The connection between faculty teaching philosophies and beliefs and use of technology in elementary methods courses

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The connection between faculty teaching philosophies and beliefs and use of technology in elementary methods courses

by

Marina Gurbo

A thesis submitted to the graduate faculty
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

Major: Education (Curriculum and Instructional Technology)

Program of Study Committee:
Ann Thompson, Major Professor
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Iowa State University
Ames, Iowa
2006

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Graduate College
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This is to certify that the master’s thesis of

Marina Gurbo

has met the thesis requirements of Iowa State University

Signatures have been redacted for privacy
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CHAPTER ONE: INTRODUCTION

This chapter introduces the background of the research, a statement of the problem, a purpose of the study, and research questions. Also it discusses the significance of the study to the topic of the research.

Background

Traditionally, teacher education programs were held responsible for most new teacher graduates’ “limited knowledge of the ways technology can be used in their professional practice” (OTA, 1995, pp.165-166). A lack of modeling use of technology to pre-service teachers, while in a teacher training program, was reported repeatedly in several studies (Brush et al., 2001; NCATE, 1997; NCES, 2000; Trotter, 1999).

Although Colleges of Education generally require some type of introductory computer course in their teacher education programs (Handler & Strudler, 1997; Thomas, 1999; Wang & Holthaus, 1999), a gap is easily seen between knowledge and skills that pre-service teachers acquire through required technology courses, and the knowledge and skills they are expected to possess to successfully integrate technology into their teaching. One of the causes for poor teacher preparation in the use of technology includes the core teacher preparation curriculum, where most experiences with technology are focused in a single course that concentrates on learning to use technology rather than how to facilitate learning with technology (Grabe & Grabe, 1998).

Even if an introductory computer course increases the proficiency level of pre-service teachers, it only does so to the point of enabling technology utilization on the personal level; and one basic technology course does not provide the necessary experience that allows pre-service teachers to integrate technology into classroom teaching (Wang & Holthaus, 1999; Willis & de Montes, 2002; Willis & Tucker, 2001). In addition, the gap in pre-service teachers’ knowledge and skills in the use of technology in the classroom can be explained that in-service technology training has been software—rather than curriculum—based (Gilmore, 1995; Moursund & Bielefeldt, 1999; Yildirim, 2000).

Preparing new teachers who will be technology integrators requires a professional education curriculum infused with opportunities for pre-service teachers to learn with technology and to see models of technology use throughout their professional preparation
The ultimate goal of technology use in teaching and learning should be to advance student learning (Cooper & Bull, 1997). Consequently, national reports highlight the need to prepare teachers to use technology to enhance teaching and learning (Moursund & Bielefeldt, 1999; NCATE, 1997). Teacher education institutions are strongly encouraged to provide programs that model effective integration of technology into teaching and learning, and graduate candidates who are prepared technologically for the 21st century.

The experience of some teacher training institutions in providing pre-service teachers opportunities to learn how to use technology for teaching and learning demonstrates that having some formal modeling sessions (Brush et al., 2001) is not enough. The use of technology for teaching and learning activities must be modeled by faculty and classroom teachers as well (Carlson & Gooden, 1999; Duhaney, 2001).

There are several reasons found in the research literature why the use of technology should be modeled by teaching methods faculty and other instructors during the teacher preparation program. First, faculty members serve as role models and mentors for prospective teachers, and their use and attitudes towards educational technology can have a significant impact on future teachers’ implementation of technology in instruction (Parker, 1997). Second, the use of modeling to demonstrate technology integration activities is considered to be a highly effective strategy, not only for pre-service teachers, but also for students in K-12 classrooms (Faison, 1996; Kovalchik, 1997; Nicaise & Barnes, 1996). Third, rather than having to change teachers’ beliefs about technology from developed visions of teaching that do not include technology, early intervention in the development of a teaching vision should include the importance of meaningful technology use (Russell, Bebell, & O’Connor, 2003). This creates a clear implication for teacher educators to provide ample opportunities for pre-service teachers to experience a wide variety of instructional technologies for teaching, along with multiple examples of technology integration as a part of methods courses (Pierson & Cozart, 2004).

As some research shows, faculty are very interested in using technology for teaching and learning, and they believe that the use of technology can add value to the total educational experience and be significantly beneficial for learning (Beggs, 2000; Byron, 1995; Draude & Brace, 1999). However, there is evidence that while a small percentage of
the faculty, as early adopters of technology, integrate technology into their courses with little prompting and assistance, most faculty do not (Brace & Roberts, 1996). Several studies of the faculty's use of technology in instruction indicate that many instructors do not use it in any systematic or curricular way, if at all (Albright, 1997; Cafarella, 1999; Parker, 1997). At the same time, teacher training faculty play a critical role in shaping pre-service teachers' teaching philosophies and beliefs, including their visions of technology use in teaching practices (Lumpe & Chambers, 2001).

Understanding what may be some underlying reasons why faculty are still struggling with technology integration into their courses seems to be important, since, as previously stated, they serve as models to pre-service teachers. Some most frequently cited reasons why faculty are slow to adopt technology into their teaching include a lack of support, the reliability of equipment, lack of technology training, lack of time to practice use of technology, and lack of reward in the form of promotion and tenure (Albright, 1996; Byron, 1995; Jacobsen, 1997). In the Campus Computing Project (1999) survey, it was found that 75.8% of colleges and universities had instructional technology programs and 65.9% had campus support centers to assist faculty in bringing technology resources into their courses. At the same time, only 13.7% of these colleges and universities had a formal institutional program to recognize and reward the use of information technology as part of the faculty review process.

However, it is important to underline that concentrating mostly on external barriers (Ertmer, 1999), as a lack of computer skills, a lack of support, etc., is not enough to help faculty integrate meaningful use of technology into their teaching. It is critical to realize the complexity of technology infusion into faculty teaching. There are three levels of information technology adoption: 1) personal productivity aids, 2) enrichment add-ins, and 3) paradigm shift (Massy & Zemsky, 1995). Technology in higher education has operated almost entirely at levels 1 and 2 (Massy & Wilger, 1998). The paradigm shift is where faculty and their institutions reconfigure teaching and learning activities to take full advantage of new technology (Rogers, 2000). The infusion of technology into teaching and learning creates shifts in the skills required from instructional delivery to instructional design—with faculty responsible for course content and information technologists responsible for applying
information technology to the content (Anson, 1999, as cited in Rogers, 2000). It is also important that institutions realize that not only technology is important, but also the learning methods utilized to employ the technology (Turnoff, 1999, as cited in Rogers, 2000). Also, during the learning process of technology infusion into their teaching, faculty must reevaluate their previous, nontechnology experiences and teaching styles, and make personal decisions of how technology can contribute to their teaching and students’ learning skills. This also means that internal factors, such as teaching philosophies and beliefs, can become serious barriers, when faculty begin to actively integrate technology into their content areas (Ertmer, 1999).

Mostly, research in the area has been concentrating on institutional efforts that addressed mainly external barriers of technology adoption. Thus, more attention should be given to internal barriers connected with teachers and faculty beliefs about use of technology in their teaching. It is known that external barriers can be significant obstacles to achieving technology integration. However, internal barriers may reduce or magnify their effects (Ertmer et al., 1999; Miller & Olson, 1994). At the same time, internal barriers, such as teaching philosophies and beliefs, may impede meaningful use of technology (Ertmer et al., 1999). Also addressing teaching philosophies and beliefs, as internal factors that may affect use of technology, seems to be necessary, since there is evidence that if technology becomes a part of these beliefs, it is more likely to be incorporated into teaching (Becker & Riel, 2000).

**Statement of the Problem**

There is an obvious paucity of research that addresses internal factors of technology adoption into individual faculty teaching. Even less is known about how faculty teaching philosophies and beliefs are connected with their use of technology in teaching to pre-service teachers. Keeping in mind that both external factors and barriers have a principal impact on the process of technology infusion, this study will concentrate more on the internal factors that affect faculty decision-making about technology use and modeling it to pre-service teachers.
Purpose of the Study

The purpose of this study is to explore faculty use of technology in elementary methods courses in the teacher training program at a Midwestern university. This study will identify whether their teaching philosophies and beliefs determine how the faculty model use of technology to pre-service teachers.

Research questions

Under the predominant research question, how faculty’s modeling the use of technology to pre-service teachers is related to their teaching philosophies and beliefs, more specific questions include:

- How is technology used in elementary methods courses and what goals does it serve?
- What strategies do faculty use to model use of technology to pre-service teachers?
- How do faculty make decisions about use of technology in their courses?
- What are some factors that influence faculty decisions about technology use in the methodology courses?
- What are the concerns the faculty express, related to technology use, for their teaching and students’ learning?
- Do the visions of technology use and modeling it to pre-service teachers differ among faculty? How can these differences be explained?

Significance of the Study

For innovation to be integrated into the classroom, it should be adopted on both institutional and individual levels (Rogers, 1995). Achieving technology integration is a multifaceted challenge that requires developing different types of strategies in order to help teachers and teacher training faculty overcome the barriers, external and internal, that may impede meaningful technology use in teaching and learning (Ertmer, 1999). Understanding the nature of these barriers and how they may interact during the process of technology adoption is critical, since it has been found that barriers to technology integration do not disappear, but persist and even reappear with new technologies (Brzycki & Dudt, 2005).

Teachers who use technology in their classrooms experience face a lot of challenges, since they have to undergo major changes in the way they plan lessons, organize their classroom, instruct their students, and view themselves as teachers (Wepner, Ziomek, & Tao,
Teacher training faculty go through the same changes, and, as teachers, they need to see if technology is important and there is an educational value in its use. Then, it is more likely to become a part of their beliefs about teaching and may be incorporated into their teaching styles (Becker, 2000).

As there is no simple model of how to integrate technology on the institutional level (Pellegrino & Altman, 1999), there is no one conceptual framework or model about how individual faculty members undergo the transformation process of technology infusion into their teaching. It seems logical to suggest that faculty in each teacher training institution find themselves on the different stages of technology adoption. As a result, faculty form various subgroups characterized not just by a different level of technology integration, but also by how they formulate their needs and concerns related to technology infusion into teaching and learning (Brace & Roberts, 1996). Their teaching philosophies and beliefs, including also beliefs about the value of technology use for their teaching, may influence what role technology plays in their courses and classrooms.

Based on this logic, the ways faculty model the use of technology in methodology courses will depend on which stage of technology adoption they are in, how they define the need of technology use in their teaching and students’ learning, and what are their major concerns related to technology infusion into teaching and learning.

Willis, Thompson, and Sadera (1999), who acknowledge the fact that previous research on technology and teacher education contributes a lot to the general knowledge about technology infusion into teacher training programs, argue that more detailed case studies on diffusion efforts are necessary to capture the process of change—“how it [is] handled and how it occurs” (Willis, Thompson, & Sadera, 1999, p. 41). The same can be addressed to studying faculty’s individual efforts to integrate technology and model its use for pre-service teachers.

A lot can be learned from faculty’s individual stories of successful technology infusion into methodology courses and specific content areas, as well as from what barriers and pitfalls faculty must overcome during the process of adopting technology into teaching pre-service teachers. This knowledge will contribute to a better understanding of the holistic view of external and internal processes of technology infusion into teacher training programs,
that will help teacher training institutions design necessary strategies to support all faculty technology adoption (Jacobsen, 1997).
CHAPTER TWO: LITERATURE REVIEW

Chapter Two presents a literature review concentrating on the models of technology integration into teacher training programs, the importance of modeling technology use to pre-service teachers, teacher educators' roles in modeling use of technology in methods courses, and barriers faculty face when integrating technology into teaching their content areas. This chapter is structured to explain the literature review methodology, narrate the literature review findings, and discuss their importance for this thesis research.

Literature Review Methodology

The initial search of the literature identified few studies and articles that directly address the topic of this research. Consequently, a decision was made to begin with a wide search and collection of publications on technology integration into teachers training programs. The search engines and online databases, such as ERIC (Educational Resources Information Center) and Educational Research Abstracts (ERA) were used to obtain the relevant literature. Keywords, such as "technology" and "teacher training," were employed during the search process in combination with other words, such as "technology integration," "faculty/teacher educators use of technology," "methods courses," "barriers to technology integration," and "pre-service teachers."

The search revealed numerous journal articles and some dissertation studies. Each article and study yielded many references that were thoroughly reviewed and added to the collection. In addition, a manual search of most of the significant publications in the area was employed, which identified more articles related to the topic. From the body of literature, articles from peer-reviewed publications, some published dissertations, conference proceedings, and reports were found pertaining to this investigation.

Refereed articles from the following journals that presented results from empirical studies, case studies, or evaluation studies were considered relevant: Contemporary Issues in Technology and Teacher Education, Journal of Research on Technology in Education, Journal of Teacher Education, Journal of Technology and Teacher Education, Educational Technology Research and Development, and Action in Teacher Education.
The main findings from the literature were summarized during the selection process. Later, these findings were reviewed and organized under the categories that provide the structure for the following literature review.

**Models of Technology Integration into Teacher Training Programs**

Institutional efforts to infuse technology in teacher training programs have been well documented in the literature (Brush, 1998, 2001; Sprague, Koffman, & Dorsey, 1998; Stuhlman, 1999; Thompson, Schmidt, & Hadjiyianni, 1995; Willis, Thompson, & Sadera, 1999).

As noted previously, there is no single solution or model of technology integration into teacher training programs. “There is not a simple descriptive schema for what it takes to create the kinds of learning environments, courses, and integrated teacher preparation programs necessary to ensure that the next generation of teachers have the capabilities needed to function well in the 21st-century schools” (Pellegrino & Altman, 1997, pp.92-93). The complexity of the problems related to technology, teaching, and learning, along with a wide variety of characteristics that apply to different teacher preparation programs in the country, create a variety of possible strategic solutions that address the issues of technology infusion into pre-service teacher education. Considering this fact, much can be gained by studying selective cases of diffusing technology into teacher training programs. First, capture the process of change—“how it [is] handled and how it occurs” (Willis, Thompson, & Sadera, 1999, p. 41), and, second, to provide partial models for effective technology incorporation into teacher preparation programs (Pellegrino & Altman, 1997).

Teacher preparation programs have been split on how students should acquire technology competencies. According to Roblyer (1994), 50% of teacher training programs report that a technology course should be taught, in addition to adequate exposure in methods and content courses. The other 50% indicate that technology should be integrated into all coursework, making the need for a separate instructional course obsolete. Roblyer (1994) recommended that full infusion of technology into all methods courses and content coursework should be an eventual goal.

