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

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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

N
early 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 help reinforce the process. Table 2 (page 7) provides an overview of the recursive steps followed during the inquiry process.

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.

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, & Fox, 1996). The need for field experiences that afford prospective teachers opportunities to use...
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 intrinsically 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...
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 literature search related to the wondering. Other data often includes student artifacts, test scores, journals, informal interviews, and rubric-type assessments. The multiple forms of data available to them in their classroom. Inquiry should integrate with classroom 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,
... within the completion of this wondering a new wondering has begun to develop. Project based learning will benefit his/her students, and in the case of my inquiry it was clearly a beneficial instructional method. 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-
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 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

<table>
<thead>
<tr>
<th>Student</th>
<th>Sample of finding related to content of university-based course</th>
</tr>
</thead>
<tbody>
<tr>
<td>CM</td>
<td>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.</td>
</tr>
<tr>
<td>MD</td>
<td>When students have an opportunity to construct their own knowledge they can show an increase in excitement and enthusiasm for learning.</td>
</tr>
<tr>
<td>LS</td>
<td>Internet strategies must be varied based on teacher goals and lesson objectives</td>
</tr>
<tr>
<td>LF</td>
<td>Technology use should always relate directly to the curriculum</td>
</tr>
<tr>
<td>HD</td>
<td>Technology integration is a process that takes time.</td>
</tr>
<tr>
<td>LF</td>
<td>Take time to thoroughly plan in the beginning, this will prevent many problems later on.</td>
</tr>
<tr>
<td>LP</td>
<td>The role of teacher in cooperative groups is very important. [in technology-supported activities]</td>
</tr>
</tbody>
</table>

**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 do not 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
References


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