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Internet Use in Teacher Preparation Programs: The Relationship between Pedagogy and Practice in the Pennsylvania State System of Higher Education

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INTERNET USE IN TEACHER PREPARATION PROGRAMS: THE RELATIONSHIP BETWEEN PEDAGOGY AND PRACTICE IN THE PENNSYLVANIA STATE SYSTEM OF HIGHER EDUCATION

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ABSTRACT

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The overall purpose of the study was to examine the relationship between Pennsylvania State System of Higher Education (PASSHE) teacher educators' pedagogical beliefs and their use of telecollaborative Internet activities in practice. The goal of this examination was to address the U.S. Department of Education's Office of Educational Research and Improvement (April 2002) call for collecting data about how digital content is being used and to make recommendations for action. The study collected data, via a web-based survey, about pedagogical beliefs and practices of PASSHE teacher educators. The analysis of descriptive statistics, rankings, Spearman rho correlations, and ANOVA calculations revealed a gap between constructivist pedagogical beliefs and actual instructional practice. Using a typology of constructivist telecollaborative activities, the study pinpointed areas of Internet-specific Pedagogical Knowledge and Technological Knowledge to be developed in PASSHE teacher educators. Recommendations were made for PASSHE programs to collaboratively create

telecollaborative inquiry and communication activities, provide professional development in the use of telecollaborative activities, and support integration into teacher preparation programs.

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TABLE OF CONTENTS

Page

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

LIST OF TABLES

Page

LIST OF TABLES (continued)

LIST OF FIGURES

Page

CHAPTER I

INTRODUCTION

In the National Education Technology Plan (NETP), the United States government issued a recommendation for Schools, Colleges, and Departments of Education (SCDEs) to move toward the integration of digital content (U.S. Department of Education, 2004). Digital content is defined by the NETP as "online content" (p. 43). As noted by Cuban (2001), this move toward digital content must be more than just an increase in the frequency of technology use. The move toward the use of digital content must focus on how online resources are being used in the classroom in terms of activities and underlying pedagogy (Harris, 2000). It is critical to examine the relationship between pedagogical beliefs and technology use in practice of teacher educators as they grapple with how to adequately prepare future teachers. This study examined pedagogical beliefs and use of digital content in teacher preparation programs.

Background

Schools at all levels, K12 and beyond, provide varied educational experiences for learners. Using a variety of strategies to engage students, many integrate digital content from the Internet into lessons across the curriculum. Harvey, Depover, DeLievre, and Quintin (2001) investigated Internet use at the university level and found a continuum of no integration to full integration in virtual campuses. They found that constructivist strategies used to meet clearly defined goals appeared to have had a positive impact on quality of student experience. Unfortunately, related research in this area has primarily

examined unimodal settings (online courses) while multimodal (face-to-face) classrooms remain poorly researched (Pollard & Pollard, 2004-05).

Past studies of the use of online content in multimodal classrooms have identified rates of Internet use, factors that influence the use of online resources, and types of curriculum-based activities (Becker, 1999; Harris, 1998a; Harris, 1998b; Harris & Grandgenett, 1999; Moursund & Bielefeldt, 1999; U.S. Department of Education, Office of Educational Research and Improvement, April 2002; Wallace, 2004). These studies show that access, age, professional leadership, pedagogy, and knowledge of resources impact the integration of digital content into instruction. Becker (1999; Becker & Ravitz, 1999) found that constructivist pedagogy increased the likelihood of K-12 teachers using the Internet. While these studies found that constructivist pedagogy increased the likelihood of Internet use, they did not specifically examine Internet use in teacher preparation programs.

The need for further investigation into the pedagogical beliefs of technology using K-12 teachers was confirmed by Harris and Grandgenett (1999). They examined relationships between demographics and teacher beliefs and the use of the Internet. Unlike the Becker (1999) study, this study did not reveal a correlation between beliefs and degree of technology use. While Harris & Grandgenett used three instruments, examining teacher attitudes and innovation, to describe beliefs, none of the belief instruments exhibited a significant correlation with total time online. Harris & Grandgenett concluded that further study of beliefs, differentiating between teacher use and teacher-directed student use of the Internet, is necessary. Additional studies have also revealed a mismatch between the emphasis on constructivism in literature, teacher

beliefs, and the actual instructional practice (Hernandez-Ramos, 2005; Hunter, 2002; Rakes, Flowers, Casey, & Santana, 1999). These studies of K-12 educators reveal a mismatch between pedagogical beliefs and instructional practice. It appears from these studies that teachers may have a limited knowledge of methods to incorporate the Internet into their constructivist teaching styles. In a study of teacher preparation programs, Moursund and Bielefeldt (1999) concluded that "the situation in college classrooms to some extent mirrors the situation in K-12 classrooms" (p. 22). A more recent study found that faculty support was successful in providing models of instruction but the support did not always translate to a change in classroom practice (Brzycki & Dudt, 2005). Taken together, these studies recommend examining the extent of constructivist pedagogy in the use of technology in teacher preparation programs.

Studying Pedagogy and Practice

Pedagogy

To begin an investigation of teacher preparation programs, it is important to understand the components of professional teacher knowledge and how those components impact use of technology. Teacher knowledge is complex and develops over time. Shulman (1987) identified components of the teacher knowledge base and Danielson (1996) developed criteria for observing and measuring teacher knowledge. As researchers examined the development of teacher knowledge and the use of technology, a new type of teacher knowledge was identified. Called Technological Pedagogical Content Knowledge (TPCK), it is a highly specialized type of knowledge that develops as teachers increase knowledge, skills, and understandings of technology, teaching, and content (Mishra & Koehler, 2005; Pierson, 2001).

TPCK is a helpful construct to use when considering factors that impact teacher integration of Internet content into instruction. Wallace (2004) identified factors that influence Internet integration in K-12 classrooms. Identified items fell into the categories of technological knowledge, pedagogical knowledge, and content knowledge. Wallace concluded that teaching with the Internet is a complex endeavor that varies widely in implementation and impact. In contrast to K-12 educators, teacher educators are expected to possess a high degree of content knowledge, even as novice teachers. However, "…relatively few researchers have examined the relationship between teachers' pedagogical beliefs and their classroom uses of technology" (Ertmer, 2005). Thus, research examining Internet use in teacher preparation programs must focus on both pedagogical beliefs and Internet integration practices.

Many researchers have promoted the use of constructivist pedagogy in education (Danielson, 1996; Harris, 1998; Jonassen, 1996; Papert, 1993a, 1993b). Constructivist strategies include an emphasis on problem-based learning, student choice and initiative, encouraging depth rather than breadth of interaction with content, critical thinking, and relevant and authentic learning assignments. According to Jonassen (1996), telecollaborative uses of the Internet are most appropriate as they are constructivist in nature. In addition, in a more recent study of teacher preparation programs, students who experienced collaboration in the teacher preparation program and found it to be beneficial were individuals who used a variety of teaching activities in their own practice (Brouwer & Korthagen, 2005). Collectively, these studies confirm that it is important for teacher educators to model constructivist practices.

Practice

The number of studies describing multimodal Internet use in higher education is meager. Early research found that the primary use of Internet technology among higher education faculty was the use of email, communication with colleagues, and research rather than teaching (Beck & Wynn, 1998; Wang & Cohen, 1998). Further, Internet access has been shown to be common for higher education faculty members and that use of email and websites were the most frequently reported activities (Warburton, Chen, & Bradburn, 2002). Faculty members indicated using the Internet to post class information and links. The report also indicated that faculty members expected students to use the Internet. Additional studies reveal similar trends and frequently end with either a recommendation for additional preservice training in constructivist pedagogy or training in Internet use and instructional practices (Brzycki, & Dudt, 2005; Good, 2004; Kurtts, Hibbard, & Levin, 2005; Wang, 2002; Yang, 2003).