Hormund and Bronak (2000) noted the need for technology modeling to pre-service teachers in both university classrooms and in practical experiences. Wang (2000) asserted
that pre-service teachers should be provided with effective models of effective technology teaching that are situated, not only in the university setting, but in the field-based setting as well so that future teachers can be equipped with appropriate teaching styles to function effectively in the classroom with computers" (p. 7).

However, the infusion approach, successful in some institutions (Todd, 1993), did not appear to be working at that time. It was recommended that a separate instructional technology course, providing a combination of technical and instructional skills, be included with a problem-oriented approach, containing projects and meaningful instructional activities (Roblyer, 1994). Initially, an overall recommendation was made that technology should be taught independent of other courses, with technology modeled throughout other courses. Teacher education majors should be exposed to technology in their placement schools through observations and use of technology during student teaching.

The study of four pre-service teacher education programs (Mergendoller et al., 1994) being exemplary in their approaches to integrating technology—Vanderbilt University, University of Virginia, University of Northern Iowa, and University of Wyoming—identified three ways of using technology in these programs: 1) as a tool to make the reality of the classroom more accessible (e.g., video cases produced at Vanderbilt University), 2) to facilitate access to and communication with additional human and text or data resources (e.g., CD-ROM informational databases in the Curry School), and 3) as a means of enhancing traditional approaches to teacher-developed curriculum materials and instructional practices (e.g., an educational technology required course at all sites or exposure to technology-rich K-12 environments in Wyoming and Iowa).

The experience of the above mentioned colleges of education also portrays three common approaches to technology infusion into pre-service teacher preparation programs: 1) through a separate educational technology course, 2) through methods and some other core courses, and 3) through teaching field-based experiences. However, these institutions were especially successful in accomplishing these three components have become interrelated and educational technology has become an integral part of the teacher preparation programs (Mergendoller et al., 1994).
This goes beyond the traditional approach of offering a single course in using technology in education. While this required course may provide a useful foundation, it is clear that such a class, by itself, is inadequate to prepare teachers to use technology effectively (Moursund & Bielefeldt, 1999). However, the literature does not address the models of technology integration only from the point of view of how learning technology should be structured for pre-service teachers. Some conceptual models of how pre-service teachers should learn about technology provide theoretical frameworks for designing pre-service teachers experience with technology in teacher training programs.

Kovalchik (1997) found a useful approach, based on a more constructivist or constructionism theory, when elements from both competency-based models and integrative models are blended into a reflexive approach, where students use technology as both learner and teacher. “In this way, pre-service teacher education students are challenged through direct experience to generate personally relevant conceptions of technology” (p. 31).

Smaldino and Muffoletto (1997) also promoted a combination approach. Their model attempts to blend the existing single course with “the need to nurture technology application within methods and other courses” (p. 37). In this way students gain an understanding of technology use in a broad sense, with an in-depth examination of how technology supports learning in specific content areas.

**Models of Technology Integration into Methods Courses**

As research shows, addressing pre-service teachers use of technology in methods courses has proven beneficial to increase their level of awareness of how technology should be used for instructional purposes. In their study of 26 self-selected pre-service teachers, Pope, Hare, and Howard (2002) found that integrating specific technology into the elementary methods courses helped increase the students’ level of confidence. The model of instructional delivery used in this four method blocked course (science, math, language arts, and social studies) presented itself in a three-prong approach: 1) pre-service teachers were required to use technology as part of their teacher education programs, not as a prerequisite to it, 2) pre-service teachers were required to apply in their elementary classrooms what they had been taught, and 3) university faculty taught the blocked methods course by modeling use of technology for the pre-service teachers what they expected from the pre-service
teachers. The researchers emphasized the point that the pre-service teachers were taught in the way they were expected to teach and attributed the increased level of confidence of pre-service teachers to having been modeled specific technologies integration into the elementary classrooms.

Similarly, a pre-service technology course taught at the University of Victoria (Francis-Pelton, Farragner, & Riecken, 2000) proved to be very successful, since students have the benefit of instructors with expertise in a subject area, who can model using technology in that subject area. Students rated this course very highly, where their instructors modeled the use of technology in the elementary science, math, and social studies curriculums.

The importance of providing pre-service teachers with the opportunity to observe models of technology use in specific content areas, combined with the opportunity to have “hands-on” experience afterwards, has been recognized in a large body of research. Most of the studies represent evaluations of the projects sponsored by Preparing Tomorrow’s Teachers to Use Technology Program (PT3) Grant initiatives (Dawson & Norris, 2000; Nicaise & Barnes, 1996; Strudler et al., 2003; Wilkerson, 2003,). The findings from these initiatives highlighted the advantages of providing pre-service teachers with “hand-one” experience of teaching specific content areas with technology.

First, faculty modeling use of technology within specific content areas increases pre-service teachers’ confidence about their own abilities to teach these subjects with technology (Dawson & Norris, 2000; Strudler et al., 2003). The efforts of Project THREAD (Technology Helping Restructure Educational Access and Delivery) at the College of Education at the University of Nevada proved that redesigning the selected courses and providing support to faculty to identify technology applications that might fit into their current courses resulted in student teachers’ more frequent use of technology and higher levels of adoption during their practice (Strudler et al., 2003).

Second, pre-service teachers’ awareness of using technology within specific content areas increases when they have an opportunity to practice what they learn and practice the use of technology within the content area in the real classroom setting. The results of the Technology Infusion Project (TIP) at the Curry School of Education at the University of
Virginia (Dawson & Norris, 2000) suggest that field-based technology experiences can better prepare prospective teachers to meet expectations for integrating technology into their curriculums. The researchers again and again emphasized the necessity of addressing content-specific use of technology. They suggested that a TIP-like experience should be built into every program area (mathematics, English, social studies, and sciences) to focus more on technology applications for the specific content area. Dawson and Norris (2003) argued that "the need to create content specific technology experiences that are targeted toward different grade levels and content areas will become increasingly important" (p. 11).

Similarly, a "triad model" used in Baylor University (Wilkerson, 2003) demonstrates an approach of combining curriculum with technology applications to provide hands-one experience for their students. The model focuses on three areas of technology infusion—communication, productivity, and research/instruction—and applies technology to specific content methodology courses, general curriculum courses, and student teaching. The previously mentioned model, the "triad" model, emphasizes the importance for student teachers to be able to explore the role of technology by integrating university course work and field experiences.

Finally, communication about technology applications with instructors and practicing teachers is a critical component that contributes to a better understanding of implementing strategies and methods. One of the significant findings of the Nicaise and Barnes study (1996), which describes how technology became integral in redesigning a secondary mathematics methods class, was the importance of communication to create "an information-rich classroom" (p. 205). Using communication technologies, such as e-mail with classroom teachers, gave students a vehicle to share their thoughts with or pose questions to practicing teachers. From an instructor's prospective, the communication technology provided students with greater opportunities for reflection, discourse, and multiplies points of views (Nicaise & Barnes, 1996, p. 209). The findings of the previously described projects suggest that teacher candidates who have an opportunity both to observe and to communicate with practicing teachers' use of technology become more critical users of instructional technology (Nicaise & Barnes, 1996; Wilkerson, 2003).
To sum up, the research on technology integration into methods courses indicates that three components are essential to providing pre-service teachers with the opportunities to learn about the meaningful use of technology in the content areas. They are: 1) the need to see models of how technology can support teaching or learning in specific subject areas, 2) the need to have multiply opportunities to practice what they have been taught both in the methods courses and a real classroom setting, and 3) the need to reflect on the meaning of technology use and to share their thoughts. Integration of technology into pre-service teachers' field experiences, in addition to having hands-on experience in their methods courses, can become a solution regarding all three essential components, that can be combined to extend pre-service teachers experience with instructional technology and transfer their knowledge and skills into real classroom settings.

**Models of Technology Integration into Pre-service Teachers Field Experience**

Collaboration between universities and K-12 schools can be key components in helping shape pre-service teachers' visions of technology in instruction and close the gap between the potential of technology and the reality of classroom use (Wright et al., 2002). Field experience during the practicum or student teaching can provide pre-service teachers with the opportunity to observe modeling of technology use in a real classroom setting, practicing the use of technology, and discussing their concerns with their instructors, peers, and technology practicing teachers.

Several studies documented collaborative initiatives between universities and K-12 schools on technology integration into student teaching (Brush et al., 2001, 2002; Dawson, & Norris, 2000; Jayroe, Ball, & Novinski, 2001; Pierson & McNeil, 2000; Thompson & Schmidt, 2002; Welzel, Zambo, & Padgett, 2001; Wright et al. 2002). Some of these studies will be discussed further to elaborate on some common themes identified in their research.

Collaboration among pre-service teachers, in-service teachers, and faculty when discussing and planning technology use was found beneficial in a way of being able to enhance the pre-service teachers' ability to applied technology instruction in the school setting (Wright et al., 2002). In addition, pre-service students seemed to develop a better understanding of technology supported instruction, when they were introduced to technology
and teaching methods at the same time, and participated in classroom observations of technology using teachers (Shoffner et al., 2001).

The PT3 project at Arizona State University (Brush et al., 2003) focused specifically on providing the pre-service teachers with opportunities to develop, implement, and evaluate their own instructional activities that utilize technology effectively and appropriately in authentic situations. After participating in the modeling sessions related to their content area, the pre-service teachers were required to develop an instructional activity integrating technology and content. A vast majority of the participants responded positively about their ability to develop content-area lessons with technology integration and to generate ideas for integrating technology into the curriculum. The findings of the collaboration initiatives support the idea that combined, reflexive models of technology integration (Kovalchik, 1997) may be most effective in developing pre-service teachers’ visions of teaching with technology.

The findings of a two-year evaluation study of Goals 2000 Pre-service Technology Infusion Project (Beyerbach, Walsh, & Vannata, 2001) highlighted the pre-service teachers’ changes in their views of technology infusion from thinking that they would teach and learn about technology, to thinking how they would use technology to support student learning. Teams of teacher educators and K-12 teachers collaborated to infuse technology into their respective teaching context and to create links between these contexts by: a) hand-on experiences with computer technology to support constructivist teaching, b) two-way interactive videoconferencing between college courses and K-12 classrooms, and c) field experiences in technology-rich classrooms. Although the findings of these studies were positive in the way that technology-based experience can provide effective models to pre-service teachers in how to incorporate technology into classroom experiences, they also identified some common problems.

The importance of being able to observe and practice technology use in the content methods courses has been supported by the fact that the lack of student-teaching placement in the technology-rich classrooms with teachers, who actively model effective use of technology tools, was mentioned as a common problem (Mergendoller, 1994). In addition, a
lack of technology equipment in the field experience locations could also hinder pre-service teachers' development of visions of technology-supported instruction (Wright et al., 2002).

The fact that majority of faculty have not spent time in K-12 classroom for several years was found as a possible challenge for faculty since what they teach may be far from the real classroom situation (Stetson and Bagwell, 1999).

In relevance to this, collaboration between universities and K-12 schools becomes critical for providing pre-service teachers with more authentic, realistic experiences with using technology in the classrooms. Glazewski, Berg, and Brush (2002) found that pre-service teachers, who participated in field-based technology enhanced practice, rated their preparation to teach with technology as lower than their peers, who completed traditional university-based methods of instruction. It may be suggested that students who had “hands-on” classroom experience developed a more realistic understanding of all that is involved in teaching with technology.

Overall, the studies on technology integration models into pre-service teacher preparation illustrate there is no one simple solution and several initiatives, “campus-based” and “field-based,” should take place at the same time. In addition, more reliable documentation of these initiatives is important to provide evidence that they indeed affect the quality of preparation of teachers to teach with technology (Glazewski, Berg, & Brush (2002). What seems important for this thesis research is that the common goal of these projects and initiatives was to provide pre-service teachers with as many as possible effective models of use of technology in teaching content areas. This suggests that modeling must be critical for developing pre-service teachers’ understanding of technology integration into classroom practices and lack of modeling can become a barrier to developing pre-service teachers’ abilities to teach with technology. Therefore, problems, such as lack of opportunities for pre-service teachers to observe practicing teachers use of technology and also the limited access to technology in schools, suggest that faculty roles becomes crucial in providing teacher candidates with models of technology use in specific content areas. However, as some previously mentioned studies also confirmed, modeling by faculty, especially in the specific content areas, has not been sufficient (Brush et al., 2003; Dawson & Norris, 2000).
Before discussing why modeling use of technology is so important, it is necessary to look at barriers and challenges that faculty face when integrating technology into teaching their courses.

**Technology Integration Barriers and Challenges**

According to Albright (1996), Byron (1995), and Jacobsen (1997), the most common concerns faculty include are: (1) the reliability of the equipment and its technical support, (2) the availability of support staff, (3) faculty training in instructional technologies, (4) the lack of proper classroom design to support the use of technologies, (5) compatibility/platform issues, (6) whether technology saves time for the instructor or demands more time, (7) if use of and expertise in technology might increase chances for reward in the form of promotion and tenure, (8) attitudes toward technology, in general, (9) whether technology can improve teacher performance, (10) whether technology is an “enhancer,” or helps students learn, and (11) whether technology is a distracter to teaching and learning. Since the focus of this study is faculty use of technology in methods courses, some challenges, especially related to technology, teaching, and learning, seem more worthwhile to be discussed here.

When faculty moves to a practical stage of technology implementation, their overall concerns shift more from technical issues to their students’ learning and how technology affects this (Hord, Rutherford, Huling-Austin, & Hall, 1987). In addition, studies of early adopters of technology identified that main characteristics that distinguish this group from other categories of adopters is that early adopters are interested in technology itself, when later adopters, who are concerned primarily with teaching and learning, view ease of technology use as critical and want proven applications with low failure risk (Jacobsen, 1997).

Not surprising, more and more research literature that addresses the technology integration into teacher training expresses the urgent need for credible, reliable, and objective research information on the effective and efficient use of technology for pedagogy and learning (Abdal-Haqq, 1995; Baron & Goldman, 1994; Roblyer & Knezek, 2003; Schrum et al., 2005; Strudler, 2003). Researchers believe that many faculty are slow to adopt new technology, simply because they are not convinced that using it will improve their students’
learning (Neal, 1998; Reid, 1996). Thus, faculty must be shown there is a relative advantage to using technology in their teaching.

Hanger (2000) reported in his study that the primary reason that faculty chose to integrate technology into their teaching was because they thought it was the right thing to do to provide a better quality education to their students. In compliance with this study, Groves and Zemel (2000) also found that, after the reliability of equipment, improved student learning, increased student interest, and advantages over traditional methods of teaching were the most influential factors on faculty technology use in their courses.

It creates an implication for future research to provide evidence to teacher educators and also to pre-service teachers that technology "does no harm" and can often enhance students learning (Strudler, 2003). Roblyer and Knezek (2003) suggest:

Future researchers must address squarely the question of why teachers should use technology-based methods. The emerging theory base demands that studies look at technologies not as delivery systems, but as components of solutions to educational problems, and that research questions be stated in a way that contributions of methods can be examined and tested (p. 63).

