relationship in real classrooms with real students via teacher inquiry will likely lead to more calculated uses of technology in individual schools and classrooms than a meta-analysis of standardized scores. The results of this exploratory study suggest that when prospective teachers are supported through the inquiry process during technology integration, student learning comes to the forefront. Student learning is certainly one form of "acceptable evidence in educational technology research" (Schrum et. al, 2005).

Likewise, a disconnect between the interests of researchers and practitioners highlights a need for more school-based research that has implications for classroom practices (Bull et. al., 2005). Teacher inquiry within the context of curriculum-based, technology-enhanced field experiences is obviously connected to schools and provides insight into teaching practices with technology. Both of these (i.e. connections with schools and insights into teaching practices) were recently highlighted as avenues to "acceptable evidence in educational technology research" (Schrum et. al, 2005).

Finally, "[d]espite the growing capability and presence in schools, advanced technologies have had limited documented impact on school improvement. Changes in schools have been limited to "islands of excellence" rather than the transformed landscape that is the ultimate objective" (Thompson, 2005, p. 74). The reasons for this are complex; however, some culprits are the mutually exclusive nature of many technology reform efforts and the complexities of teaching. Often, technology is the focus of reform efforts while other aspects of teaching and the culture of teaching such as the first and second order barriers identified by Ertmer (1999, 2005) are ignored or glossed over. Helping prospective teachers navigate these complexities through teacher inquiry in an authentic context is one way to move toward a "transformed landscape" that focuses on what really matters—school improvement for increased student learning.

Conclusion

While the merger of teacher inquiry and curriculum-based, technology-enhanced field experiences meet many of the requirements outlined in recent editorials on a "proactive research agenda" designed to "develop acceptable evidence in educational technology," the exploratory studies to date supply only snippets and segments of data suggesting teacher inquiry provides positive outcome for prospective teachers participating in curriculum-based, technology-enhanced field experiences. Such exploratory studies are important in that they verify the importance of continuing research in this area. However, such studies can neither suggest causality nor predict the likelihood that a prospective teacher will experience a particular outcome. Nor can they provide a coordinated analysis of inquiry results.

A recent call to strengthen research within specific research areas via codebooks or heuristics (Dawson & Ferdig, 2006) is directly applicable to teacher inquiries conducted during curriculum-based, technology-enhanced field experiences. Such a common frame of reference for use during analysis "dramatically increase[s] both the generalizability of results and the synthesizability of research findings" (Cavanaugh, Gillan, Kromey, Hess, & Blomeyer, 2004, p. 25). This exploratory study provides data to suggest developing such a codebook is the logical next step to ensuring

research related to teacher inquiry within the context of curriculum-based, technology-enhanced field experience yields "acceptable evidence" that contributes to the body of knowledge about how prospective teachers are prepared to use technology in classrooms.

References

Bondy, E., & Ross, D. D. (2005). *Preparing for inclusive teaching: Meeting the challenge of teacher education reform.* Albany, NY: State University of New York Press.

Carr, W., & Kemmis, S. (1986). *Becoming critical: Knowing through action research*. Geelong, Victoria: Deakin University Press.

Cavanaugh, C., Gillan, K. J., Kromrey, J., Hess, M., Blomeyer, R. (2004). *The effects of distance education on K-12 student outcomes: A meta-analysis*. Learning Point Associates. Naperville, IL. Retrieved from http://www.ncrel.org/tech/distance/k12distance.pdf

Clark, R. W., Foster, A., & Mantle-Bromley, C. (2005). *Hybrid educators and the simultaneous renewal of schools and the education of educators*. Seattle, WA: Institution for Educational Inquiry.

Conant, J. B. (1963). *The education of American teachers.* New York: McGraw-Hill.

Cochran-Smith, M., & Lytle, S. L. (1999). The teacher research movement: A decade later. *Educational Researcher, 28*(7), 15–25.

Cooper, J. M., & Bull, G. L. (1997). Technology and teacher education: Past practice and recommended directions. *Action in Teacher Education, 19*(2), 97–106.

Dana, N.F., & Dawson, K. (2005). *Fostering prospective and practicing teachers' reflection on meaningful technology integration into instruction through teacher inquiry*. Association of Teacher Education. Chicago, IL.