While studies have examined the amount of Internet use, most have not investigated types of Internet use. One notable exception is a collaborative project between the University of Virginia and the University of South Florida that found that the use collaborative online activities can help teacher educators to align constructivist pedagogical beliefs and instructional practices (Good, 2004). This examination of the complex relationship between pedagogical knowledge, technological knowledge, and content knowledge, was carried out using case study methodology. The project engaged preservice teachers in telecollaboration using *Virtual Architecture*, a typology of telecollaborative Internet activities (Harris, 1998). Harris' telecollaborative models were based on hundreds of actual K-12 lesson plans examined and coded into two broad

categories, *communication* and *inquiry*. The two categories describe instructional purposes for integrating the Internet into instruction. Within the two broad categories of use, Harris described eight types of telecollaborative activities that teachers use when incorporating Internet content into instruction. These activities provide a tool for examining instructional practice among teachers who integrate digital content into instruction.

Statement of the Problem

Teacher preparation programs are expected to integrate and model technology use throughout coursework (Hofer, 2005; Moursund & Bielefeldt, 1999; National Council for Accreditation of Teacher Education, 2002; NETSProject, 2000; NETSProject, 2003). Past studies have examined access and use rates, constructivist beliefs, and teacher uses of the Internet. Many reveal a mismatch between pedagogical beliefs and instructional practices. The development of TPCK has been identified as a factor which influences the integration of technology. The pedagogical beliefs and instructional practices of teacher educators had not been described and there was no instrument for such a study. There was a clear need for this study in order to add to the developing professional knowledge base.

Importance of the Study

This study examined whether pedagogical beliefs are reflected in actual teaching practice among teacher educators. The study utilized a web-based survey to describe pedagogical beliefs and technological practices of teacher preparation faculty who integrate digital content into instruction. The goal of this study was to address the U.S.

Department of Education's Office of Educational Research and Improvement (April 2002) call for collecting data about how digital content is being used.

This study is of value for several reasons. First, research examining Internet-specific pedagogy and practice has been urged by researchers in the past (Brzycki, & Dudt, 2005; Good, 2004; Kurtts, Hibbard, & Levin, 2005; Wang, 2002; Yang, 2003). Second, no similar data had been previously collected regarding Internet integration in teacher preparation programs. Third, the results aid in the identification of professional development opportunities for teacher educators. Fourth, the results provide a baseline for future comparison and study. Lastly, the study results will help to guide SCDEs as they seek to meet the NETP (2004) recommendation for increased use of digital content in a pedagogically sound manner. This study identifies gaps in the TPCK of teacher educators and makes recommendations for professional development opportunities.

Delimitations

The study was conducted during the Fall 2006 semester using teacher educators from the Pennsylvania State System of Higher Education (PASSHE) teacher educators who had a primary responsibility for teaching undergraduate students in the Elementary, Secondary, and Special Education departments. Those surveyed did not have primary responsibility for teaching a technology course.

Research Purpose and Hypotheses

Purpose Statement

The overall purpose of the study was to examine the relationship between PASSHE teacher educators' pedagogical beliefs and their use of telecollaborative Internet activities in practice. The study describes pedagogical beliefs held by PASSHE teacher

educators, identifies the types of telecollaborative activities used in teacher preparation programs, determines which activities are being integrated into instruction most frequently, and determines whether there is a correlation between constructivist beliefs and the use of telecollaborative activities.

Research Hypotheses

First research hypothesis. Based on the emphasis in literature on the use of constructivist pedagogy in teacher education, it was believed that the majority of teacher educators will strongly support the use of constructivist beliefs.

Second research hypothesis. It was believed that the majority of teacher educators will strongly agree with collaborative instructional goals.

Third research hypothesis. Telecollaborative activities that mimic traditional collaborative structures, like information collection, would be preferred by faculty over more innovative telecollaborative activities, like strategies exchanges. Of Harris' two telecollaborative activity types, it was believed that telecollaborative inquiry activities would be used in practice more frequently than telecollaborative communication activities.

Fourth research hypothesis. Based on similarities to traditional inquiry activities, it was believed that the information comprehension activities would be used in practice most frequently followed by information reframing, information application, and information creation activities from among the telecollaborative inquiry activities.

Fifth research hypothesis. Based on similarities to traditional communication activities, interpersonal exchanges would be most frequently used followed by works and

experiences exchanges, information exchanges, and strategies exchanges from among the telecollaborative communication activities.

Sixth research hypothesis. It was expected that there would be a positive correlation between constructivist beliefs and the use of telecollaborative communication activities in teacher preparation programs.

Seventh research hypothesis. It was expected that there would be a positive correlation between constructivist beliefs and the use of telecollaborative inquiry activities in teacher preparation programs.

Eighth research hypothesis. It was expected that there would not be a significant difference between the respondents' primary certification program affiliation and the use of telecollaborative inquiry activities.

Ninth research hypothesis. It was expected that there would not be a significant difference between the respondents' primary content area affiliation and the use of telecollaborative inquiry activities.

Tenth research hypothesis. It was expected that there would not be a significant difference between the respondents' primary certification program affiliation and the use of telecollaborative communication activities.

Eleventh research hypothesis. It was expected that there would not be a significant difference between the respondents' primary content area affiliation and the use of telecollaborative communication activities.

Definition of terms

Activity structures: a set of flexible models that can be used in the design of curriculum-based, online, educational projects.

Asynchronous learning: the education of students at different times and locations through the use of a two-way online communication that occurs with a time delay, allowing participants to respond at their own convenience

Constructivist pedagogy: a theory of learning that emphasizes active participation by the learner in constructing meaning, rather than receiving knowledge.

Content knowledge: the knowledge of the content, methods of inquiry, syntax, and structure of an academic discipline

Cookies: electronic files sent by a Website to a client computer that allows for the automated transfer of identifying information.

Digital content: multimedia or online information (U.S. Department of Education, Office of Educational Technology, 2004, p. 43).

Elementary education: a program that is planned and organized for people who are training to teach grades K-6, or some combination of those grades.

Information application activities: activities which require students to use information accessed online to solve problems or persuade others.

Information comprehension activities: activities in which students use information available online to help them understand more about a curriculum-related topic.

Information creation activities: activities which use online tools to generate data, the analysis of to help students to understand a topic.

Information exchange activities: activities which involve electronically collecting, compiling, and comparing information either synchronously or asynchronously.

Information reframing activities: activities in which students combine and/or evaluate multiple sources and/or types of information about a topic.

Instructivist pedagogy: a theory that the view that knowledge is attained passively by information transfer from a knowledgeable authority figure (teacher) to the learner.

Internet: A global network connecting millions of independent computer networks to facilitate data transmission and information communication.

Interpersonal exchanges: activities in which individuals communicate electronically with other individuals, individuals communicate with groups or groups communicate with other groups. Interpersonal Exchanges include: keypals, global classrooms, electronic appearances, telementoring, question-and-answer activities, and impersonations.

Mindtools: computer based tools and learning environments that engage and facilitate critical thinking and higher order learning.

Modeling: a teacher's demonstration, by words and actions, of the behaviors, skills, or competencies that students are to learn.