Relative advantage must be clearly shown to teacher educators before it becomes a significant and ubiquitous component of teacher education programs. Without this, technology use in teacher education programs will continue to be peripheral (Swain, 2005). However, a more important finding for this study that emerged from the studies of faculty technology integration is that faculty teaching philosophies and styles can also be critical factors that enhance or hinder faculty technology use for teaching and learning.

In a follow-up study of four teacher training programs deemed to be exemplary in their approaches to teach pre-service teachers use of technology, Strudler and Wetzel (1999) found that pedagogical fit is another factor that influences faculty use of technology and students' opportunities learn with technology. This study confirmed that teacher training faculty must see the fit between their philosophies of teaching and learning, and technology applications; the faculty in the studied sites used technology more in their courses when it matched or enhanced their beliefs.
In a study of 15 teacher education faculty members, Swain (2005) investigated how the faculty make decisions regarding use of technology. Categories shown to affect their use of technology were teacher beliefs, the context of instruction, the nature of instructional task, and information about students. The study demonstrated that teacher education faculty weighted the use of technology and the perceived value added to their courses as a part of their goals. They also carefully weighed how the use of technology might mesh with the experiences pre-service teachers needed during that course. They were also careful how technology could benefit the teaching of specific concepts (Swain, 2005).

Although Becker’s (2000) study was about practicing teachers, it can also relate to teacher education faculty. He pointed out that if technology is important and there is an educational value in its use, then it is more likely to become a part of teacher’s beliefs about teaching and may be incorporated into teaching styles. His findings indicate a clear relationship between teaching philosophy and whether a teacher uses technology with students. At least two of the studies suggest that teachers who use technology in the classroom are more constructivist than teachers who do not (Becker, 2000; Dexter et al., 1999).

Addressing teachers’ beliefs, Lumpe and Chambers (2001) suggested these beliefs toward technology use are “the most likely form during time spent in the classroom either as teachers or students. These experiences help form teacher beliefs that may or may not be consistent with the literature about best practice” (p. 94). The other challenge, not been addressed much in the literature, is the change process that faculty must forego when infusing technology into their teaching.

In their study on K-12 teachers, Wepner and Tao (2002) found that teachers who use technology in their classrooms experience major changes in the way they plan lessons, organize their classroom, instruct their students, and view themselves as teachers. Later, these same researchers conducted a study on teacher educators and their perspectives about the shifting responsibilities of infusing technology in the curriculum (Wepner, Ziomek, & Tao, 2003b). Four general categories of shifting responsibilities emerged from the study: 1) a shift in the role of the instructor; 2) a shift in way how the instructors plan for instruction and
supervision; 3) a shift in actual instruction and supervision; and 4) a shift in the way the instructors monitor students’ progresses with technology infusion.

This means that infusion of technology permeates the entire teaching culture and involves change of previously developed, before technology, teaching philosophies and styles. This may be considered the most difficult barrier for faculty to overcome, since they are required to shape pre-service teachers’ beliefs about technology and effectively model meaningful practices, while they still are incorporating technology into their own teaching.

Developing effective strategies that help faculty, and as a result pre-service teachers, to find a place for technology within their values systems that includes their beliefs about teaching and learning seems to a critical issue, since the literature shows that some barriers do not disappear with time. Brzycki and Dduit (2005), after analyzing the results of the PT3 grant projects at three universities of Pennsylvania, concluded that the barriers to technology adoption—time, support, models, infrastructure, and culture—persist and even reappear with new technologies.

The findings from the literature provide an explanation why modeling use of technology becomes critical for pre-service teachers, since an opportunity to see and practice technology use in a meaningful context can be an effective strategy to help overcome the barriers related to their beliefs about use of technology for teaching and learning.

**Importance of Modeling Use of Technology**

Traditionally, technology training, for both pre-service and in-service teachers has focused on helping teachers overcome external, first-order barriers (e.g., acquiring technical skills needed to operate a computer). More recently, training programs have incorporated pedagogical models of technology use as one means of addressing the internal, second-order barriers (Ertmer, 1999). Teachers may face second-order barriers when they start implementing technology in meaningful ways. There, barriers, as discussed in the previous section, relate to teachers’ beliefs about teacher-student roles as well as their traditional classroom practices, including teaching methods, organizational and management styles, and assessment procedures (Ertmer, 1999). One of the ways of addressing these barriers is to provide teachers with opportunities to observe models of integrated technology use.
The need for models was recognized long ago and formulated by Hord et al. (1987) in the CBAM (Concern-Based Adoption Model). The Concerns-Based Adoption Model (CBAM) proposed by Hall, Wallas, and Dosett (1973) suggests these concerns, as well as the strategies for addressing them, will vary as implementation proceeds (Hall & Rutherford, 1983). However, the importance of change facilitators to provide models to users persists in the first four stages of concerns (Awareness, Informational, Personal, and Management) remain (Hord et al., 1987).

Since teachers and faculty face the same problems, when integrating technology into their teaching practices, faculty have the same need to see how technology can be meaningfully used for teaching and learning. Brzycki and Dudt (2005) stated that faculty need to see examples of how technologies can be applied to their specific disciplines in order to be able to model appropriate examples for future teachers. The collaboration initiatives describe in the previous sections can be one of the ways how faculty may develop a vision of how technology should be used in K-12 classrooms (Brzycki & Dudt, 2005; Strudler et al., 2003).

In case of training pre-service teachers, it is important to address technology infusion-related concerns as early as possible. As Russell, Bebell, O’Dwyer, and O’Connor (2003) suggest, rather than having to change teachers’ beliefs about technology from developed visions of teaching that do not include technology, early intervention in the developing of the teaching vision should embed in it the importance of meaningful technology use. Although a number of typical college-aged students have grown up with computers as a normal part of their lives, they have not yet considered what an effective technology-rich classroom looks like.

This creates a clear implication for teacher educators to provide ample opportunities for pre-service teachers to experience a wide variety of technology of educational technologies for teaching, along with multiple examples of technology integration as a part of methods courses (Pierson & Cozart, 2004). Modeling technology-rich strategies by instructors will strengthen attitudes towards beliefs about the benefits of using such technology (Abbott & Farris, 2001; Russell et al., 2003). In addition, observing meaningful uses of technology can help future teachers understand what it takes to translate it into
classroom practices (David, 1996). “Models can provide important information about how to complete a complex task, as well as increase the confidence of those who observe them. Given the complexity involved in creating and implementing technology-rich lessons, it is likely that teachers (at all levels) will benefit from observing varying degrees of expert performance as they move toward more advanced levels of technology use themselves” (Ertmer, 2003, p. 126).

Modeling meaningful uses of technology in teaching and learning is considered to be one of the effective strategies to address pre-service teachers’ and faculty technology, and pedagogy-related concerns (Faison, 1996; Kovalchik, 1997; Nicaise & Barnes, 1996; Pope, Hare & Howard, 2002).

The University of Georgia’s efforts to integrate technology into their teacher education program (Schrum & Dehoney, 1998) demonstrates that with support, modeling, and proper training, pre-service teachers can experience success in using technology. The study found that attitudes towards the use of technology improved and confidence in their own abilities to use technology increased. The pre-service teachers were able to articulate potential uses of technology for their future classrooms.

To provide effective technology integration modeling, educational technology and methods faculty at Arizona State University collaborated to develop a set of model lessons which focused on a specific content area (language arts, social studies, mathematics, or science) and utilized different forms of technology to enhance the lessons (Brush et al., 2003). The formative evaluation of the model indicated that the modeling activities may have had benefits beyond simply providing the pre-service teachers with authentic examples of effective technology-integrated lessons.

Describing the PT3 grant activities at three universities in Pennsylvania, Brzycki and Dudt (2005) articulated how these activities addressed the barrier of a lack of models: a) faculty used a grant support to make innovative uses of technology in teaching and came to the attention of other faculty, b) faculty successful in technology integration helped train other faculty, and c) Technology Success Stories was written to recognize faculty’s efforts to integrate technology and extend the impact of these models.
It is generally acknowledged that first-order barriers can be significant obstacles to achieving technology integration, yet the relative strength of second-order barriers may reduce or magnify their effects (Ertmer et al., 1999; Miller & Olson, 1994). At the same time, beliefs (second-order barriers) may impede meaningful use, but first-order barriers may hinder actualization of more facilitative beliefs. Teachers and also faculty need effective strategies for dealing with both kinds of barriers.

Overall, the research suggests that modeling can be a very effective strategy to address the second-order barriers that faculty and pre-service teachers may have when starting to implement technology into teaching. The next section discusses some ways of modeling technology use employed by teacher training programs and teacher education faculty.

**How Technology is Modeled in Teacher Training Programs**

There are several approaches that teacher preparation programs take to provide pre-service teachers with the opportunity to observe models of technology uses for teaching and learning. They can gain access to models through structured on-site observations of technology-using teachers or via text-, video-, or Web-based case studies of technology-integrating teachers (Ertmer, 1999).

In the article that discussed the results of five projects, Ertmer (2003) pointed out that in all of these projects, modeling activities were developed almost implicitly within their community-based efforts. Faculty, in-service, and pre-service teachers worked together to create technology-infused lessons, and the modeling of technology occurred naturally, with more expert users modeling effective uses for more novice users. Still, in at least one instance, modeling was used in a very explicit manner to help pre-service teachers understand what technology-infused lessons might look like before creating and implementing such lessons themselves.

Willis and Tucker (2001) described efforts to redesign a required technology course for all elementary pre-service teachers in the Center of Excellence in Education at Northern Arizona University. In this case, pre-service teachers were “modeling” technology use themselves. The redesign was based upon the tenets of constructionism and provided the students with the opportunities of meaningful learning by allowing them to select a topic of
research (technology-related) and a grade level they are willing to teach. Students were
developing a usable piece of multimedia software that, in their opinion, may help their future
students learn the content. According to Willis and Tucker (2001), the pre-service teacher
training should provide students models, “willing to be innovative, risk-taking ourselves, to
explore new strategies, methods, and technologies” (p. 7). In their opinion, a course like that
should model: a) good practices in utilizing technology for higher-order thinking, b) relevant
and engaging activities, c) hands-on technology integration, and d) be more than just drill and
practice.

The other approach described quite often in the literature involves use of electronic
devices to model practical use of technology in the classroom. Ertmer et al. (2003) designed
an experimental study to examine whether electronic models of exemplary technology-using
teachers, presented via CD-ROM, could provide a valuable alternative for developing ideas
about use of technology and self-efficacy for technology integration. Sixty-nine students,
who enrolled into a one-credit technology course at Purdue University, participated in the
online survey before and after interacting with the CD-ROM. Results suggested that
electronic models can significantly increase pre-service teachers’ ideas about technology
integration and self-efficacy for technology integration. However, the study was not able to
determine the extent to which these students were able to carry out these ideas when they
started teaching in a real classroom.

To sum up, the research shows there are several ways that teacher training programs
incorporate into their courses to model use of technology to pre-service teachers: a) modeling
sessions are provided by faculty, pre-service teachers, instructional technology specialists, or
combined, b) modeling sessions include the university or K-12 schools, c) pre-service
teachers create their own models of technology use, using a hands-on approach, and d) electronic means are used to show models of classroom teaching with technology.

The various approaches to technology integration and modeling discussed in this
section demonstrate the integrity of institutional efforts to provide pre-service teachers with
as opportunities as possible to observe models of meaningful technology use and to help
develop their own vision of how technology can be implemented effectively into classroom
teaching and learning.
Summary

Findings from the literature review reveal a rich body of research that has been focused on different institutional efforts to integrate technology into teacher training programs and as well into specific content areas. The majority of the studies in the technology area present a description of strategies and activities that aim to redesign the curriculum so it is infused with opportunities for pre-service teachers to learn with technology and to see models of technology use throughout their professional preparation (Mills & Tincher, 2003). The highlights of these studies provide a basis for developing a theoretical framework of essential components and factors that facilitate technology infusion into teacher training programs.

However, since all these studies mostly concentrate on the external elements of technology integration, there is an obvious paucity of research that addresses internal elements of technology adoption into individual faculty teaching. Although there are many studies that address the barriers and challenges that faculty face when integrating technology into their teaching, few studies concentrate on the process of change that faculty undergo when they start actively use technology for teaching and learning. Even less is known about how faculty creates a connection between their pedagogy and technology, and what they believe modeling technology use constitutes. It is also necessary to examine if the content area that faculty teach may impact on how faculty define the need for technology use and if there is a difference in what modeling strategies faculty prefer to use, depending on their content area. Keeping in mind that external factors and barriers have a principal impact on the process of technology infusion, this study will concentrate more on the internal factors that affect faculty decision-making about technology use and modeling it to pre-service teachers.
CHAPTER THREE: METHODOLOGY

Chapter Three describes the study method, participants, data collection and analytical procedures to be employed during the study. It also acknowledges the role of the researcher in this study.

Method

This study was conducted using case study methodology. Case study is considered an ideal methodology when a holistic, in-depth investigation is needed (Feagin, Orum, & Sjoberg, 1991). To identify a connection between faculty teaching philosophies and beliefs, and modeling use of technology, developing an explanatory case study seemed to be the most appropriate method to use, since it may be used for completing causal investigations (Yin, 1994), in this case, the effect of internal barriers, such as teaching philosophies and beliefs, on technology integration into teaching elementary methods courses. To ensure accuracy and alternative explanations, or triangulation of data (Yin, 1984), multiply data resources, interviews, observations, documentation, and physical artifacts were used in the process of data analysis.

The study consists of two single cases studies—3 math and 3 literacy—of methods faculty’s modeling use for technology in elementary methods courses. The decision to develop two separate cases was supported by the literature on research methodology. According to Denzin (1984), data source triangulation may also occur when the researcher looks for the data to remain the same in different contexts.

Building an explanation on the evidence from the cases, first, within one content area (math or literacy), and then across the context, was to follow replication of logic and to attain the external validity of findings (Yin, 1994). However, it seems important to stress that each case study consists of a "whole" study, where the evidence was collected from various sources and conclusions were drawn based on that evidence.

According to Stake’s definition (1995), this study also may be considered as intrinsic case study, since the researcher has an interest in the case. The position of the researcher in this study and personal interest in the topic has been influenced by previous teacher training experience and involvement into the research on technology integration into teacher training at the institution where the case study was administered. This researcher’s belief that faculty,
and consequently, teachers, use of technology depends on more internal than external factors was a driving force in this investigation.

**Participants**

Six faculty members, who taught methodology courses in spring 2005, fall 2005, and spring 2006, participated in this study. They were three faculty members teaching elementary math method courses and three faculty members teaching elementary literacy courses.