Dana, N. F., & Silva, D. Y. (2003). *The reflective educator's guide to classroom research: Learning to teach and teaching to learn through practitioner inquiry*. Thousand Oaks, CA: Corwin Press.

Dawson, K., & Dana, N. (2007). When curriculum-based, technology-enhanced field experiences and teacher inquiry coalesce: An opportunity for conceptual change? *British Journal of Educational Technology, 38*(4), 656–667.

Dawson, K. (2006). Teacher inquiry: A vehicle to merge prospective teachers' experience and reflection during curriculum-based, technology-enhanced field experiences. *Journal of Research on Technology in Education, 38*(3), 265–292.

Dawson, K., & Ferdig, R. E. (2006). Commentary: Expanding notions of acceptable research evidence in educational technology: A Response to Schrum et al. *Contemporary Issues in Technology and Teacher Education [Online serial], 6(1).* Available: http://www.citejournal.org/vol6/iss1/general/article2.cfm.

Dawson, K. (2005). *Preparing preservice teachers to use technology: Are authentic experiences enough?* National Educational Computing Conference, Philadelphia, PA.

Dawson, K., & Nonis, A. (2000). Preservice teachers' experiences in a k-12/university technology-based field initiative: Benefits, facilitators, constraints and implications for teacher educators. *Journal of Computing in Teacher Education, 17*(1), 4–11.

Dawson, K., Pringle, R., & Adams, T. (2003). Providing links between technology integration, methods courses and traditional field experiences: Implementing a model of curriculum-based and technology-enhanced microteaching. *Journal of Computing in Teacher Education, 20(1),* 41–47.

Dexter, S., & Riedel, E. (2003). Why improving preservice teacher educational technology preparation must go beyond the college's walls. *Journal of Teacher Education, 54*(4), 334–346.

Dole, J. A., & Sinatra, G. M. (1998). Reconceptualizing change in the cognitive construction of knowledge. *Educational Psychologist, 33*(2/3), 109–128.

Ertmer, P. (2005). Teacher Pedagogical Beliefs: The Final Frontier in Our Quest for Technology Integration? *Educational Technology Research and Development, 53*(4), 25–39.

Ertmer, P. (1999). Addressing first- and second-order barriers to change: strategies for technology integration. *Educational Technology Research & Development, 47*(4), 47–61.

Glazewski, K., Brush, T., & Berg, K. (2002). Integrating technology into preservice teacher education: Comparing a field-based model with a traditional approach. In *Proceedings of Society for Information Technology and Teacher Education International Conference 2002* (pp. 1968–1972). Norfolk, VA: AACE.

Goodlad, J. (1994). *Educational renewal*. San Francisco: Jossey-Bass Publishers.

Grove, K., Strudler, N., & Odell, S. (2004). Mentoring toward technology use: Cooperating teacher practice in supporting student teachers. *Journal of Research on Technology in Education, 37*(1), 85–107.

Hubbard, R. S., & Power, B. M. (1993). *The art of classroom inquiry: A handbook for teacher researchers*. Portsmouth, NH: Heinemann.

Jacobsen, D. M., & Lock, J. V. (2004). Technology and teacher education for a knowledge era: Mentoring for student futures, not our past. *Journal of Technology and Teacher Education, 12*(1), 75–100.

Krathwohl, D. R. (2004). *Methods of educational and social science research: An integrated approach*: Waveland Pr Inc.

Lave, J., Wenger, E., & Pea, R. (1991). *Situated learning: Legitimate peripheral participation (Learning in doing: Social, cognitive & computational perspectives).* New York: Cambridge University Press.

McIntyre, D. J., Byrd, D. M., & Foxx, S. M. (1996). Field and laboratory experiences. In J. Sikula, T. Buttery & E. Guyton (Eds.), *Handbook of research on teacher education: A project of the association of teacher educators* (2nd ed.). New York: Macmillan Library Reference.

NCATE. (1997). *Technology and the new professional teacher: Preparing for the 21st century classroom*. Washington, D.C.: National Council for Accreditation of Teacher Education.