Multimodal: a delivery method in which Internet integration is practiced extensively in face-to-face classrooms

Pedagogical content knowledge: knowledge of subject matter and the most effective way to introduce it to the student (Shulman, 1987).

Pedagogical knowledge: the general concepts, theories, and research about effective teaching, regardless of content areas.

Pedagogy: refers to the art and profession of teaching, the methodology one uses as a teacher, the style of teaching a teacher chooses.

Pennsylvania State System of Education (PASSHE): comprised of 14 Pennsylvania state universities, including: Bloomsburg, California, Cheyney, Clarion, East Stroudsburg, Edinboro, Indiana, Kutztown, Lock Haven, Mansfield, Millersville, Shippensburg, Slippery Rock, and West Chester.

Secondary education: a program that is planned and organized for people who are training to teach grades 7-12, or some combination of those grades.

Special Education: a program that is planned and organized for people who are training to teach K-12 students who have been identified with specific disabling conditions.

Strategies exchanges: activities in which students are involved in some type of cooperative or collaborative problem solving, and are attending to the problem solving processes as part of their learning.

Synchronous: the education of students through the use of online communication occurring simultaneously in time.

Teacher educators: individuals involved in the pre-service teacher preparation programs of the PASSHE.

Teacher preparation program: a specified program of curricular and co-curricular experiences designed to prepare people to become teachers

Technological content knowledge: a specialized type of knowledge that integrates technological knowledge and content knowledge.

Technological knowledge: knowledge that typically would be held by technologically proficient individuals.

Technological pedagogical content knowledge: a specialized type of knowledge that integrates pedagogical knowledge, technological knowledge, and content knowledge.

Technological pedagogical knowledge: a specialized type of knowledge that integrates pedagogical knowledge, and technological.

Technology integration: the use of technology in a seamless manner to support and extend curriculum objectives thus engaging students in meaningful learning.

Tele: a prefix meaning “at a distance.”

Telecollaboration: using a computer connected to the Internet to collaborate with others at a distance.

Telecollaborative communication activity structures: activities that allow students to interact with others online. They fall into four categories: interpersonal exchanges, information exchange, works and experiences exchanges, and strategies exchanges.

Telecollaborative inquiry activity structures: Online activities engage that allow students to gather information for higher-order thinking tasks. The four types of inquiry are: information comprehension, information reframing, information application, and information creation.

Teleresearch: using a computer connected to the Internet to do research at a distance.

Works and experiences exchanges: activities in which students share their texts, images, soundtracks, multimedia creations and/or experiences virtually with others.

CHAPTER II

LITERATURE REVIEW

History of Internet in Education

Nearly a half-century ago, President Dwight D. Eisenhower created the Advanced Research Projects Agency (ARPA) to investigate and develop technology for the future. ARPA developed a network, called ARPANET, which connected Department of Defense computers to those of civilian researchers and universities engaged in military-funded research. This network of computers was the forerunner of today's Internet (Schrum & Berenfeld, 1997; Williams, 1996). In the 1970s the network grew and expanded to additional academic, research, and military institutions. During the mid-1980s the National Science Foundation (NSF) created its own network, NSFNET, to relieve stress on the ARPA network and extend service to additional entities. Initial users of this high-capacity network continued to be primarily research universities (Bissell, Manring, & Rowland, 2001; Ryder, & Hughes, 1998). In 1995, commercial services replaced the NSFNET and the Internet expanded rapidly into homes, schools, and businesses (Ryder, & Hughes, 1998).

In the field of education, teachers were quick to find uses for the Internet. Early Internet uses included finding information, accessing data, investigating current events, participating in global communication, and publishing online (Serim & Koch, 1996). With the publication of the International Society of Technology in Education (ISTE) National Educational Technology Standards for Teachers (NETS*T) and Standards for

Students (NETS*S), Internet integration became a required competency for teachers and their students (NETSProject, 2000). Currently, the National Education Technology Plan (NETP) recommends that Schools, Colleges, and Departments of Education (SCDEs) move toward the integration of online content (U.S. Department of Education, Office of Educational Technology, 2004). According to the NETP, teacher preparation programs are now expected to "Ensure that teachers and students are adequately trained in the use of online content" (p. 43).

Academics have also ranked the investigation of teaching and learning with specific technologies, like the Internet, as a high priority (Pollard & Pollard, 2004-05). Thirty educational technology experts from the United States, brought together via the Internet, identified research priorities in the field of educational technology. The top two priorities revolve around teaching and learning and call for an examination of the role of multimodal learning and effective instructional strategies. Teacher preparation programs are described as likely targets of further investigation.

Theoretical Explanations Supporting Use of Internet in Teacher Preparation Programs

Currently, teacher preparation programs are struggling to understand how to best train their students in the integration of the Internet into instruction. To understand how to train students to become Internet-using educators, it is important to examine the components of professional teacher knowledge (Shulman, 1987), how to assess growth in professional knowledge (Danielson, 1996), and the relationship between professional knowledge and technology (Keating & Evans, 2001; Mishra & Koehler, 2005; Pierson, 2001).

Teacher Knowledge is Multifaceted

Studies of teachers who integrate the Internet into instruction are based on a premise developed by Lee Shulman (1987) that teachers develop professional knowledge over time. Shulman turned to literature and examined philosophy, psychology, and case studies to develop a theory about the development of professional teacher knowledge. Using multiple sources, he described teacher knowledge as multifaceted. Shulman's work identified seven components of the teacher knowledge base. They are: content knowledge, general pedagogical knowledge, curriculum knowledge, pedagogical content knowledge, knowledge of learners and their characteristics, knowledge of educational contexts, and knowledge of the purposes of education. Although each component develops independently, it is the combined effect of expertise in all areas that mark exemplary teachers.

Teachers develop these multiple types of professional knowledge over time. Of particular importance in the study of teachers who use the Internet in instruction, is the acquisition of pedagogical content knowledge (PCK), a highly specialized knowledge of content and teaching strategies that are appropriate for specific tasks. According to Shulman, PCK develops over time through a series of stages which include personal comprehension of the content, transforming the knowledge for communication to students, planning lessons, selecting teaching and learning strategies and materials, delivering and evaluating the instruction, and reflecting. As teachers engage in these stages, they develop a new comprehension and increase their PCK. As with other types of teaching, learning to teach with the Internet involves the development of PCK as

teachers make thoughtful decisions about content delivery based on their knowledge of content and pedagogical beliefs

Teacher Knowledge is Observable and Measurable

While Shulman's work is central to studying teacher development, it does not provide guidance in the measurement of teacher knowledge. *Enhancing Professional Practice: A Framework* was published to assist individuals and SCDEs in measuring and improving professional knowledge and practice (Danielson, 1996). In the book, a series of rubrics for evaluating teacher development are presented. Based on Shulman's work, Danielson's framework has been adopted in whole or in part by states including California, Texas, and Pennsylvania, to evaluate pre-service and in-service teachers. This framework was intended to apply to experienced as well as to novice teachers for purposes beyond the initial licensing of teachers.

Identified in the framework are four domains of professional practice: planning and preparation, the classroom environment, instruction, and professional responsibilities. Danielson described types of documentation for each component and provided an evaluation rubric for each component. The rubrics identify teacher practice as unsatisfactory, basic, proficient or distinguished. Like Shulman, Danielson notes that knowledge evolves over time, and there is an expectation that teachers will continually move toward the distinguished level of practice through self-reflection, continuing education, collegial interaction, and professional development. Danielson views technology as a tool to be used for clear and accurate communication and engaging students in learning. She places the use of technology as a component of professional practice into Domain 3, Instruction.