The participants’ experiences with technology integration into teaching methods courses was a consideration for inviting them to participate in the study. It is necessary to mention that the most of the study participants participated in the faculty mentoring program that has been offered to the faculty at the Department of Curriculum and Instruction at this university since 1992. This program adopts the approach of recruiting graduate students as mentors through a graduate course “Technology and Teacher Education.” For the field component of this course, each graduate student paired with a faculty member spend approximately one hour per week working on technology-related learning tasks. This model is characterized as a more individualized approach to professional development because each faculty member involved focuses on his or her specific needs (Zachariades & Roberts, 1995). Individual attention is given to each faculty member to facilitate the process of technology integration. There are rich technology resources available for faculty for individual and classroom use. After 14 years of this program, the faculty have made significant advances in their ability to use technology in their classes and their goals and activities for using technology have changed significantly (Thompson, 2005).

Most of the study participants were involved in the mentoring program for one semester or more. In this sense, the study participants represent a new generation of faculty who have had ample opportunities and institutional support to develop their technological skills and practice technology integration into their classroom teaching in technology-rich environment.

It was important to study the faculty who already had a rich experience of implementation of technology into teaching. The reason for this was that on the stage of practical implementation of technology into their teaching, faculty are more likely to move to
a higher level of concerns (Hord, Rutherford, Huling-Austin, & Hall, 1987) which are more internal, such as how use of technology relates to teachers’ beliefs about teacher-student roles and their classroom practices including teaching methods (Ertmer, 1999).

Selecting the participants for the study, who had a long experience with technology integration into their teaching, was believed to facilitate in finding a link between their teaching philosophies and beliefs, and how they are translated into modeling the use of technology to pre-service teachers. Previous experience of faculty use of technology was confirmed before the study was started. Participation in another study that focused on teaching pre-service teachers technology use provided this researcher an opportunity to observe and interview most of the methods faculty and to develop some preliminary conclusions that were further investigated in this case study.

**Data Collection**

Data collection included faculty course interviews and classroom teaching observations (see Appendix A). Some of the data collected for *Teaching Teachers to Use Technology: What Works and Why* project (University of Illinois at Chicago) in fall 2005 were used during Stage One of data collection and analysis. After receiving the faculty member’s consent, transcripts of the course interviews were obtained from the primary investigators. These data were used to provide a description of the context in which the elementary courses were taught, the faculty’s overall goals and core ideas for the courses, as well their descriptions of their teaching philosophies.

During Stage Two of data collection, the faculty were invited to participate in a semi-structured interview, which focused more on their technology use in the elementary methods classes. The questions were open-ended to establish a dialogue between the researcher and interviewee to obtain rich stories about the technology use in their courses through the observations conducted during fall 2005 and spring 2006 (see Appendix B for the Faculty Interview Protocol). Since the description of the faculty teaching philosophies and their course goals were already obtained during the first stage of data collection, to avoid repetition and to lower the possibility of subjectivity of self-reported data, the questions were mostly non-directive, but required describing their activities with technology and the processes of making decisions about their particular technology implementation.
During Stage Three, 2-3 observations of each instructor were conducted in fall 2005 or spring 2006. Selection of classes to observe was based on two considerations. First, these observations allowed capturing a variety of technology uses, and, second, these were activities that the faculty described in their interviews as some of their favorite or the ones they had been using with students on a regular basis. The second consideration seemed to be most significant to this study, since observing some favorite activities meant that the faculty had a high comfort level with them. Moreover, having some history of how these activities developed over time allowed deeper insights into the process of planning technology use and identifying which factors seemed to the most significant to determine the faculty decision-making. Observations followed the free protocol, this researcher tried to capture in field notes beginning with the classroom setting, the instructor’s presentation, interactions with students, instructions, procedures, etc. Notes of informal discussions of observations and related artifacts, e.g., class handouts, worksheets, presentations, courses syllabi, and images were collected to help develop a better understanding of the faculty members’ goals and objectives related to technology use for teaching and learning.

Data Analysis

The analysis included coding transcripts of interviews and observations notes. The qualitative analysis software package NVIVO was used to code the data and produce coding reports. Primary coding was based on reading and rereading the interview data to note the recurring themes, which were coded in bigger categories related to the research questions of the study. Further, the coded data was summarized into separate documents, which were reread and coded again, if necessary, to clarify some issues or develop a code tree within larger categories. A full list of coding categories is included in Appendix C. At this stage, the links were also made between interviews and observation notes.

The explanation-building was used as a strategy for the analysis (Yin, 1994). Explanation-building is considered a form of pattern-matching (Trochim, 1989), in which the analysis of the case study is carried out by building an explanation of the case. It is considered in the research literature to be most useful in explanatory case studies (Yin, 1984), when the researcher looks for some causal relationships.
Explanation-building in this case started with developing a theoretical statement that the internal factors, such as faculty teaching philosophies and beliefs, may have a major influence on how they integrate technology into their teaching. This proposition came out of this researcher’s experiences and to some extent was also confirmed by the literature (Ertmer, 1999; 2003). The case study was developed by looking for explanations of technology use in the elementary methods courses and linking those uses to the faculty’s teaching philosophies. Revisiting and refining the theoretical statement during the process of categorizing and summarizing the data helped the research stay focused and also provided a structure for reporting the case study results.
CHAPTER FOUR: FINDINGS

This chapter contains the findings from two cases studies—three math and three literacy faculty—use of technology in elementary methods courses. The findings are organized into two separate sections, each concludes with a summary that discusses a connection between faculty teaching philosophies and beliefs, and use of technology related to the particular, math or literacy, case study.

Faculty Use of Technology in Elementary Math Methods Courses

This section presents a case study of the use of technology by three elementary math methods faculty in the Elementary Education teacher training program at a Midwestern university. For the purpose of this study, it was important to determine, first, what kinds of technology they used and what goals they served and, second, to identify if there was a connection between faculty’s teaching philosophies and beliefs, and their technology use when teaching pre-service teachers. To make this connection, in the next section, an overview will be given of how the faculty define their teaching philosophies in the interviews and what they see as their courses goals and core ideas. Next, the faculty use of technology will be described, based on the series of observations. Finally, in the summary of the math methods faculty case study, an attempt will be made to link the faculty modeling use of technology to pre-service teachers with their teaching philosophies and beliefs.

Teaching Philosophies the Math Methods Faculty Share

Each faculty member responded to a question about teaching philosophies in a very different manner. Some obviously had spent more time trying to formulate it for themselves, and gave a very direct and explicit answer without difficulty; some were still in the process of shaping or rethinking their philosophies and were hesitant to define it in clear terms. However, a cross analysis of interviews showed a lot of similarities between what all math instructors see as their teaching philosophies. They want their students to be reflective teachers, who think very hard about what they want to achieve in the classroom, can analyze and listen to their students, respect their students' thinking, and try to modify their teaching, using the data they receive from the analysis of the students' thinking and research. As one of the math instructors stated, he wants to see a teacher as “a person who is seriously thinking
about mathematics and about how children learn mathematics and has the tools to understand what the students are thinking about it."

Another math instructor said that she was a big believer that she should help her students understand children’s thinking and provide them with as many resources as possible to illustrate how children think:

“So I think my philosophy is to provide the resources that will illustrate what I want them to know about children’s thinking but it’s hard to find some of these resources, so right now it is still a balance between my telling here’s what we know and setting them up to discover some of these things by themselves. I’m moving more and more towards their being able to discover it.”

Another important part of what the math instructors include in their teaching philosophy is viewing their goals as helping pre-service teachers become good practitioners, “help them succeed at helping kids learn.” This very practice-oriented task requires from the faculty, as they see it, to provide their students with many experiences about children’s thinking that get as close to a real classroom situation as possible.

**What Math Methods Faculty Define as Their Instructional Goals and Core Ideas of the Course**

The faculty’s teaching philosophies determine, to a large extent, what the faculty set as their instructional goals for the course and what core ideas they want to transfer to their students. Although there were certain differences in what all math methods faculty reported during the interviews as their goals for their courses, there were also some commonalities in what they saw as critical to address with pre-service teachers—developing their thinking about mathematics, building their understanding about how children think mathematically, and what strategies and resources are available to help children learn mathematics.

All the instructors underlined the importance of developing students’ understanding of mathematics in their courses. As one of the faculty said, he had a tremendous amount of work to do over the semester “in terms how my students rethink what they mean by mathematics, why they should teach mathematics, how students learn mathematics; how they have learned mathematics, their own relationships with the subject.” This is why the main focus is on teachers and children’s thinking about mathematics: what mathematics is, why we
teach mathematics, what role mathematics plays in our society, and what societal influences
determine some answers to these questions in terms of everyday practices. As another
instructor added, she has a philosophy of helping her students reconstruct their own ideas
about what math is if they “look beyond traditional classroom definitions of mathematics.”

With this goal in mind, as another instructor stated, the main thing that she would like
students to do is to begin to develop ideas about how they want to teach mathematics. Then,
the instructor’s role becomes to give students some ideas about the different kinds of
resources available for teaching, once they have decided which direction they want to go.
One of the instructors also stated that he wants his students to use the resources available for
teaching mathematics “in a way that is consistent with what their beliefs about mathematics
and how people learn mathematics are.”

The other point that all instructors see in training of pre-service teachers is to focus
more on how children think and learn how to develop their problem-solving strategies
through mathematics. In addition, they want pre-service teachers understand how they can
influence children’s development by applying what research determines about how children’s
thinking typically evolves.

These overall goals determine what kind of core ideas the instructors want their
students to think about and what typical strategies they use to stimulate students to develop
their visions of what teaching mathematics is. As one of the instructors said, “students
usually come with a very unclear idea about what mathematics is and usually with a lot of
misconceptions that have crystallized over the years”. Then, it becomes really important to
help students rethink what they know about mathematics and realize that it is not just giving
a set of activities to students, but that learning occurs in different ways and the learning
outcomes may be different from the same activity. Thus, teacher’s beliefs are critical because
they will determine what students are expected to achieve. One respondent said:

In terms of what we do day-by-day, for example, we are going to start talking about
geometry next week, so we are looking at learning theories about geometry; how kids,
how people, learn geometry, and at the same time we are going to look at some
activities and we are going to do some activities in class, and we are going to try to fit
those activities into the theory of our learning.
How children think about mathematics is another core idea of the math methods classes. "Teaching in alignment with math standards," as one of the instructors said, she always wants pre-service teachers to understand why these standards were chosen and how they are connected to how children think and how they solve problems in mathematics. "Having knowledge of children’s thinking will help [a teacher] to go and interact with a child and by observing how a child operates with mathematical concepts to suggest what would be a next good step for him."

In order to "tie an individual student to what we know about how students' thinking develops," the math methods instructors spend a lot of time in their courses on children’s thinking. Pre-service teachers go out and interview children in schools, they look at lots of examples of children’s work in class, actual paper work or on video. As one of the instructors complained, it is really challenging for pre-service teachers without having children in front of them to talk about their thinking. Thus, examples of children’s work are supposed to help pre-service teachers know what children understand, what they don't understand, what they are thinking about in the content of a task, what questions the teacher would ask for understanding, and what would follow.

Similarly, another math instructor defined her core ideas for the course in an inquiry-based manner. "How are students thinking, what do you know from research? What would you do knowing that? What would your next goal be for the student developmentally and what would you do to help them get there?"

Keep in mind the faculty themselves formulated the importance of teacher’s beliefs in determining how they approach their instructional goals. Now, it is necessary to look at how their own teaching philosophies and beliefs were translated into their teaching practices, more concretely, into their use of technology for instructional purposes.

**Technology Use in Elementary Math Methods Courses**

All three elementary math methods instructors used different amounts and types of technology, varying from very minimal, “very bare bone things,” as one instructor said, to a very extensive use, “too much of technology,” in another instructor’s words.

There were several purposes for technology use identified through the faculty interviews and classroom observations. The faculty use technology for five main objectives:
1) information about a course, 2) communication, 3) provide a link to a real classroom, 4) technology tools for teaching/learning mathematics in elementary grades, and 5) technology tools for mastering course content.

Since the purpose of this study is to provide a description of faculty's modeling use of technology in their courses, not all technology uses seem relevant for discussion in detail. In the next subsections, an overview of technology uses will be given; later, some of the more relevant examples of technology connected with the content area for the study will be discussed.

**Technology Use for Information and Communication**

In terms of technology use for informational or organizational purposes in math methods courses, the faculty use WebCT or their developed course websites. Students have access to the syllabi, readings, assignments, grades, and some other items. Two of three instructors preferred to use their own developed course websites. The reasons they did not use WebCT much were for different reasons: one of the instructors is new to this university and does not have much experience with WebCT and the other instructor did not find it flexible enough. At the same time, the third math instructor said, "[in her courses] everything is going through WebCT." Students turn in their assignments, she posts daily summaries of the class discussions, and every class they go over with students through the summary files and their postings.

The use of technology for communication by the math instructors also differed in class. One instructor created a mailing list for students to communicate; however, his own role, as he said, was minimal there. Another instructor, apart from use of discussions and web mail in WebCT, uses special discourse software installed on every student's laptop. As she said in the interview, she uses it in every class to keep students prepared for class, since they know from their schedule what type of questions they will be asked. Also, it helps the instructor see what each of her students has completed. However, a more important reason is the use of discourse technology to connect with the students' thinking about the content. As this instructor said, "I focus on my learners' thinking as well. I need to know what they're thinking... They do work, they're all bright people, but they don't want to talk about what they are thinking. So it gets me into their heads."
In addition, posting questions and reviewing students’ responses every day, in her opinion, enables everyone to be included in discussions. The chat option in the discourse software gives her the possibility to interact with selected students during the class time, while they are working on some questions. Seeing what they are thinking at that moment gives the instructor the idea where they are now in understanding the lesson’s content and whether they need some coaching through the assignment.

Interviews with the instructors and especially observations of their classrooms revealed the faculty were very attentive to what their students thought about mathematics and how their thinking develops during the course throughout the semester. Considering this is how they see a future math teacher (as “a person who is seriously thinking about mathematics and about how children learn mathematics and has the tools to understand their students’ thinking about it”), the strategies that the faculty employ for discovering their own students’ thinking are consistent with what they believe. Although not all instructors use technology widely for the purpose of identifying what students think about class content, most have a lot of discussions during class. However, when technology is used, it serves the goal of “getting into students’ heads,” as one of the instructors said. Practically, when using technology for communication, the instructors followed the major instructional goal of probing students’ thinking of the content area.