NCATE. (2002). NCATE: *The standard of excellence in teacher education*. Available: http://www.ncate.org/March 25, 2002].

O'Bannon, B., & Nonis, A. (2002). A field-based initiative for integrating technology in the content areas: Using a team approach to preparing preservice teachers use technology. In *Proceedings of Society for Information Technology and Teacher Education International Conference 2002* (pp. 1394–1397). Norfolk, VA: AACE.

O'Bannon, B., & Judge, S. (2005). Implementing partnerships across the curriculum with technology. *Journal of Research on Technology in Education, 37*(2), 197–216.

Oppenheimer, T. (2003). *The flickering mind: The false promise of technology in the classroom and how learning can be saved*. New York: Random House.

Posner, G. J. (2005). *Field experiences: A guide to reflective teaching* (6th ed.). New York: Allyn and Bacon.

Radinsky, J., Lawless, K., & Smolin, L. I. (2005). Developing technology-integrated field experience sites in urban schools: Approaches, assumptions, and lessons learned. *Contemporary Issues in Technology and Teacher Education* [Online serial], 5(2). Available: http://www.citejournal.org/vol5/iss2/currentpractice/article1.cfm

Rossman, G. B., & Rallis, S. F. (1998). *Learning in the field*. Thousand Oaks, CA: SAGE Publications.

Ryan, T. (2003). *Field experiences in instructional technology: Take a field trip to the k–12 schools.* Presented at EERA February 28, 2003. Available at http://pages.towson.edu/pryan/field/

Schmidt, D. A. (2001). *Simultaneous renewal in teacher education: Strategies for success.* Paper presented at the Society for Information Technology and Teacher Education, Orlando, FL.

Schrum, L. (2005). Editorial: A proactive approach to a research agenda for educational technology. *Journal of Research on Technology in Education, 37*(3), 217–220.

Schrum, L., Thompson, A., Sprague, D., Maddux, C., McAnear, A., Bell, L., & Bull, G. (2005). Advancing the field: Considering acceptable evidence in educational technology research. *Contemporary Issues in Technology and Teacher Education* [Online serial], 5(3/4). Available: http://www.citejournal.org/vol5/iss3/editorial/article1.cfm

Stake, R. E. (2000). Case studies. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (2nd ed., pp. 435–454). Thousand Oaks, CA: Sage Publications, Inc.

Strudler, N., & Grove, K. (2002). Integrating technology into teacher candidates' field experiences: A two-pronged approach. *Journal of Computing in Teacher Education, 19*(2), 33–38.

Strudler, N., & Wetzel, K. (1998). *Lessons from exemplary teacher education programs.* Paper presented at the Society for Information Technology and Teacher Education, Washington, D.C.

Thomas, L. (1999). National educational technology standards project. Retrieved November 3, 1999, from http://cnets.iste.org

Thompson, A. D. (2005). Scientifically based research: Establishing a research agenda for the technology in teacher education community. *Journal of Research on Computing in Education, 37*(4), 331–227.

USDOE. (2001, August 24, 1999). *Preparing tomorrow's teachers to use technology.* Retrieved February 15, 2001, 2001, from http://www.ed.gov/teachtech/

Yendol-Hoppey, D., Dawson, K., Dana, N., League, M., Jacobs, J., & Malik, D. (in press). Professional Development Communities: Vehicles for Re-shaping Field Experiences to Support School Improvement. *Florida Journal of Teacher Education*.

Zeichner, K. (1996). Teachers as reflective practitioners and the democratization of school reform. In K. Zeichner, S. Melnick & M. L. Gomez (Eds.), *Current reforms in preservice teacher education* (pp. 199–214). New York: Teachers College Press.

Kara Dawson is an associate professor in the School of Teaching and Learning at the University of Florida (UF). She currently serves as co-coordinator of the face-to-face and online Educational Technology programs at UF. (http://www.coe.ufl.edu/school/edtech). Her research relates to innovative uses of technology to support learning in face-to-face, online, and blended environments.

Kara Dawson
2403 Norman Hall
PO Box 117048
Gainesville, FL 32611
Phone: 352.392.9191, Ext. 261
dawson@coe.ufl.edu