According to the Danielson framework, best practices associated with the student engagement criterion are consistent with constructivist strategies and include an emphasis on problem-based learning, student choice and initiative, encouraging depth rather than breadth of interaction with content, critical thinking, and relevant and authentic learning assignments. Proficient practice is described as that which cognitively engages students (Danielson, 1996, p. 98). Cognitive engagement indicates that students are actively constructing understanding. They are not passive recipients of information using a pre-determined process to determine correct answers. Cognitive engagement requires students to be active participants in the learning process. Educators cognitively engage students when they provide activities and assignments that require analysis, synthesis, and evaluation. Planning instruction that includes interaction with both a variety of groups and a variety of instructional materials and resources can also engage students in constructing knowledge (Danielson, 2007). While the framework provides a means to measure overall PCK, the specific types of activities that an observer would see are not described in terms of technology use in general or Internet use specifically. It can be inferred from the rubric that constructivist uses of the Internet are most appropriate but the rubric does not provide a means for evaluating Internet integration practice.

Teacher Knowledge Includes Technological Pedagogical Content Knowledge

Studies have only recently begun to investigate the relationship between PCK and the knowledge of technology access and operation (Keating & Evans, 2001; Mishra & Koehler, 2005; Pierson, 2001). Keating and Evans (2001) found that preservice teachers feel confident in personal use of technology but lack confidence in the instructional use of technology. They used the term *Technological Pedagogical Content Knowledge*

(TPCK) to describe the specialized knowledge that a teacher develops when technological knowledge, content knowledge, and pedagogical knowledge are brought to bear in a teaching and learning environment. Pierson (2001) also determined that there is a difference in technology use associated with differences in teaching and technology experience. Teaching expertise was assessed in terms of PCK through the use of interviews and observations. Technology expertise was evaluated by observing faculty and determining their developmental stages using the Apple Classrooms of Tomorrow (ACOT) stages of development. The ACOT project identified five stages of development as teachers begin as novices in the entry phase and continue development as they adopt technology for personal use, for student use, and eventually invent new uses that emphasize student engagement (Sandholtz, Ringstaff, and Dwyer, 1997).

Pierson's findings revealed that teachers in different stages of development defined technology integration differently and that teachers' definitions of technology integration impacted the management of student computer use. The study also found that planning habits of novice versus expert teachers changed based on their technical skills. Pierson, like Keating and Evans, suggested that technology adds another component to PCK. She theorized that teachers develop technological knowledge in addition to the other types of professional teacher knowledge as identified by Shulman (1987). Pierson also used the term *Technological Pedagogical Content Knowledge* (TPCK) to describe the intersection of technological knowledge and pedagogical knowledge. While the Keating and Evans study and the Pierson study both recognize the existence of TPCK, although they did not indicate how to examine TPCK in future studies.

Examining Technological Pedagogical Content Knowledge

More recently Mishra and Koehler (2005) have added to the theory of TPCK by identifying specific components of TPCK that should be examined by researchers. Mishra and Koehler propose evaluating TPCK through more than an examination of CK, PK, and TK. They identify pedagogical content knowledge (PCK), technological content knowledge (TCK), and technological pedagogical knowledge (TPK) as equally important components in the study of technology used for instruction. While CK, PK, and PCK have been previously described by Shulman and Danielson, TK, TCK, and TPK have only recently been described by Mishra and Koehler. TK is the knowledge of technology access and operation. TCK is knowledge of technological resources specific to the content area and TPK is knowledge of technological strategies specific to meeting the pedagogical goal. A closer examination of the components of TPCK follows.

Content Knowledge

Content knowledge (CK) is the expert knowledge of a subject area that a teacher possesses. Research on learning supports the premise that teachers continue to move along a continuum from novice to expert throughout their careers. Teachers learn through many experiences including their own practice, interactions with others, specific training, degree programs, self-reflection and experience outside the classroom (Bransford, Brown, & Cocking, 2000; Danielson, 2007). Teacher preparation educators are expected to possess greater CK than the typical K-12 teacher based on the attainment of terminal degrees and scholarly endeavors

Pedagogical Knowledge

Pedagogical knowledge (PK) encompasses the beliefs and practices held by educators. Educators use a wide range of learning theories, including constructivism, for

a wide range of purposes (Jonassen, 2006; Mehlinger & Powers, 2002). As one of many strategies, constructivist teaching is used along with traditional approaches by many educators (Jonassen, 2006; Knight, 2002).

Constructivism in education. Constructivist pedagogy, advocated in education today, has a foundation in theory and is supported by research. Constructivism is not a model for teaching but rather a descriptor of strategies which have a common foundation in philosophy and psychology (Windschitl, 2002, p. 136). Colburn (2000) called constructivism the "Grand Unifying Theory" because the umbrella of constructivism covers a variety of strategies that promote high levels of engagement, active learning, and social interaction (Bransford, Brown, & Cocking, 2000; Perkins, 1999; Sandholtz, Ringstaff & Dwyer, 1997; Spodark, 2005).

Constructivists believe that students create personal understandings based on their current understandings modified by new experiences (Fosnot, 1996a). Researchers agree that constructivist theory is rooted in the work of Dewey and Piaget (Rakes, Fields, & Cox, 2006; Roblyer, 2004; von Glasersfeld, 1996). Dewey (1938) believed that learning is based on experience. He believed that students must be actively involved in authentic experiences to build meaningful learning. Piaget (1971, 1973) furthered the movement toward constructivist approaches by describing learning as a cognitive process in which learners engage in constructing knowledge. He described learning as the process of assimilating and accommodating new knowledge based on experience. Constructivists emphasize active engagement in which the learner acts in a social environment and the social environment acts on the individual in order to create new understandings (Cobb, 1996).

"Constructivist teaching emphasizes thinking, understanding, and self-control over behavior but does not neglect basic skills and knowledge" (Zahorik, 1995). Constructivist-oriented teachers develop lessons that require students to engage in critical thinking within real-life situations as a means to modifying understandings (Jonassen, 1996). In several states a framework "…grounded in the constructivist approach" (Danielson, 1996, p. 25) is used to assess teaching.

In addition to the theoretical foundation, research supports the use of constructivist strategies. In a study of memorization versus constructivist type strategies, Iran-Nejad (1995) found that memorization is not as effective as constructivist strategies. Constructivist strategies are those which require students to "organize information, explore the learning environment, conduct learning activities, and monitor their own learning" (p. 18). In the constructivist classroom the teacher asks open-ended questions, encourages collaboration, and requires students to support ideas as learning is scaffolded and meaning is created by learners. The concept that learners create meaning is validated by the *How People Learn* (HPL) framework which provides justification for use of constructivism in education based on a broad review of research on learning (Bransford, Brown, & Cocking, 2000). The review of literature for the HPL framework revealed that learners have prior knowledge and experiences upon which they build (or construct) new understandings. The research also revealed that if students are not engaged in meaningful construction of new understandings that they will not retain the new material. This research-based finding supports the use of constructivist approaches in education.