**Use of Technology for Providing a Link to a Real Classroom**

The math methods faculty interviews and the classroom observations revealed that most typically a link to a real classroom was provided through extensive use of video clips. Their reason for this was the extent each echoed each other. For all of them, it is critical to provide students the exposure to what happens in classrooms, to examples of mathematics teaching. As one of the instructors stated, “video clips help students get into children’s thinking about particular mathematical ideas.” All the instructors have collected a variety of video clips, some come with the textbooks, some come from the practicing teachers’ classrooms, or Internet-based resources of video clips to which students have access. Observing children working with mathematics follows later with the discussion about “what were teacher’s actions” and what other strategies to deal with the same problem may be used.
As an example of a typical strategy working with video clips, one of the instructors described the following:

We usually watch it [a clip] twice and for the first time I want them to see the kind of things that are accomplished, like, oh, that’s neat, when they really did a lot of thinking. And then I go back and watch and say, what kinds of moves did actually the teacher make specifically, what does she do, what kinds of questions did she ask, what did you see, what’s happened, what kind of specific strategies did she use to get them to that point?

Watching examples of classroom teaching, students generate a “running list” of some strategies they may use as teachers to solve particular problems. As the same instructor noticed through her experience, certain clips of different teachers teaching that seemed to “sparkle discussions” among the students turned out to be very memorable to them. Students would return semester after semester and reflect on some ways of doing problem solving with children.

Another “powerful” use of video all the instructors see is providing examples of children doing mathematics. As one of the instructors emphasized, there is a tendency with college students not to believe that the children actually do mathematics in one or another way. Using video to show what actually is happening is one step, as she defines it, of a three-step process. At the beginning, they talk about it in class and imagine how children might solve that problem. Next, they actually see it happening in a video. Finally, they see it in person during their practicum.

The following example demonstrates how one of the instructors uses video to model one of the word problem-solving strategies in math—direct modeling. During the observation, the instructor introduced the video clip the students would watch. It showed children solving problems by themselves using different tools, e.g., Legos. The instructor wanted students to observe children solving word problems and to try to understand what they all were doing differently. After watching the clip, the instructor used manipulatives to model one of the word problems students saw in the clip. She pointed out that direct modeling, the strategy they were focusing on today, involved following the language of the problem. The instructor showed students another video clip that presented a child working out math word problems
and asked them to follow the child's thinking about the problems. After students had watched the movie, they had to demonstrate direct modeling in groups, using manipulatives and solving the same word problems the child in the video clip was given to solve. After they went through all problems, the instructor asked them to talk in groups and think of a more abstract strategy they could use to solve the same problem or, in other words, how they might connect direct modeling with more advanced strategy.

Another instructor demonstrated a way of providing access to a real classroom and children learning about mathematics by giving an assignment for students based on the web blog developed by a math methods faculty at the University of Texas and which has examples from her collaborative teaching with a practicing elementary grades teacher. As Figure 1 presents, the web blog contains four second-grader case studies developed during a 10-week period.

*Figure 1: A web blog created by a math methods faculty and used in one of the math methods courses.*

During one of the observations, the math instructor gave an assignment to students in her course to trace one of the children learning through the study and to reflect on some examples of teacher decision-making in the particular case. In addition to discussing the strategies used by the teacher, students were invited to elaborate on their own pedagogical
solutions to the particular situation and support their decisions by referring to the literature, e.g., a textbook.

These two powerful examples demonstrate a strong connection between how technology is used and actual faculty’s teaching philosophies and beliefs. Referring to how the faculty formulated their teaching philosophies, technology is used as a tool to build pre-service teachers’ understanding of how children think about mathematics and to model various strategies that will “help them succeed at helping kids learn.” Considering that all the math instructors use video clips of classrooms very frequently in their courses, they obviously see it as an effective tool to help pre-service teachers become good practitioners, who seriously think about teaching mathematics and children’s thinking. The strategies the faculty use with video clips demonstrate clearly their beliefs that teachers should be critical assessors of their practice. They do not simply show or tell pre-service teachers what to do in one or another particular case, but provide them with enough resources and strategies that “set them up to discover some of these things for themselves.”

Technology Used for Teaching and Learning Mathematics

In the selection of technology tools for teaching and learning math, the math methods faculty demonstrated similar preferences to the most extent. As mentioned in the beginning of this section, the instructors vary in the amount of technology use. Nevertheless, all of them use, or at least introduce virtual manipulatives. The instructors inform students of available websites, where they can find virtual manipulatives based on standards and address different grade levels and topics, e.g., National Laboratory of Virtual Manipulative for Mathematics. As one of the instructors said, she “allocated some time in class to explore some general websites, where there are different kinds of manipulatives”. The actual activity she would do with students would be trying solving problems with physical and virtual manipulatives and then “try to evaluate the pros and cons of each for the classroom.” In her own words, she wants the students also to think “what would be your purposes for using a virtual manipulative, when and under what conditions and for what reasons would you want to use that kind of manipulatives.” This kind of discussion seems very valuable. Although, as the same instructor commented, “Students do not have much time and chance to practice the use of virtual manipulatives, and most of them will not use them either when they go on
practicum.” However, she still thinks it important to introduce them to virtual manipulatives. Some of them may include use of manipulatives as part of lesson plans and add to their portfolios at some point in their teaching.

Another instructor demonstrated a different strategy with introducing virtual manipulatives in class that had similar purposes, as in the previous examples, of making students reflect on ways of using virtual manipulatives meaningfully when teaching math to children. As one of her favorite activities, the instructor gives her students three assignments using the same virtual manipulative:

The first one is—do what you want, ok, what did you learn from that? Nothing. You learned how to manipulate, that’s not going to work instructionally. And then the next that I do, ok, now I’m going to tell you what to do and I give them extraordinarily specific instructions, just like they had all through school. You’re going to move two spots forward and so on, what did you learn from that? Absolutely nothing … and then I give them a task, ok, so if you can figure out this using this manipulative, now what did you learn?

As she commented further, she wants her students to realize they cannot just teach children technology by letting them do it or give them very specific instructions because they are not doing any thinking. It is necessary to give children some type of task when they have something to think about.

The following example of an observed classroom activity with Geometer’s Sketch Pad, another tool that all math instructors use to some extent in their courses, provides a very distinctive illustration of how an instructor introduced technology to pre-service teachers as a tool for thinking about mathematics. The instructor offered the students an assignment that consisted of two stages. The first stage was modeling by an instructor an activity with the Geometer’s Sketch Pad in the way it would happen in the elementary classroom. Figure 2 presents the first two steps of this activity.
During the classroom observation, the students followed the instructor’s oral directions, and also questions and action buttons created in the program, as he developed some instructions within the assignment. After each step, students were involved in the discussion of what they just did and what they can conclude about the shapes they worked with. At the second stage, after all students completed all steps in the assignment, the instructor wanted them to think of what they just completed. “What was its objective? Was it achieved or not? What are good and bad points of using technology here?” Students suggested that with the steps given, children were asked to reason what and why it happened and if it was easier than trying to figure out on their own. So, they agreed that instructions made it more effective. Meanwhile, the instructor showed the Sketch Pad—how it looked and how he created this activity. Students tried some simple tools and the instructor also showed what other options of this software were available. The important thing, as the instructor pointed out, was to make students discuss the activity. He told the class it is not usually in the software, very few software programs can make students reflect. As future teachers, they must worry about how to ensure children communicate and reason. He added
that teachers must build a reflection component into the activity. Finally, the instructor and the students discussed the learning objectives of this particular activity; students were invited to think in groups about how children would think about this activity. Students came up with a list of instructional goals, and some strong and weak points of using Sketch Pad, e.g., “more variety of shapes than with physical manipulatives, faster, focus on each separate instructional goal, etc.”

One more way of modeling possible activities with elementary school children observed in some of the math instructors’ classes was the use of web-based resources for teachers. One of the instructors discussed and showed how she used the National Math Trail website. Practically, she encouraged her students to do what typical children would do—get out of the classroom and search for math problems related to community life. In some ways, this activity is similar to digital storytelling, because when children come back, they put together video and pictures, or create a digital book of math problems they discovered on their math trail. However, at this point, the instructor said she did not require making digital stories or books, but students create wall posters with pictures, images, and math problems. Together with other activities, like using children’s literature for completing math, this activity from the National Math Trail database, in this instructor’s opinion, creates a link to a child’s real life context, providing a meaningful experience for learning mathematical concepts. In her own words, she is “really trying to spark their imagination” in terms of what can be done by going out and creating an Ames Math Trail, similar to what they saw on the website.

These selected examples of modeling classroom activities with technology make a clear connection to what faculty described in their interviews as their understanding of meaningful use of technology in teaching and learning. As one of the math instructors said about use of technology in his courses, he wants to “give them an example of technology that is flexible enough for future teachers to be able to adapt it to the particular needs and also to motivate their students.” Also he wants them to remember to leave space for reflection when they use technology for instruction. “If they don’t have their reflection, there is not a lot of learning occurring. I want them to know they have to integrate reflection into their activities. Especially, when they are building technology in the lesson …” In connection to this, another
instructor said she always asks herself a question—"Do we have a particular goal which the
technology can help us accomplish better than anything else?" From this perspective,
integrating video clips helps "develop some understanding of what children are doing"
instead just of trying to memorize problem types and strategies.

When making a decision when to use technology, the math instructors wanted future
teachers to think whether it would be more accessible or it could help achieve the
instructional goal more effectively. More important was students’ thinking about
mathematics and how their ideas developed over time. Speaking about developing pre-
service teachers’ understanding about how people learn mathematics, one of the instructors
concluded in her interview, "I use technology to support all that happens."

The next section will provide a summary and discussion of the findings of what, in
the researcher’s opinion, the math methods faculty model when using technology to teach
pre-service teachers.

**Faculty Model Use of Technology in Math Method Courses: Summary and Discussion of Findings**

It seems important to distinguish what possibly can be understood by modeling use of
technology to pre-service teachers. Most of the literature discussed in the Literature Review
of this paper addresses modeling of technology use relevant to the content area, in this case,
elementary math classrooms. No doubt pre-service teachers need to observe and have hands-
on experience with technology-based activities for their grade level content.

All math method faculty, who participated in this case study, modeled some of the
technology applications that may be used with the particular content area. Apart from the
 technological tools previously mentioned, such as virtual manipulatives and Geometer's
Sketch Pad, the instructors reported in their interviews also uses of some commercial
software and Internet-based games developed for learning mathematics. The instructors had
very different experience with various technology tools they used in the past and continue to
use today. However, what was common, their attitude to bringing to class and showing more
and more technology was rather critical, in some cases even skeptical.

Observations of what the faculty were trying to achieve with their students in class
explains, from this researcher’s opinion, their attitudes to some types of technology, mostly
package software. As mentioned previously, the reflection component on the content of the course was a very strong point for all instructors. As one of the instructors said:

the actual mathematics doesn't necessarily use the technology but the technology is used to document and reflect on, and compile and share their work. I think for the kids and for my students that's the most exciting use of technology, rather than kinds of pieces of software, but taking real hard mathematics, which is problem-solving and the number sense and using the technology to put that together in a way that it is not a problem-solving on the worksheet, but actually going out, doing math, documenting it, and sharing. And showing learning...

It is interesting that most instructors emphasized what they wanted future teachers to use technology for—reflection—whether it is children’s thinking or teachers’ own teaching. Two of the instructors shared at the end of their interviews the viewpoint they would like to see how their students are going to use technology to document and reflect on their own work during a practicum or later when they start independent teaching. The strategies the observed instructors used with introducing technology to their students’ in the classroom demonstrate they care most about how their students and then their children are going to think about the particular activity with technology and what they will learn from this. For this purpose, the flexibility of technology and the possibility to guide students’ thinking were the most mentioned factors that determined the selections of technology applications.

The examples included in the previous subsections of some technology-based activities show that instructors do not choose to demonstrate use of technology themselves because, as one of instructors said, “it is not going to help learning.” They encouraged students to do a math activity with technology as children and to reflect on their experiences by referring to what they already know about children’s thinking development.

Being reflective practitioners and technology users themselves, the math methods instructors modeled to pre-service teachers the use of technology in the way they think it is meaningful—how technology can support students’ learning about mathematics.

To the most extent, the findings of this case study were consistent with what is known from the literature about the barriers to technology integration into faculty teaching practices. The math faculty expressed the same concerns to technology use in their courses, such as
time, lack of skills, limited access of technology in elementary classrooms, etc. However, their main concern was how students’ thinking about mathematics and use of technology fit together. As one of the instructors said in her interview, she did not like using technology, e.g., package software, with students when she does not know “how to guide their thinking about it [mathematics].” In relevance to this, the math methods faculty wanted future teachers to focus, first of all, on how students think about mathematics and, then, think of technology potentials to support this thinking.

The math methods faculty’s experiences with technology in their courses, in this researcher’s opinion, was supposed to model to students that teachers should be critical assessors of practice. All math instructors expressed in some way or another that their technology uses change over time. Apart from new ideas or information they receive from someone, they modify technology use, based on their reflection about technology use with students and also on students’ feedback. Since the faculty interviews were taken between semesters or in the beginning of a new one, most instructors reflected on the changes they were going to make with some of technology applications, based on their students’ experiences with them, like posting more students’ responses through the discourse software to show a variety of possible answers or transform a paper-based activity into a digital format, etc. Speaking about their future plans of technology use, most interests laid within evaluating their own practices with technology and providing better learning experiences for their students, whether in the form of action research in their own sections, or students using technology to capture their experiences during the practicum. Another possibility was introducing electronic portfolios instead of a traditional portfolio students are required to submit at the end of the course.

Although a limited number of observations of every faculty classroom does not allow broad generalizations, it is still possible to suggest that the math methods faculty’s use of technology came from their teaching philosophies and beliefs about teaching and learning. By providing students with a variety of resources, the faculty wanted them to reconstruct their own knowledge of mathematics in light what is known about children’s learning and to make a decision about how they want to teach mathematics. And when students determine which direction they want to go, as one of the math instructors said, “They would look at the
resources available for teaching mathematics, including technology, in a way that is consistent with their beliefs about mathematics and how people learn mathematics.”
Faculty Use of Technology in Elementary Literacy Courses

This section presents a case study of three elementary literacy methods faculty use of technology in the Elementary Education teacher training program at a Midwestern university. In the beginning, similar to the math faculty’s use of technology case study, the overview of the faculty teaching philosophies are given, as well as what they see as their course’s goals. To provide the context in which modeling use of technology to pre-service teachers will be a primary focus of investigation, there is a need, first, to describe the literacy methods faculty’s use of technology and the purposes it serves. Later, attention will be given more to the faculty’s modeling use of technology for teaching and learning literacy in elementary grades. In the summary, the findings will be discussed to establish whether there is a connection between the faculty’s teaching philosophies and beliefs, and their modeling use of technology to pre-service teachers.