In addition to the HPL research, constructivist teaching approaches are advocated by professional organizations such as the National Council of Teachers of

Mathematics and the National Science Teachers Association, the organizations that created the national science and mathematics content (National Council of Teachers of Mathematics, 2000; National Research Council, 1996). Research in science and teacher preparation supports the effectiveness of constructivism in promoting deeper understanding (Alesandrini & Larson, 2002; Krockover, Shepardson, Adams, Eichinger & Nakhleh, 2002; Liang & Gabel, 2005). However, researchers caution that the results are unique to each context (Krockover, Shepardson, Adams, Eichinger & Nakhleh, 2002) and dependent upon social interactions (Liang & Gabel, 2005). Research in mathematics has attempted to determine whether constructivist instruction is more effective than traditional instruction (Chung, 2004; Gales & Yan, 2001; Kroesbergen, Van Luit, & Maas, 2004; Naiser, Wright & Capraro, 2004; Neal, 2004). The literature in mathematics education has not clearly supported constructivism as more effective than traditional instruction. Some studies have found constructivism to be effective in raising standardized test scores, increasing student engagement, and facilitating application to real-life situations (Chung, 2004; Gales & Yan, 2001; Naiser, Wright, & Capraro, 2004) while others have found that it is not always effective (Kroesbergen, Van Luit, & Maas, 2004). Still others have found that constructivism may or may not be effective depending on context (Neal, 2004). This lack of clear support for constructivism is not unexpected but the result, according to many researchers, of the appropriateness of using constructivism as one of several pedagogical approaches (Knight, 2002; Jonassen, 2006; Papert, 1993a and 1993b; Sandholtz, Ringstaff & Dwyer, 1997).

While constructivism has been widely advocated in science and mathematics education, it also has been demonstrated to be an effective approach in other disciplines

such as art (Milbrandt, Felts, Richards, & Abghari, 2004), history (Bennett & Soule, 2005), and language arts (Hunter, Gambell, & Randhawa, 2005). In the field of technology, constructivism has been advocated by researchers in multiple studies (Papert (1993a; 1993b; Dwyer, Ringstaff, & Sandholtz, 1991; Sandholtz, Ringstaff & Dwyer, 1997). Papert (1993a; 1993b), the original promoter of constructivism in technology integration, proposes that constructivism is a particularly appropriate strategy for use with computers in education. His view was based on research associated with his use of Logo to create "microworlds," in which students worked with a visual programming language to create on-screen designs. Papert, however, did not provide guidance for teachers seeking to apply constructivist beliefs as they integrate technology into their teaching.

The ten-year Apple Classrooms of Tomorrow (ACOT) study examined K-12 teachers as they integrated technology (Dwyer, Ringstaff, & Sandholtz, 1991; Sandholtz, Ringstaff & Dwyer, 1997). The ACOT study identified five stages that teachers progress through as they move constructivist beliefs into practice. In Entry, the first ACOT stage, teachers struggled to gain technical knowledge as they unpacked boxes, plugged in machines, and made initial attempts at setting up and using computer technology (Dwyer, Ringstaff, & Sandholtz, 1991; Sandholtz, Ringstaff & Dwyer, 1997). In this stage researchers found that teachers experienced a return to novice in their knowledge of resources and classroom management. As teacher became more adept with the technology, their knowledge of resources and classroom management increased and they moved into the Adoption stage. The ACOT study identified teachers in the adoption stage as those who used technology to support traditional instructional approaches. In this stage teachers used the technology to produce instructional materials. Some teachers

in the study moved from Adoption to Adaptation. In the Adaptation stage teachers continued to use technology for productivity. However, they changed focus from teacher productivity to student productivity. Teachers in the Adaptation stage emphasized student engagement with content through technology. In Appropriation, the next stage, teachers exhibited a personal mastery of the technology and were observed using the technology to engage students in active, social, authentic tasks. These teachers emphasized making meaning from their experiences. Finally, teachers in the Invention stage were found to be creating new, content-specific uses of technology. According to the ACOT study, while classrooms continue to employ both constructivist and traditional instruction practices, constructivist practices can be developed over time as TPCK develops. The observation of these "Classrooms of Tomorrow" supports Papert's original claim that, in some classrooms, technology and constructivism can help to establish a "computer culture" (1980, p. 177) in which learners are actively engaged in learning in society.

Constructivist pedagogy and practice. Becker and Ravitz (1999) conducted a study of computer use and instructional practices and found that frequent users of technology tended to use constructivist practices. They concluded that the technology allowed constructivist beliefs to be put into practice. The researchers asserted that the technology caused a change in practice. The study, however, resulted in the question of whether beliefs precede practice.

Outside of the field of technology, Brewer and Daane (2002) conducted a qualitative study of the relationship between beliefs and practices in teaching primary mathematics. They found that instructional practices do not always reflect teacher

beliefs. They concluded that constructivist beliefs must precede constructivist practice. In one case study, a teacher began with traditional practice but, with coaching, adopted constructivist pedagogy and translated the new beliefs into practice (Fosnot, 1989). The study concluded that while beliefs must precede practice, it is possible to influence a change in beliefs. This is further supported by a study of inservice and preservice teachers who participated in constructivist based professional development and mentoring (Fosnot, 1996). In the study participants documented their experience through journaling. From an analysis of the journals, it was documented that pedagogical beliefs changed through the program. Some studies have examined how constructivist beliefs can be reflected in practice. Others, focused on improving teaching, found that teachers need to see and experience constructivist models in order to adopt constructivist practice (Gonzales, Pickett, Hupert, & Martin, 2002).

Windschlitl (1999) outlined reasons constructivist beliefs may not be put into practice. He indicated that some subject areas and learning environments lend themselves more easily to the problem-solving activities associated with constructivist tasks. In addition, he noted that some educators are reluctant to move theory into practice due to an emphasis in school culture on a single evaluation criterion such as standardized testing scores. In a subsequent review of studies of pedagogy and practice (Windschlitl, 2002), he stated that "Even among experienced educators, this type of instruction is difficult to put into practice" (p. 144). This is reiterated by a qualitative study of four teacher educators who embrace constructivist beliefs but found it difficult to put their beliefs into practice (Strehle, Whatley, Kurz, & Hausfather, 2002). According to Dewey

(1964), this mismatch between practice and pedagogy frequently produces a "dualism" (p. 120).

Constructivism and Internet use. Jonassen's (1996) work on *Mindtools* extends the previous studies by providing specific examples of constructivist uses of the Internet. Jonassen defines Mindtools as "computer-based tools and learning environments that have been adopted or developed to function as intellectual partners with the learner in order to engage and facilitate critical thinking and higher-order thinking" (p. 9). Using Mindtools, teachers can create active, engaging, integrated lessons using technology as theorized by Papert. One class of Mindtools is used to promote *telecollaboration*, the use of Internet-based collaboration between students and others to engage in higher-order thinking activities (Jonassen, 1996; Jonassen, Carr, & Yueh, 1998). Higher-order thinking involves students in solving problems that may be ill-defined and may have more than one correct answer. As students engage in higher-order thinking activities they must go beyond recall of knowledge to make thoughtful decisions. Research has found that infrastructure and teacher knowledge of Internet-specific activities are factors influencing the integration of higher-order thinking Internet activities into K-12 instruction (Jonassen, Howland, Moore and Marra, 2003).

An action research project investigating the role of technology in teaching and learning with the World Wide Web (Ewing, Dowling, & Coutts, 1998) provides anecdotal support for the use of constructivist Mindtools. The study found that the Internet, by itself, did not cause students to engage in construction of knowledge. Instead, the way an online activity was structured led to student engagement and construction of knowledge. The project identified five major indicators of the

constructivist approach. Culled from a review of literature, these indicators can be used to measure the extent to which an online activity is constructivist in nature. The indicators are: context-based learning, learning through active collaboration, personal control over learning, learning as a form of personal growth, and learning for understanding. Ewing, Dowling and Coutts concluded that, "In the context of the WWW, but possibly even wider, the support for adopting an approach to learning based on constructivist theory is increasing" (p. 20).

While Jonassen and colleagues emphasize the need for use of Mindtools in higher education, there is little evidence that the theory of using telecollaborative Internet activities has been adopted in teacher preparation programs (Jonassen, Howland, Moore and Marra, 2003). The authors note that many teachers create lessons focused on information searching, a strategy associated with instructivist practice as it does not necessarily result in higher-order thinking or yield meaningful learning. The authors promote the use of constructivist strategies and provide examples of telecollaborative activities that are constructivist in nature.

Studies of constructivist pedagogy and Internet use in K-12 schools. Although Jonassen, Papert, and others promote the theoretical use of constructivist-based telecollaborative projects, there has been limited research in the field. Most of the research projects have examined the use of constructivism and Internet activities in K-12 environments (Becker, 1999; Gibson & Skaalid, 2004; Harris & Grandgenett, 1999; Hunter, 2002; Rakes, Flowers, Casey, & Santana, 1999). A review of the literature on those studies is necessary in to inform research of telecollaborative project use in teacher preparation programs.

An analysis of technology use and constructivist behaviors of K-12 teachers found that those teachers with a high technology rank had significantly higher constructivist scores than the moderate or low technology rank individuals (Rakes, Flowers, Casey, & Santana, 1999). Study participants were part of a purposive sample of educators with Internet access and were chosen randomly from both electronic lists and volunteers to complete a two-part email survey. The survey included self-reported recall of the frequency of fourteen constructivist teaching behaviors. The study also found that teachers with fewer years of teaching had higher constructivist scores and teachers of grades K-3 had higher constructivist scores than those of other grade configurations. A mismatch between the emphasis on constructivism in literature and teacher beliefs and the actual practice of constructivist behaviors in the classroom was also found in this study.

In 1998, the National Science Foundation report, Becker (1999) concluded that there is a relationship between constructivist pedagogy and Internet use. The study looked at frequency of Internet use and types of use by students and further considered the extent that teachers valued access in classrooms and the amount of access available. Instructivist teaching was defined as having the whole class read the same material, explaining content through questioning or direct explanation, and having students practice understanding repetitively until they can demonstrate competency on a test. Constructivist teaching was defined as active, problem-based, and authentic. The pedagogical beliefs of teachers were measured by 11 belief items and 15 professional practice items which described both instructivist and constructivist beliefs. Three teacher purposes were examined: finding information and resources, email, and posting material

on the World Wide Web (WWW). Student uses were email, participation in online collaborative projects, and research. Student use of the WWW was primarily for research with few students reporting use of email and involvement in online collaborative projects.

Becker's study identified seven significant predictors of the amount of Internet use. The single best predictor was classroom access. Computer expertise was the second most significant predictor with pedagogy being the third, suggesting that the TPK component of TPCK is important in Internet use. The study did not consider content expertise. The report found that most constructivist teachers believed Internet presence in the classroom was essential. The report concluded that, "Clearly, a teacher's pedagogical beliefs and practices are strongly related to how relevant they see the Internet for their teaching and whether they use it" (p. 23).

Although Becker found a relationship between constructivist pedagogy and Internet use, other studies have found little or no correlation (Harris & Grandgenett, 1999; Hunter, 2002). In a quantitative study to discover whether the use of telecommunications is related to learner-centered, innovative, and constructivist practices, no direct relationship between teacher beliefs and Internet use was found (Harris & Grandgenett, 1999). The researchers used a randomly selected population of one thousand teachers holding Texas Education Network (TENET) accounts to respond to a survey either online or on paper. TENET is a statewide telecomputing network used voluntarily by teachers in the state of Texas. As expected in a survey of Internet using educators, the study found high network use (number of logins and amount of time online) throughout the sample. Online respondents were found to have a significantly higher mean for network use and total time spent online. This was the most significant

correlation found in the study. Unlike the Becker (1999) study, no direct relationship between teacher beliefs and network use was found. Limiting the generalizability of the Harris and Grandgenett study is the fact that, "the educators comprising the sample have, to some degree, self-selected themselves for the study, first by using Internet-based resources through TENET, and then by agreeing during online registration procedures to later consider participation in research efforts" (p. 335).

Hunter (2002) also examined Internet use in constructivist classrooms and failed to find any constructivist uses of the Internet, such as accessing primary sources, real-time data, and content area experts, among the participants. The case study used a sample composed of three elementary school teachers from two schools. Each teacher was chosen to participate based on high levels of Internet use. Data analysis described the degree to which constructivist indicators were discovered in each teacher's practice. Cases were analyzed individually and a cross case analysis was performed. The findings revealed a conflict between pedagogical beliefs and practice. Teachers demonstrated a limited knowledge of how to incorporate the Internet into their constructivist teaching style.

Recognizing the conflict between constructivist beliefs and actual classroom practice, a recent study examined professional development as a strategy for increasing constructivist uses of the Internet among practicing teachers. The study found that instructional modeling and use of constructivist teaching strategies by teacher educators are influential on teacher practice (Gibson & Skaalid, 2004). Making explicit theory to practice connections was also found to be important in influencing perceptions of constructivist use of the Internet among practicing K-12 educators. The authors

concluded that it is important to develop a vision for constructivist use of the Internet among teachers.

While the aforementioned studies recommend investigation of the relationship between pedagogical beliefs and actual teaching practice, they did not provide a tool for measuring constructivist beliefs or constructivist practices in the use of the Internet for instruction. Hernandez-Ramos (2005) created a set of questions for measuring constructivist beliefs in a study of technology use in Silicon Valley schools. The questions, part of a larger survey of technology use, can be used to measure pedagogical beliefs of Internet using educators. The Hernandez-Ramos study found that while many teachers have the technological foundation to use technology, they do not put their knowledge into practice to support their beliefs (Hernandez-Ramos, 2005). The author traced the exposure to technology back to the teacher preparation program and found that few teacher educators model pedagogically appropriate uses of technology.

Technological Knowledge

Although the previous studies have identified PK as a topic of future investigation in teacher preparation programs, PK is only one component of teacher knowledge that informs the decision to integrate the Internet into instruction. Technological knowledge (TK) is another factor that influences the integration of the Internet into instruction. Wallace (2004) used case study methodology to examine TK, PK, and CK based on a premise identified by prior research that "the Internet is widely used in K-12 schools. Yet teachers are not well prepared to teach with the Internet, and its use is limited in scope and substance" (p. 447).

Technological knowledge of the Internet. Wallace identified specific aspects of TK that impact teacher use of the Internet for instruction. Studying three high school science teachers, Wallace found four prominent challenges to the use of Internet in instruction: knowing the subject matter, knowing what students know and can do, keeping track of student work, and developing a coherent progression of ideas. Based on the case study, Wallace developed a theory that there are five considerations when teaching with the Internet that form a framework for practice. Two of the considerations, pedagogical context and disciplinary context, describe PK and CK. The remaining considerations describe the TK that teachers must possess in order to begin integrating Internet content into instruction.

According to Wallace, when teaching with the Internet, teachers must consider boundaries, authority, and stability. Because the Internet has no boundaries in terms of what quality and quantity of content is available, teachers must recognize and be able to set boundaries for students as they use the Internet. This requires that teachers have some degree of technological proficiency in assisting students in navigating the Internet. In addition, teachers must have some technological proficiency in locating authoritative and valid resources for students as well has being able to help students evaluate information and resources. Finally, teachers must consider the stability of Internet resources. Wallace's study indicates that teachers must possess some technological knowledge of how to access sites that have been moved or how to find new sites to replace ones that no longer exist. She concludes that these considerations have not been carefully examined in research or policy settings and are an area for further investigation.