Teaching Philosophies the Literacy Methods Faculty Share

Two major points were identified as being an essential part of all three literacy instructors’ teaching philosophies. First, they strongly believe that everyone has an ability to learn and, second, that students should be actively involved into their learning.

One of the instructors said, “Whether I have a philosophy that is constructivist or behaviorist . . . I truly believe my philosophy of teaching and learning is, as teachers we have to do the kind of things, the different strategies, the different things, that will enable students to learn whatever it is they’re learning” and to “have an ability to interact and connect with students so that they can learn.” In this faculty member’s opinion, this should make an instructor think about the way teaching can be engaging, interesting, and motivating, and whether “there is a piece of innovation and uniqueness creativity that comes along with that.”

All three literacy instructors said their philosophies of teaching are bedded in research about how people learn and come out of their own teaching experience. As one of the instructors said:

. . . initially I believe that our learners are active learners and this is a philosophy of play, I believe that they cannot passively take knowledge that they have to put into practice. And they have to be active learners.” Active learning would also mean, in her opinion, taking action with every assignment students are doing in her courses,
like "go to the grocery store and I want you to get down on your knees and I want you to see what a 5-year old sees. So I try to take whatever article they're reading, and I want to pair that with them experiencing what a 5-year old would experience.

Understanding children's learning and their background experience was claimed as part of all three literacy faculty's teaching philosophies. One of the instructors said:

that every person has a story to tell and I try to create a space where they are able to tell that story; when they're able to question their literacy past, so that they would see that the children in their classroom will also have literacy stories to tell. That we all don't take the same path to literacy, that we take multiple paths.

Along with the belief that "everybody has a story to tell," one of the instructors emphasized the need for students to "embrace that we are not the same and how awful the world would be if we all had the same stories," and, as a result, to accept diversity and multicultural aspects of literacy. As another instructor commented, her philosophy is more of a social constructivist in terms of what she believes works in the classroom; that students learn from others, and to help them she must bring in their background experiences.

Realizing there are different "paths" to learning, the instructor believes in their teaching they should use "whatever philosophy of learning, whatever strategy" that is the most needed at the time, and model that approach for future teachers before they go out to teach independently. As one of the instructors said:

I tell my students that I am not a trendsetter, but when I teach, if I think that you are going to learn something more effectively by changing how I think you'll learn better, that is what I do.

Related to this, one of the instructors said she wants her students to become the critical assessors of practice, she wants them to look at every activity or book they will be using through the individual child's needs and to see what are pluses and minuses, and which children does it work for and which ones it does not.

Knowledge of the current research and need for the ongoing professional development were other issues that came up in the literacy instructors' interviews. As one of the instructors stated, there was no way that an instructor or a teacher could know everything and being a life long learner should be a part of the teaching philosophy. She explained it as a
foundation she tried to install in her classes that a teacher needs to learn all the time, to read, and to share ideas with colleagues.

The necessity to be a critical, reflective teacher was an essential part of the faculty’s teaching philosophies they tried to transfer to their students. As one of the instructors said, she wanted her students to see that they need to reflect on what they have accomplished during the day as teachers to see if it worked, because if it did not, they are the ones who need to make some changes and they must be willing to do this. In relationship to this, some faculty saw the importance for future teachers to build a social network, whether this is to find support in colleagues, or mentors to share ideas for the purpose of improving their own classrooms.

What Elementary Literacy Methods Faculty Set as Their Course Goals and the Core Ideas of the Course

All three literacy instructors defined the goals of their course very similar to each other: first, prepare students to teach reading and writing competently for children, second, develop pre-service teachers’ understanding there are multiple ways to do this and there is not just one approach to teach reading and one approach to teach writing. As one instructor said, “we investigate many different approaches to teach reading, 5 or 6 approaches to teaching writing and then ... discover as many as we can in the classroom context.”

Linking her teaching philosophy with the goals of the course, another instructor said she wanted to help future teachers become critical assessors of practice.

We want them to be able to think what they know about theory and research, and then are able to put it out into practice. Or think about, what are the pluses and the minuses of the strategy or this method. So that’s probably the underline...

To engage students into active learning, as one of the instructors stated, she saw her overall goal for this course is to create an atmosphere for a community of learners. Teaching different approaches to teaching reading and writing starts with learning what students’ past experiences are, “and it's just like they would go out into their own classrooms.” Another instructor said, she was trying to make a connection to some general philosophy of teaching at this university:

... it kind of follows our philosophy at Iowa State, where we believe that students will
have their own philosophy of learning, but we want them to understand that there are still different approaches to use with different children.

All the instructors put emphasis on the connection between what pre-service teachers learned before and what they were learning in literacy courses. Another instructor added, besides being critical assessors of practice, she wanted her students to “be[ing] able to act as professionals, putting together what they have learned about how children learn.” Out of what they will learn in a literacy methods class, they should be able to apply strategies in the classroom to assist children to become independent readers and writers, speakers and listeners. All other things fit into this goal, including how to set up a classroom environment, a literacy classroom environment, what materials to include, assessment, and then critically thinking what to include in early literacy, specifically K-3 classroom or intermediate literacy in 4-6 grades.

**Technology Use in Elementary Literacy Methods Courses**

The overall use of technology in all three elementary literacy faculty classes is characterized by a richness of the technology applications used for instruction. There is not just computer technology, but also digital, still, and video cameras, DVDs, CDs, handhelds, assistive technology, such as ELMO, and others. There is a wide range of software used in the courses, including word-processing, photo- and video-editing software, presentation software, software packages for reading, and some software related to teaching elementary grades.

Although all three literacy faculty saw use of technology as an essential part of their classroom teaching, their level of technology use varied to a large extent. Also, their approach to doing similar activities with technology, for example, digital stories, was different, starting from the technology tool selection, the activity’s structure, and the learning outcomes. However, it was extremely interesting to observe this variety in terms of how the faculty tried to reach the same instructional goal with different technology tools.

The main purposes for technology use in literacy methods courses were similar to the math methods courses, with the exception of a high use of presentation technology in all literacy classes. In the next several subsections, an overall description will be given of how technology is used by the literacy methods faculty. Then, in more detail, the faculty modeling
use of technology to teach literacy in elementary grades will be discussed. In the summary, the findings will be discussed relevant to the faculty’s teaching philosophies and beliefs, and how they may have affected the strategies that the faculty used to present use of technology for teaching literacy to pre-service teachers.

**Use of Technology for Presentation and Course Content Organization**

All three literacy methods instructors use a variety of presentation technologies. The reason may be embedded in the nature of the subject content. There is a large amount of text material students have to deal with on a daily basis—articles, children’s books, examples of children’s work, and also instructors’ and students’ presentations. The course content, e.g., teaching standards, theories of teaching reading/writing, teaching strategies, etc., requires the instructors to organize the material into more manageable, concise formats that students will be able later to reference, revise, or use during their practicums. As one of the instructors explained, she strongly used PowerPoint, because it had really become a useful tool for years that helped her “keep on track.” Besides, her students appreciate that also, it provides “somewhat of the structure for them.” Another instructor had a similar opinion and said that PowerPoint had become a “good organizing tool” for her. At the same time, all three literacy faculty expressed their concerns that PowerPoint presentations should not provide too much information for students. In order not to overload class presentations with textual information, as one instructor explained, she writes only some basic ideas and then refers students to reading the chapters from the textbook or other course materials.

In addition to PowerPoint, the instructors use ELMO a lot. Students share their own products, e.g., ABC books, worksheets, discussion results, concept maps, and others. Also, the instructors are able to show books, pictures or other images, related to a task. It obviously makes more effective class activities, such as discussing samples of children’s work. Then, the entire class can work together on editing or discussing some problem areas, such as phonetics, comprehension, or grammar. It also allows for quickly sharing some students’ work even in a digital format. For example, in one of the observed classes, students placed their handheld devices on ELMO and showed the animations they created for a vocabulary activity.

In many ways, from some of the instructors’ points of view, WebCT provides a very
convenient platform for organizing content and storing the resources. As one of the instructors said, “I appreciate it [WebCT] to provide them with extra articles, things for them on WebCT, it's a nice place ... to be able to show them something in class and then make it available on WebCT, and if they want it or not they are able to download it straight to their computer.”

Use of Technology for Communication and Connection to a Real Classroom

Another use for WebCT, that most literacy instructors demonstrated in their classes, is for the purpose of communication. Some instructors use intensively the email and discussion tools. From the point of view of one of the instructors, communication becomes especially critical when students leave for their practicums, and having a discussion forum in WebCT allows them to get an instructor’s help when they need it. As another instructor commented, “I appreciate WebCT as a tool, I would tell you I love the discussion board, that’s why I’m really interested in following up on the blog idea, because they do the discussion board and they talk about their books and when they are out in practicum, and the thing that is found most important is creating a social network for them in a way they couldn't.” As she explained, in the situations when 50 students are off campus, they are no longer in a physical location, but the computer makes them feel like they are. She assigns them to small groups, similar to how they talked in class about the books, about the children in their classrooms, and how the books relate to children. From this, they learn from each other and make a connection to their experiences. The instructor sees it as an invaluable experience “where the technology has created a social world, a social -professional world that they wouldn't have had otherwise,” and she tries to reflect back to students how this opportunity to talk to each other is important for them.

Another instructor shared her experience of using different communication tools with pre-service teachers, such as email, video conferencing, and blogging. The activity she developed over the years with her students was meant to provide them with an opportunity to have an access to a real literacy classroom situation. As the instructor explained, she used a 7th-grade language arts teacher to be a “voice” from the classroom, to help her students become reflective practitioners. They were required to read a journal that the teacher wrote every week and respond by email. The instructor pointed out that this activity could not have
been accomplished without the use of technology. In addition, over the years she had been modifying this activity, depending on students’ reactions and participation. In the beginning, they would use email, and the teacher would send her reflection on her thoughts on what was happening in the classroom.

However, students would not engage with the teacher very much, so the instructor chose to use videoconferencing to connect with the teacher for ten minutes before she started the class. The student’s excitement and engagement with this was much higher, since they were able to see the teacher in her classroom and talk to her about what she was planning for that day and experience how a teacher makes every day classroom decisions, based on what went well or not so well in the classroom the previous day.

Later, the instructor modified the activity because they had a problem with the school district firewall settings. Starting this year, she is blogging with students. The same teacher writes her journal and students become engaged in giving comments. This activity will be expanded and students will be required to create their own blogs when they are leaving for practicum. What the instructors see in this activity is a way of providing a model for reflective teaching practice. As she stressed, she wanted students to think during the practicum about what is going on in the classroom—what went well, what did not go well. In this case, technology used by this instructor provides the means to connect her students with a practicing teacher, who serves as a model of reflective teaching to pre-service teachers.

**Modeling Use of Technology to Teach Literacy in Elementary Grades**

Most activities with technology observed in the literacy methods classes were meant as models for pre-service teachers’ possible uses of technology for teaching elementary reading and writing. There has been a rich selection of technology tools that literacy instructors already use in their classrooms and, as all of them shared in their interviews, they are exploring opportunities to integrate more.

The purposes for using such a variety of technology seem to have a deep connection with the instructors’ beliefs about teaching and learning literacy. Realization of the diversity of children’s learning and there are “multiply paths” to literacy may have determined the richness of teaching methods and strategies modeled to pre-service teachers, including strategies with use of technology. The fact that all literacy instructors place in the center of
their teaching philosophies students’ active involvement in learning may provide an explanation of why the instructors modeled use of technology aimed to engage students’ and motivate their learning.

In this sense, the use of digital storytelling seems to be a powerful example of how the instructors model technology use as a means to motivate students’ learning by giving them opportunities to “tell their story,” to get a sense of ownership of what they have learned. As one of the instructors said, although working on the digital stories usually took a lot of time and work, most students came with their best assignments they had ever completed. The way she does this activity that after showing some examples of digital storytelling, she turns it to students to work independently on their own stories. One of her favorite activities is a digital story about ISU. Students go out and photograph, then they select some images to write a “compelling story” about what they think about the topic.

Similar to digital storytelling, the same instructor engages her students to make digital book talks using iMovie. This activity comes as a part of the literature circles unit and should teach students how to motivate children to read books. In order to provide a more meaningful learning experience for her students, the instructor established a partnership with a 7th-grade teacher, whose students evaluate the digital books—discusses and reads the books they were based on. This activity provides, in the instructor’s opinion, a model of how the possibilities of technology, i.e., image and video editing, sound, transitions, and others, can be used to create suspense, and, thus motivate children to read a book to discover what happened in the story.

A powerful example of integrating digital photography into teaching literacy, and especially motivate children’s writing was demonstrated by another instructor in one of her classes. The assignment she gave to students, called “Voice of the Author,” was to model for them how technology can help introduce a concept of a point of view in writing. The students were asked to take 5-6 images and write about one of them. The following passage describes how the activity was structured by the instructor. After explaining to students how to write from the first person and third person point of view, the instructor showed a lot of images to demonstrate different angles and perspectives, and also read examples of writings. To give students a better sense of a point of view, she showed the images taken by her and talked
about what they meant personally to her. Then, she read two pieces of writing, a narrative
and a poem, she had written herself. Figure 3 presents an image and a poem written by the
instructor as a sample for her students.

Figure 3: An image and a poem written by an instructor to illustrate “first person”
point of view.

Inhabitants of a Winter Garden

I am a tan beauty,
faded now but still filled with grace.
See how I soften the landscape of this winter
garden?

I have altered with the seasons
emerging from the cool earth in spring,
growing tall in the summer heat,
drying during fall’s crisp nights
and winter’s biting cold...

(First person sample)

As she explained in the post observation interview, in her opinion, with the use of a
digital camera for this activity it is easier to demonstrate the idea of focus, than to try to
define it. The technology helps focus her thinking on the student’s writing. Apart from this,
she finds use of a digital camera motivating and exciting for children. As she explained, “it
pinpoints what to write about and, in this sense, provides motivation for kids who hate
writing. Practically, through technology, a picture of an angle helps understand what the
point of view is.” Using technology makes the whole learning experience more authentic,
and writing is accomplished for more authentic reasons. As she said:

My thinking is that the camera is a resource for students to take pictures of something
they are interested in. Then, being able to write about what interests them should
motivate them to do the writing. Tying the angles of the pictures they are taking to the
angles they will use when writing is a second connection. Angles through the camera’s eye are similar to a point of view for a writer. So, going from the angle of a selected picture, I want them to practice a writer’s point of view, either first person or third person. Thus, the activity starts with a bit of technology, the camera, involves previewing and selecting appropriate photos using iPhoto, involves printing out the photos to support a piece of writing, and then word processing the final, polished piece of writing. That’s tying the technology and literacy together.