Studies of technological knowledge in teacher preparation programs. Other than the Wallace study, very few studies have examined technological knowledge in teacher preparation programs. No others have examined Internet-specific TK. A study commissioned by the Milken Exchange collected information about "the IT preparation that preservice teachers receive" (Moursund & Bielefeldt, 1999, p. 1) and found that "the situation in college classrooms to some extent mirrors the situation in K-12 classrooms" in general technological knowledge and use (p. 22). Based on the findings, the authors were able to confirm that the technology infrastructure of SCDEs increased more rapidly than the integration of technology into instruction. In order to facilitate the integration of technology, they recommended using an integrated instructional technology approach to develop TK and PK in tandem.

A later study found a disconnect between preservice teacher development of TK through coursework and actual use of technology by K12 teachers (Marion, 2003). The study, a doctoral dissertation, looked at how teacher educators integrate technology into coursework and how technology was used by program graduates within 2 years. While graduates were required to use technology in their teacher education program, they did not continue to do so outside of their courses in K-12 schools. Specifically, the use of word processors, Internet, LCD projectors, and spreadsheets were found to differ between the two environments demonstrating that while teachers appeared to develop TK, they did not continue to use it in context. According to Marion, "Faculty members in colleges of education play a vital role in training preservice teachers for technology integration. If the faculty in the colleges of education are not integrating technology or not demonstrating technology use for preservice teachers, then preservice teachers are going

to continue to struggle with technology integration" (p. 106). Research to investigate the development of TK and PK in theory and in practice among teacher educators was recommended.

In a study of the development of teaching competence in teacher preparation programs, occupational socialization was found to have a considerable influence on the use of technology in K-12 classrooms (Brouwer & Korthagen, 2005). The longitudinal study tracked individuals as they moved through teacher preparation and into their 3rd year of inservice teaching. The study showed that students who experienced collaboration in the teacher preparation program, as they developed TK, were individuals who practiced a variety of teaching activities in their own practice. The authors concluded that teacher education programs can make a difference in the practice of recently graduated teachers by modeling good practice to facilitate development of TK and PK. Additionally, the authors recommended an investigation of practice-to-theory and theory-to-practice programs as preservice teachers develop TPCK.

TPCK Changes Over Time

Each of the studies presented so far provides evidence that TPCK is a factor in the decision to use the Internet for instruction. While the term TPCK has not been used explicitly in the majority of studies, evidence exists that TPCK is not stagnant. Development of TK, PK, and CK may not be even; some instructors, like teacher educators, may have a high degree of CK expertise but a low degree of TK. These variations in knowledge levels influence the integration of technology into instruction. As knowledge levels change, so must TPCK (Finley & Hartman, 2004; Wetzel & Williams, 2004-05). The following studies support the development of TPCK over time.

Finley and Hartman (2004) identified factors impacting change and resistance as teacher educators begin to integrate technology. The study found that PK of instructional objectives was important along with the development of TK in a supportive, collaborative environment. The study concludes that TPCK is complex and can change over time.

In another study, long-term professional development strategies were found to be significant in developing TPCK among teacher educators (Wetzel and Williams, 2004-05). The study, conducted as part of a Preparing Teachers of Tomorrow (PT3) grant, included support for the development of TPCK of teacher educators in the form of workshops, technical support, instructional support, supportive leadership, and access to hardware and software. The professional development activities resulted in an increase in the integration of technology in teacher educators' syllabi, class activities and assignments, web course support, communication, and search strategies. The authors recognized the importance of impacting teacher educators as a means of improving the preparation of teacher candidates. Using a repeated measures design, course portfolios were reviewed at the beginning and end of the study to determine what differences existed in the planning and implementation of technology in courses. The study found an increase in technology used in class materials and confirmed that the TPCK of teacher educators can change over time. Further study of the development of TPCK and technology integration by teacher educators is recommended.

Studies of Instructional Practice among Internet Using Educators

Studies presented to this point represent the theoretical basis for integrating the Internet into instruction. Some of the studies presented found a relationship between constructivist beliefs and technology integration while others did not. All studies described barriers and influences in the field of instructional technology. Most of the

studies focused on technology integration in general. Research that examined Internet use specifically has recommended further study of teacher preparation programs but has not clearly described how to examine instructional practice among Internet using educators. To inform future study of the development of TPCK in teacher educators, studies focused on Internet use in practice, both in K-12 and in higher education, are examined in this section of the literature review.

K-12 Studies

Studies of K-12 instructional use of the Internet have rarely focused on curriculum-driven, constructivist, student uses of the Internet which makes it difficult to identify teacher practice. They have, however, resulted in the identification of access, connection speed, and professional development, and authentic experiences as factors that facilitate or impede the integration of the Internet into instruction (Harris, & Grandgenett, 2002; Kleiner & Farris, 2002; Lanahan, 2002; Norris, Sullivan, Poirot, & Soloway, 2003; Parsad & Jones, 2005; Schofield & Davidson, 1997; Schofield & Davidson, 2002).

The factors associated with Internet use in a large district were investigated as part of a four-year National Science Foundation project titled Common Knowledge: Pittsburgh (CK:P) (Schofield & Davidson, 1997). The study found that, while the Internet was used for instruction, the activities were frequently optional or enrichment assignments, not integral parts of teachers' instructional plans. Schofield and Davidson identified

> five common patterns of Internet use in NET classrooms: (1) onetime use, which gave students a brief introduction to the lnternet and its resources as they carried out some relatively limited activity; (2) augmental project use, which involved students sporadically in Internet-based activities

> throughout the school year; (3) curriculum enhancement use, which employed the Internet briefly but quite regularly to complement students' ongoing classroom activities; (4) major project use, which involved students with the Internet and its resources for extensive amounts of time; and (5) integrated curriculum use, which made intensive Internet use a regular and important part of the curriculum (2002, p. 139).

Schofield and Davidson (1997; 2002) discovered that the full integration of Internet into instruction may have been impeded by school and community beliefs that teachers are knowledge dispensers, students are quiet, passive receivers of information, and Internet material is not a valid instructional resource. This reveals the instructivist view as an inhibitor of Internet use.

Technology access was identified as the factor that most strongly influences the curricular use of computer technology and Internet resources in a study by Norris, Sullivan, Poirot, and Soloway (2003). The researchers excluded technology teachers since the focus of the study is on discretionary use of technology. They found that students were not using technology due to lack of access to computers in classrooms. They also discovered that Internet use was less than overall technology use. The study revealed that only 1.4% of teachers used the Internet for instructional purposes, 25% did not use the Internet at all, and 6% used it less than 15 minutes per week. The authors concluded that Internet use, while strongly influenced by access, may also be related to other factors.

Factors, in addition to access, have been identified by researchers in other studies (Kleiner & Farris, 2002; Lanahan, 2002; Parsad & Jones, 2005). Increased access, connection speed, and professional development were identified as factors influencing Internet integration in a larger-scale study sponsored by the National Center for Education Statistics' (NCES) (Kleiner & Farris, 2002). The study examined access

types, locations, amounts and other factors related to educational use of the Internet in U.S. public schools and found that 99% of schools had access to the Internet in the Fall 2001, most via broadband connection. In addition, 79% to 87% of the schools had classroom-level access. Data collection used the NCES Fast Response Survey System (FRSS). The study identified access and connection speed as factors influencing Internet integration. Schools indicated that they provided professional development opportunities for staff members in the integration of the Internet into instruction. However, the study did not investigate the use of specific constructivist online collaborative activities. The same methodology was repeated in 2003 using the NCES FRSS (Parsad & Jones, 2005). By 2003, nearly 100% of schools had access to the Internet and 90% to 97% of individual classrooms had Internet access. In addition, 95% of schools had broadband access and they continued to report that teachers sought professional development activities that addressed integration the Internet into instruction.