Besides modeling use of technology for increasing learners’ motivation and creating an authentic learning experience for students, the literacy instructors demonstrated use of technology that supposedly enhanced students’ better understanding of the content they learn in literacy classes. The above example of integrating digital photography into teaching writing also shows how the instructor tried to use the possibilities of technology to visualize one of the major concepts’ in reading and writing—a writer’s point of view.

The following example of using one of the handheld applications, Sketchy, highlights how some unique tools of this technology, e.g., animation, can be used to create vocabulary activities for elementary grade students. The assignment that one of the literacy methods instructors gave to students was to develop a visual representation of vocabulary. The purpose of this activity was to show an understanding of the content of the word. From the point of view of the instructor, this would be more difficult for elementary grades children, since they would have to demonstrate it without using a word in the context. The words the students in class chose to demonstrate were very different, sometimes rather complicated scientific concepts, like “volcano eruption,” “half,” “water cycle,” “life cycle,” “cell division,” and others. Figure 4 presents one of the examples of the animations the students created in Sketchy.
The presentation of students’ projects was followed by a discussion, where the instructor and the students shared some ideas about how Sketchy could be used in the elementary literacy classroom. Some ideas included an activity, where a picture of the word could be matched with the spelling, use of animation to help visualize when learning to write letters and words, etc. For all three literacy instructors, thinking intensively about what technology can do “better” and why use it was a “kind of drive” in selecting what they were going to do with their students.

Reflecting on her use of technology in class, one of the instructors said, she thought of it in some categories: 1) using technology for things they already do in their classrooms and 2) using technology to enhance instruction that, without technology, would be difficult. Although she sees it as a challenge that many of the technology activities that she integrates into her teaching the students may see as something they can do without technology, she still tries to demonstrate to them how they can think innovatively and see what technology can do to help “reach at a higher goal or think about it [content] more cognitively.” Some very common technological applications for students, like word-processing, which most students have access to, can change, in her opinion, the whole process of writing in school. Having an opportunity to edit and revise on a computer makes it very different than with pencil and paper. As the instructor expressed, she wished her students could do “more of a true sense of writing process in the classroom” and, in this sense, use of technology with students helps make more steps towards accomplishing this goal. Additionally, the literacy instructors try to
demonstrate how some traditional activities can be transformed with technology to facilitate learning and provide an opportunity to reach a higher learning goal.

As all three instructors said, creating ABC books was a very popular activity in the elementary classrooms. Also, all literacy instructors incorporate it into their method courses in different ways. One of the instructors said this was the first assignment students had to do for her in class. They used it to introduce themselves to the class and to the children in their practicum. Usually, they are encouraged to use technology to create a book, and this also involves a lot of learning of how to use technology, e.g., word-processing, working with images, formatting, etc. The instructor expressed she really hoped they would teach it to their students, as it allows integrating reading and writing, integrating graphics, and creating a good quality publishable product. To alternate this activity and to create a connection between using children’s books and also e-books in the elementary literacy classroom, another instructor has her students make a digital alphabet book. As she said, she used “Iowa” to model this activity to them, and each book page presents a letter and a picture, and then gives some information about Iowa. This year, as she shared in her interview, she wants to use the Olympics taking place in Turin, Italy, to model how children can do research on the topic and create a digital book. By providing this model to pre-service teachers, she wants them to think about creating a digital book, not meant to be printed, but be viewed on the computer.

Another example of using technology to add a new meaning to a traditional activity was demonstrated by another instructor, who modeled a possible use for handhelds as a “fabulous, little, convenient device to use for gathering notes.” She suggested to her students that children might use handhelds during the field trip. As she said, it was still possible to take a traditional notebook to the museum and make notes, but what she wanted to show students other possibilities that could be done with this piece of technology, in addition to a traditional note-taking format. When working on the assignment, her students were able to realize what they could do with this piece of technology, like drawing a sketch, organizing notes, sending a file to other students, and later writing a story from their notes.

Many of the activities that the literacy faculty model to pre-service teachers made a clear connection to their course goals of addressing the diverse needs of students. By
introducing a variety of reading and writing strategies supported by a rich variety of technology applications, the faculty tried to make students think about different contexts they were going to teach and very different levels of access to technology.

Supporting her point as to why she tries to use other technologies than computer technology, e.g., handhelds, one of the instructors said that she was trying to prepare her students to think differently about what technology tools were available, what their students may have in the future, and how they should be able to accommodate teaching reading and writing with that piece of technology:

I always tell my students that they have to remember they’re not just teaching next year. They are going to be teaching five and ten years from now. What will those tools look like at that point? Will it still be paper and pencil? Well, it might be. We all know education moves at a pretty slow pace. But for some of them, it’s not. … I think we take the philosophy here that we are trying to prepare our students for classrooms not just next year but beyond and what will these tools look like.

The belief that students should be actively involved in learning determined how the literacy faculty structured modeling use of technology. In most cases, the instructors wanted students to have as much as possible hands-on experience, “I need the students to have used the technology as much as possible themselves, only because, again, to get a comfort level, now that’s part of what we’re trying to do is get them to use technology, be comfortable, and say “I can use it.” Explaining the way how she structured the writing activity with digital photography, one of the instructors said she wanted her students to experience for themselves the difference to give a camera to children and make them do everything themselves, “I want them to understand—technology works beautifully in the literacy classroom, if we think about how we’re going to use it initially.”

Having students experience a writing or reading activity with technology, the instructors wanted them to “focus on the content and strategies, not on the use of technology itself.” In one of the observed classrooms, while students were using handhelds to revise each other’s stories, the instructor clearly emphasized they were not learning to use technology and the practice was about the content and pedagogical application, “a handheld is just a tool.” Giving students technology into their hands, the instructors wanted them to realize
what technology contributed to the activity and how it would be different when teaching the same content but without technology.

The approach the faculty modeled for use of technology was more to provide a purpose of doing the activity with technology. As one of the instructors said, she tried to avoid direct instruction of how to do something with technology. Another instructor also added to that:

Good teaching tells us when we're teaching a new skill or strategy, you explain why you are going to use that. ... And then you show the students how to use it. I would always start by modeling how I use it to develop an understanding in students what are my expectations and then I turn the technology over to them and say, now you do it and I'm going to be here to answer your questions if I can.

Explaining the rationale for accomplishing an activity with technology was very important from the point of view of all instructors. First, they wanted students to understand the literacy connection with the technology. One of the literacy instructors explained that the message she wanted to pass to her students is, “I think it is wonderful if you know how to use a digital camera, I want to talk to you how you can use it to teach literacy better, more effectively in a more memorable way.”

In many cases, as the instructors explained, they allowed students to “play” with technology and see what they could get from this. As one of the instructors said, she was quite confident they already had some previous knowledge of technology, and she was trying to build also on this. Some students were more competent than others with technology. Thus, she set the activities in a way so they could learn some things on their own, and then teach some things to each other. As she added, in most cases the use of technology in her classes was rather exploratory; she tried to give students only minimal instructions—how to save, cut, or paste, because knowledge of these operations is transferable from one computer program to another.

Building their own activities on students’ prior knowledge of technology, the literacy instructors encouraged them to think they might take the same approach with elementary grade school children. As one instructor said, referring to her students:
I want them to knock over the barriers to young children learning with technology, because I see where the little ones will have very little fear, when it comes to moving that mouse, trying things. I want them to see that as an opportunity. And, like I see myself, I become a technology integrator. I want them to pay attention to the kids and to build on what I see how children would approach technology or the computer.

To help in some ways to overcome this fear of not being very confident with technology, most instructors modeled themselves on how they would overcome the barrier of not knowing something about the technology they used with students. As one instructor said, she made it very well known to her students that she does not know everything about programs. So, she hopes that when her students will be using technology in their classrooms they will make the same connection. Another instructor said that in several cases, her students showed her the way to do some things more effectively, e.g., video editing. The idea of not being afraid to give technology into the hands of children, because “they will figure out what to do with it,” appeared repeatedly in the faculty’s interviews and in some classes. This vision of a learner, who is capable of learning independently and sometimes has more natural view of technology use, may explain the faculty’s intentions to bring new types of technology into the classrooms, e.g., iPods, and see if students may find “more connections and uses” than the instructors realize.

However, instead just throwing technology on students, all instructors considered students’ levels of technology skills and tried to provide students with a less stressful experience as possible. For this purpose, the instructors made sure they were quite comfortable themselves with the technology activity they were modeling. Also, they used available outside classroom technology support as much as they can.

The goal to provide pre-service teachers with as many examples as possible of the use of technological tools was an incentive for the literacy faculty’s ambitions to explore more and more types of technology and to determine a match for them with teaching reading and writing. The previously discussed examples of modeling technology use for teaching literacy are just a few of the rich experiences from the literacy methods faculty. It would be impossible to discuss all of them here. The selected examples, from this researcher’s point of view, provide some distinctive uses of technology that were observed across all literacy
faculty’s classrooms in this study. In the next section, the findings from the literacy faculty’s use of technology will be discussed in connection with the faculty’s teaching philosophies and their beliefs.

**Faculty Model the Use of Technology in Literacy Method Courses: Summary and Discussion of Findings**

From this researcher’s opinion, how faculty modeled use of technology in their courses was, to a large extent, determined by their beliefs that every child has an ability to learn and that every child learns differently. The richness of technology applications used in method courses to teach literacy may be explained by this. In addition, it may be also connected to the faculty’s goals to demonstrate to pre-service teachers there are “multiple paths to literacy.” There are also different strategies, different things, and also different technological tools to enable students to learn.

The other important reason for using such a wide variety of technology may be explained by the fact that the faculty realized the diversity of elementary schools’ contexts. The issue of access to technology in schools was a main concern of all literacy methods instructors. As one of the instructors said, she wanted her students to question “who gets access to technology and who does not and how we can help kids get access.”

I think that is so important, many of them go to their student teaching and they say, “Iowa State taught all these great technologies and there is nothing out there”. I try my best in my course, to show them free tools that are out there...

In order to diminish this possibility of becoming frustrated, the literacy instructors built students’ knowledge of how to use technology, by making them aware that access to technology will be different and that students have to learn to use the tools which may be available at the moment. This explains a variety of activities and strategies the instructors used for the same activities with technology, meant to demonstrate to students how the same things can be achieved with different technological tools, e.g., the ABC books. As one of the instructors said, she introduced to them the use of handhelds for teaching writing to show the possibilities when students could do the same things they would do with a computer, but in some cases it would be a cheaper solution.
In most of the instructors’ classrooms, there was an obvious message—a call to students to think about their teaching innovatively and how use of technology can make learning in schools different. The ideas the instructors shared with students went beyond activities for classrooms and were a part of their own vision of how technology can help connect families, communities, and teachers’ professional development. Demonstrating to students how they can create a website for class or newsletters to parents with their children, or have online conversations about a book with children in other states, the instructors wanted them to think about teaching in a different form, from what they most experienced and become “change agents” in the schools where they are going to teach. In this sense, there seems to be a link to the faculty’s own beliefs that they are technology integrators. As they expressed in their interviews, the faculty hoped their students would take it from them.

The extensive use of technology in the literacy methods courses may create, as a first impression, the feeling of it being “overused.” However, an opportunity to observe some of the instructors over a longer period of time helped identify that the faculty carefully planned and modeled to their students the use of technology connected directly with the purpose of instruction. The same use of technology they wanted to see from the pre-service teachers linked to an objective, and if “the technology will enable them to do, to reach that goal, and [then] reach it better or at the standard that they want when they use the technology.” Talking about their own reasons for selecting the appropriate type of technology when modeling its use in the elementary classroom, they demonstrated a connection between an instructional goal and what they know from research about children learning literacy. For example, children learn vocabulary better when they can visualize the meaning of words. From this, they thought about what would be “the perfect technology,” to help children learn better.

Using technology to show learning was another consideration that some instructors incorporated, when modeling use of technology to their students. Speaking about the use of digital stories in her classes, one of the instructors said she wanted them to realize how technology could be a way to show what they have learned in the literacy methods courses. In the activity with the digital stories, as she does at the end of every semester, she wants them to look back over the semester’s work and tell their “unique story” about what they learned about teaching literacy. This brings, in her opinion, the issue of assessment, how to
integrate a more reflective type of assessment of activities with technology, “where the
technology has become a tool for them to be able to show learning rather than reach a certain
level of learning.”

The approach literacy faculty modeled the use of technology was connected with the
goal to create more effective, more meaningful, and a better learning experience for their
students. At the same time, the literacy faculty demonstrated a very natural use of technology,
when it was not either “focusing all on technology or over focusing on the content. It was
supposed to be woven together.”

Concentration on the learner, as a part of their teaching philosophies, whether it was
an elementary grade or teacher training program student, determined the most frequently
expressed concerns about use of technology. From the faculty’s point of view, active
involvement of a learner into his/her learning requires a very good access to technology tools.
Thus, availability of technology was a concern most often heard from the literacy faculty in
relationship to teaching in elementary schools. Often, the rationale for making a decision
about demonstrating one or another use of technology was based on what will be future
teachers’ possibilities when they teach in an elementary school context. However, it did not
make the faculty refuse to use technology. On the contrary, they demonstrated and spoke
about wide varieties of technologies, not just computers, to help students realize what they
can build and how they can integrate these tools into teaching literacy.

Purposeful, in one the instructors’ words, “appropriate” use of technology was
another shared concern that made faculty reconsider the tasks they were completing with
technology. The examples of how faculty changed and continued changing their activities
with technology over time, or dropped some technology uses, showed in all these cases their
decisions were influenced by how it affected or did not affect students’ learning. Being
critical, reflective users of technology, the faculty wanted to model to their students that
thinking about a learner and how “children would approach technology,” and what the
children learn from this technology should be the foundation on which they build their
teaching.
CHAPTER FIVE: DISCUSSION

The purpose of this study was to explore the relationship between the teacher training faculty’s teaching philosophies and beliefs, and how they model the use of technology to pre-service teachers. This chapter presents the summary of the findings from both elementary math and literacy methods faculty case studies, as well as the practical implications and recommendations the findings suggest for technology integration into methodology courses, and implications for future research.

Summary of the Findings

The findings from this study suggest the faculty’s teaching philosophies and beliefs may explain how they use technology in their courses. The faculty, who participated in this study, demonstrated their teaching philosophies and beliefs determine how they make technology-related decisions, such as the selection of technology tools, a structure of activities, and students’ engagement with technology. Moreover, their modeling use of technology for teaching elementary math and literacy was consistent with what they saw as core ideas of their teaching philosophies and what they believed about teaching and learning.

Findings from the Math Faculty Case Study

In the case of math methods factors, building pre-service teachers’ learning experiences around children’s thinking about mathematics was the most significant factor that determined use of technology in these courses. When selecting technology and planning activities with students, the faculty strongly demonstrated their belief that technology use is justified, when it helps show students’ or children’s thinking about mathematics and then helps a teacher take them to a higher level of understanding mathematical concepts. They saw their primary goal to demonstrate to pre-service teachers that thinking and learning about mathematics happens differently and depends on a learner’s previous experiences. Thus, selection of teaching strategies must come from the analysis of their learners. This influenced how they set their requirements to technology use and the structure of the whole experience with technology. Two major components for teaching with technology were critical for most math instructors. First, flexibility of technology, so the instructor would be able to modify instruction to address the particular learners’ needs. Second, a strong rationale for the faculty, when making technology-related decisions was connected with a possibility to include a
reflection part into learning mathematics with technology. The expectations that faculty had about technology to be able to show students’ thinking about mathematics may explain the limited modeling use of technology for teaching mathematics in elementary grades, since the faculty expressed they did not see much opportunities for this at the elementary school level.

It was obvious that some skepticism the faculty demonstrated to the use of technology to teach elementary math was not connected with their overall negative attitude to technology. On the contrary, the faculty showed they saw a strong contribution that technology could make to advance their students’ learning. For example, use of video clips became an essential part in all math methods faculty classes because they saw an educational value of this for developing pre-service teaching to understand methods and strategies for teaching elementary math. This is consistent with previous research that suggested faculty were more likely to use technology, when they saw that it could enhance their students’ learning (Groves & Zemel, 2000; Hanger, 2000; Strudler, 2003).

**Findings from the Literacy Faculty Case Study**

In the case of the literacy methods faculty, they built pre-service teachers’ experiences with technology upon the idea that every child has an ability to become a successful reader and writer. The core ideas of their teaching philosophies included a respect for diversity of students’ literacy backgrounds and understanding there are different ways to learn. Based on this, they saw their goals to show pre-service teachers a variety of teaching methods and strategies to teach reading and writing, and teachers must be able to make a decision in every particular case. They must decide which methods and strategies will be most effective for their learners.

Related to this, the literacy methods faculty considered use of technology to be one of the available strategies to enhance students’ learning. Similar to the math methods faculty, the literacy instructors considered using technology in their courses, when they saw it supported their goals. The way in which they modeled use of technology to pre-service teachers was meant to demonstrate ample opportunities regarding how technology can create for students a better learning experience, based on research about how children learn to read and write. The faculty themselves used technology with pre-service teachers, when they were
convincing it was going to be a better strategy over traditional methods of teaching (Groves &
Zemel, 2000).

A rich variety of technology used in elementary literacy courses was supposed to
model for students that the same learning objectives could be reached using different
technology tools. It also demonstrated a connection to an overall goal the faculty set for
themselves—to equip pre-service teachers with a set of teaching strategies, including use of
technology, they can use to address different learners. They wanted future teachers to take
away from their courses an understanding of the diversity of learners and their literacy
backgrounds, as well as the diversity of the classroom contexts. They also wanted future
teachers to realize there will be diversity in the kinds of technology available for them and
they must be ready to deal with this.

The Connection between the Faculty Teaching Philosophies and Beliefs and
Modeling the Use of Technology: Findings from Both Case Studies

Reflection was a key word that linked all participants in this study regarding faculty’s
teaching philosophies. As reflective practitioners, these faculty built their students’
experiences with technology in a way it would help them become reflective teachers or, in
the words of one of the faculty, “critical assessors of practice.”

The faculty’s teaching philosophies and beliefs determined the strategies they
selected when modeling use of technology to pre-service teachers. Their belief that learners
must be active in order to learn made them place technology use, as much as possible, into
the hands of pre-service teachers. Instead of providing them with direct instructions on how
to fit technology within the content area, they structured modeling sessions in a way that
students receive hands-on experience and work independently. In this sense, the faculty
helped pre-service teachers develop their own vision of how use of technology could make
the entire learning experience better or more effective, depending on what they saw as their
teaching and learning objectives.

In relevance to this, reflection about what students are doing and what they are
learning from every step is a natural part of modeling the use of technology. In this study,
the instructors involved students into discussions about their experience with technology and
how they see the connection to a specific grade level they are going to teach.
Providing a strong rationale for all that teachers do in their classrooms, including use of technology as a part of their teaching methods, was another parameter the faculty modeled themselves and what they wanted students to realize when they were taking them through the experience with using technology in their specific content areas. As one of the instructors explained, her view of what she should be modeling to her students is that it should make a difference. Her first consideration whether to use technology with students was, “is it going to get a point across, are the students going to understand what we are doing better?”

The faculty beliefs that the different ways of how people learn have translated in their classrooms by introducing their students to a variety of teaching methods and strategies. Technology was modeled as one of these strategies that future teachers may use with their students. However, from the faculty’s point of view, use of technology, as with any other teaching methods and strategies teachers may employ in their classrooms, must be strongly connected to an instructional goal and learners’ needs.

Teaching Philosophies and Beliefs as Internal Barriers to Technology Use: Connection to the Literature

Providing students with a rich experience using a variety of teaching resources including technology, the faculty wanted them to find their own way of teaching that would be “consistent with what their beliefs are.” Overall, the findings support previous research that found faculty teaching philosophies and beliefs can become critical internal factors that enhance or hinder faculty technology use for teaching and learning (Swain, 2005). The faculty in this study demonstrated that if use of technology for teaching and learning becomes a part of their teaching philosophies, they are more eager to deal with external factors, such as access to technology or a lack of their own or students’ technology skills.

In this sense, the literacy faculty in this study, who considered technology to be an essential part of their instruction, provided a strong example of modeling to pre-service teachers how to deal with external barriers to technology use. Although they expressed high levels of concerns related to technology access in elementary schools and considered the practicality of this knowledge to pre-service teachers for their future teaching, the understanding that future teachers may have very different and often very limited access to technology did not lead the faculty to refuse to model use of technology in their classes. On
the contrary, this made the faculty actively seek solutions and demonstrate a larger variety of technology tools in their courses, e.g., digital cameras or handheld devices, which might be more accessible for future graduates in elementary classrooms.

Additionally, some of the faculty’s experiences with technology in their courses demonstrate that, although the level of instructors’ confidence and possible students’ “fear” of technology were seriously considered when making decisions about technology applications, this was not considered a primary reason to abandon technology when the faculty saw its educational value. What the faculty attempted to model to their students was that none of them will ever know everything about technology, but this would not mean they should be restricted to technology use only if a teacher and students are comfortable with using it in the classroom.

As one of the literacy instructors said, she “believed that if teachers were sure that new type of technology might be beneficial in some ways to their students, they must try it.” The method some of the faculty in this study modeled to their students how to overcome the “fear” of technology use was by a careful structuring of the activities with technology. As another of the literacy instructors said, “in a way, those who are scared of the technology can find as much success on their own level.”

The faculty in this study demonstrated how they were trying to overcome the “fear” of technology use by building the learning experience in their classes so that some students may be more advanced in technology use than the instructors and by seeking support from the technical support people or students in class. Moreover, the faculty encouraged pre-service teachers to think of their own teaching with technology in the same way, since their students, especially in elementary grades, may have very little fear of technology. “They are capable,” as one of the instructors said, “of figuring out many things about technology by themselves.”

These findings support evidence from previous research on classroom teachers (Ertmer et al., 1999; Ertmer & Hruskocy, 1999), who found that teachers’ beliefs about a value of technology use in their teaching may result in a different weight they assign to external, first-order barriers. Although it was not possible in this study to establish a clear causal relationship between faculty teaching philosophies and how they deal with the
external, first-order barriers, the findings suggest the internal factors or barriers, such as faculty teaching philosophies and beliefs about technology use in their content area, may become more important and may affect faculty responses to external barriers.

**Implications and Recommendations**

The findings of this study provide some considerations for practical implications, when planning technology integration into teacher training programs and designing professional development activities. The time pre-service teachers spend in teacher training institutions is when they are actively developing their teaching philosophies and beliefs, although they already have some ideas about teaching from their previous experiences in the classrooms (Lumpe & Chambers, 2001). Experiences with technology in their courses should help them determine a connection between what they believe as teachers and how technology fits into this.

Learning from the faculty about how they find the place for technology within their own teaching philosophies and beliefs, and how they model use of technology to pre-service teachers helped determine some critical components that most of the faculty in this study incorporated into their students’ experiences with technology. First, the reflexive approach in which students use technology as both learner and teacher may be the most appropriate method to help students develop “personally relevant conceptions of technology” (Kovalchik, 1997, p. 31). The faculty in this study demonstrated this approach by making their own technology-related decisions, based on what they knew about learners and how they would address this as teachers. The modeling activities for their students were structured in a way to give them an experience with technology as learners and as teachers.

Next, hands-on experience with real learners is very important to help pre-service teachers develop their own vision of technology use that fits with their beliefs about teaching and learning. In this sense, the faculty in this study served as models of learning about technology, since their vision of technology use has been developed, based on their learner’s needs and context, and through the process involved in their own reflection and students’ feedback. Actually, lack of opportunities for the students to teach with technology during their practicum was reported as a major concern by most of the faculty in this study. As one of the instructors said, she was really concerned if the students will be able to make the same
connection as she makes for herself between what she wants to achieve and how technology fits the scenario. In addition, a lack of opportunities for students to try what they have been modeled in a real classroom situation does not allow the faculty to evaluate the usefulness of the experience with technology they provide for students in their courses.

Additionally, pre-service teacher experience should involve opportunities to learn about meaningful technology use in different content areas. Students should be able to see the differences in technology use, based on the core ideas across the content areas. The findings from the faculty in this study suggest some essential differences in use of technology in the literacy and the math methods, which may be related to what the instructors believe to be the central ideas of teaching and learning in their content areas.

Finally, the technology professional development activities, including teacher training faculty, should be tailored in a way that provides a connection between faculty teaching philosophies and their beliefs, and technology use. It also should be considered that there are always differences in how individual faculty members see the role of technology and its potential applications in their courses. As this study demonstrated, there may be some commonalities both within and across content areas. Thus, the one-to-one approach to faculty training should be combined with an opportunity to collaborate with other colleagues to determine if their experiences with technology can fit within their teaching philosophies and beliefs, and, therefore, be integrated successfully into the courses.

**Conclusions and Implications for Future Research**

This study showed the use of technology that the faculty modeled to pre-service teachers was related to their teaching philosophies and beliefs. It also confirmed previous research by Strudler & Wetzel (1999), whose results showed that technology is likely to become an essential part of faculty teaching, when they see a pedagogical fit between technology and teaching in their content areas.

These findings also suggest that the internal factors or barriers, such as the faculty teaching philosophies and beliefs about technology use in their content area, may become more important and may affect faculty responses to external barriers. This means the relationship between internal and external barriers to technology integration may be more complex (Brickner, 1995), compared with the traditional view that if external, first-order
barriers, are eliminated, then technology integration will follow (Ertmer, 1999).

Understanding how both internal and external factors may interact and affect technology integration into pre-service teacher training requires further investigation. Future research may contribute to a better understanding and knowledge of the relationship between faculty teaching philosophies and beliefs, and how they respond to external barriers to technology integration into their teaching.

Also, it is necessary to investigate pre-service teachers' reactions on how faculty's modeling the use of technology shape their own teaching philosophies and beliefs about teaching with technology. Learning from pre-service teachers, if they make a connection between pedagogy and technology similar to what faculty believe they try to model in their courses, or if it is different, why, will provide valuable information that can assist faculty and teacher training programs refine their strategies and approaches to technology integration into content areas.
References


### APPENDIX A: The Data Collection Process

<table>
<thead>
<tr>
<th>Participants</th>
<th>Stage 1 - September 2005</th>
<th>Stage 2 - December 2005-January 2006</th>
<th>Stage 3- December 2005-February 2006&lt;sup&gt;1&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Elementary math methods faculty</strong></td>
<td>45-minute overall course interview conducted for <em>Teaching Teachers to Use Technology: What Works and Why</em> Project; course syllabi obtained</td>
<td>45-minute faculty use of technology interview conducted (See Appendix 1)</td>
<td>2 classroom observations (4 hours)</td>
</tr>
<tr>
<td>Faculty 1</td>
<td></td>
<td></td>
<td>3 classroom observations (5 hours);</td>
</tr>
<tr>
<td>Faculty 2</td>
<td></td>
<td></td>
<td>3 classroom observations (4 hours)</td>
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<tr>
<td>Faculty 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Faculty 3</td>
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<td></td>
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</tbody>
</table>

| **Elementary literacy methods faculty** | 45-minute overall course interview conducted for *Teaching Teachers to Use Technology: What Works and Why* Project; course syllabi obtained | 45-minute faculty use of technology interview conducted (See Appendix 1) | 3 classroom observations (6 hours) |
| Faculty 1    |                          |                                     | 3 classroom observations (6 hours)         |
| Faculty 2    |                          |                                     | 2 classroom observations (5 hours)         |
| Faculty 3    |                          |                                     |                                                |

<sup>1</sup> During Stage 3, the worksheets and other related to observations artifacts, such as activities samples, web site addresses, faculty email, and etc., were collected. In some cases, individual informal discussions with the participants were conducted related to classroom observations.
APPENDIX B: Faculty Interview Protocol

1. What are your overall goals for this course? What are the core ideas? How were these learning goals/core ideas determined?

2. On a more general level, can you describe the guidelines or process that you use when planning or preparing to teach courses? Do you have a philosophy of teaching?

3. Will you be using/do you use technology in this course? If so, what will you be doing with it? What goals will it serve?

4. What are some of your favorite activities that involve use of technology in the courses you teach? What do you aim at integrating these activities into your teaching?

5. When you make a decision to use technology as a part of your instruction which factors influence your decisions about the 1) selection of technology application; 2) activities; 3) procedure- who and how will be using technology?

6. What would be the reasons that may you decide not to use technology in your class? Have you ever experienced the situation when you decided not to use a technology application for the activity/activities in class? What made you decide that?

7. What kind of teaching with technology would you like to see in your graduates when they start their teaching carriers?
APPENDIX C: Coding Categories

Faculty teaching philosophies and beliefs
philosophy of teaching
goals of the course
core ideas of the course
where core ideas come from
guidelines to plan the course
attitude to technology in courses
expectations of graduates' use of technology

Faculty use of technology
what technology use
favorite activities with technology
why use technology
how choose technology
strategies to introduce technology
future plans with technology

Barriers to technology use
why not use technology:
- external barriers
- internal barriers

Purposes to use technology
use of technology/presentation
use of technology/organization of the content
use of technology/communication/reflection
use of technology/link to a real classroom
use of technology/content teaching/modeling:
- use of technology for teaching literacy
- use of technology for teaching math
- use of technology/teaching resources