According to the NCES short paper *Beyond School-level Internet Access: Support for Instructional Use of Technology,* universal access to the Internet, as evidenced by high school and classroom access figures, does not result in universal instructional use of the Internet (Lanahan, 2002). The paper used data collected in the 1994-2001 NCES studies on Internet use in K-12 schools to show that access, supplemented by training and support, does appear to result in increased instructional use of the Internet. However, the authors noted that, " there is much more to be learned about teachers' instructional use of technology. Data on digital content used in classrooms, online assessments, the quality and duration of instances of instructional use of

technology and other areas would further our ability to understand how technology is changing the nation's classrooms" (p. 3).

While most professional development occurs through teacher training sessions, Harris and Grandgenett (2002) found that K-12 teachers who engage in constructivist uses of the Internet report improvement in teaching skill, communication skill, content knowledge, and ability to vary instruction. Although the term TPCK is not used by the authors, it is clear that the educators who participated in telecollaborative projects experienced TPCK development, growth in professional knowledge. Designed "to provide an emerging profile of the "online K-12 teacher" (p. 55), the study reveals a need for study of telecollaborative projects as a factor influencing TPCK development. To date, such a study has not been conducted.

Higher Education Studies

While there are fewer studies of instructional practice in higher education, they follow the pattern of the K-12 studies. Most studies focus on access rates and teacher use of the Internet instead of teacher-directed student use of the Internet (Harvey, Depover, DeLievre, & Quintin, 2001; Wang & Cohen, 1998; Warburton, Chen, & Bradburn, 2002).

General faculty studies. One early study found that universities varied from no integration of Internet into instruction to full integration through virtual campuses (Harvey, Depover, DeLievre, & Quintin, 2001). In addition, most efforts in higher education were focused on moving courses online, a delivery method the authors termed *unimodal*. The term *multimodal* was used to describe another point on the continuum in which Internet integration is practiced extensively in face-to-face classrooms.

Multimodal classrooms make use of a variety of strategies to engage students with content, including the use of the Internet. Teacher educators are responsible for training preservice teachers to work in multimodal environments. The study found that, regardless of the level or type of Internet integration, a clear relationship between activities and learning objectives was the single most important factor influencing a successful teaching event. The authors concluded that, while teachers must use a variety of pedagogic approaches, constructivist strategies used to meet clearly defined goals appeared to have had a positive impact on quality of student experience. As in the K-12 arena, an investigation of the relationship between pedagogical beliefs and instructional practice is recommended.

Another exploratory study of public university faculty use of Internet found that while most faculty members had been exposed to the Internet, more used it for research than for teaching (Wang & Cohen, 1998). The study examined use of email, mail lists, gopher, WWW, and ftp. It found that the majority of faculty used the Internet for facilitating teaching and research. Email was the most popular service followed by search and retrieval of information. Once again, this study did not find evidence of constructivist instructional uses of the Internet. More recently, a study of higher education found that Internet access was common for post-secondary faculty members and that the use of telecommunications technology was increasing (Warburton, Chen, & Bradburn, 2002). Use of email and websites continue to be the most frequently reported activities with faculty members using the Internet to post class information and links. While the report indicated that faculty members expected students to use the Internet, the use of constructivist telecollaborative activities was, once again, not investigated.

Teacher preparation program studies. In the teacher preparation arena, very few studies of Internet integration and teacher practice have been completed. The studies that exist have concluded that modeling a constructivist approach throughout the teacher preparation program influences preservice teacher use of constructivist strategies (Beck & Wynn, 1998; Brzycki, & Dudt, 2005; Cuban, 2001; Flake, 2001; Kurtts, Hibbard, & Levin, 2005; Hofer, 2005; Wang, 2002; Yang, 2003).

An investigation of exemplary teacher preparation institutions found that modeling technology integration throughout the teacher preparation program is a practice espoused by exemplary teacher preparation institutions in the United States (Hofer, 2005). Unfortunately, teacher educators may not be modeling constructivist beliefs and instructional practices. A survey of teacher educators, sponsored by the American Association of Colleges for Teacher Education (AACTE) and National Council for Accreditation of Teacher Education (NCATE), found that 50% or fewer of institutions require students to integrate technology into instruction (Beck & Wynn, 1998). According to Beck and Wynn, the primary use of Internet technology is for email and communication with colleagues. The study further identified three factors that influenced faculty use of technology. First, faculty members were more likely to use technology when the lesson engaged students. In other words, when constructivist teaching and learning were occurring in practice, faculty members were more likely to use technology. Second, technology was more likely to be used when faculty members considered technology to be integral to instruction. In other words, when pedagogical goals were clear, faculty members were more likely to use technology. Finally, instructors who had acquired technological knowledge were more likely to use the Internet. The authors

concluded that faculty use of technology in practice must increase and improve to provide a model for preservice teachers.

Another study examined readiness to use the Internet and found that while the entry level confidence and competence of students increased over time, students continued to perceive the technology class coursework as valuable to their developing skills (Flake, 2001). Flake concluded that confidence building using hands-on coursework was important and contributed to increased confidence and competence as the preservice teachers prepared to take on the task of teaching with the Internet. Again, this supports the need for modeling in practice a curriculum-based, constructivist approach throughout the teacher preparation program.

In a report critical of the use of Internet in teacher preparation programs, Cuban (2001) found that while the availability of Internet in classrooms had increased dramatically, teachers used them infrequently and changed their teaching styles very little. According to Cuban,

> As a result of the substantial increases in access to information technologies, remarkable changes have occurred in how students use computers in dorms, labs, libraries, and elsewhere on wired campuses. Furthermore, most professors collect their research, produce publications, communicate in their scholarly disciplines, and prepare for teaching through electronic means. Yet when it comes to teaching, few close observers would deny that most professors in colleges and universities are either nonusers or occasional users of computer technology in the classroom (p. 104).

Cuban reports that two surveys of teaching at Stanford University found that few faculty members use constructivist teaching strategies. He generalizes his findings to claim that the pattern of infrequent use is repeated at universities across America. Cuban's claim

that constructivist practice is infrequent has not been investigated among Internet-using teacher educators.

A study of preservice teachers found that while preservice teachers believed in both teacher and student centered uses of technology, they chose teacher-centered uses for computers over student-centered uses when presented with the opportunity (Wang, 2002). This mismatch between beliefs and practice led the author to conclude that "…teacher delivery styles involving the use of technology is an overlooked area" (p. 155). Wang recommended training for preservice teachers that demonstrates and uses constructivist pedagogy. Based on a survey of students in both secondary and elementary teacher preparation programs, Friedman and Kajder (2006) also recommend training that models constructivist pedagogy. This recommendation was made after examining the survey results showing that the students reported both a lack of faculty modeling effective technology integration and a desire to see effective models throughout the teacher preparation program. In another study focused on Internet use, an increase in Internet use correlated with an increase in self-efficacy and a decrease in anxiety by preservice teachers (Yang, 2003). The study examined attitudes, self- efficacy, and Internet anxiety in preservice elementary educators before and after instruction on integrating the Internet into instruction. Recommendations for future research include a study of Internet use and instructional practices in teacher preparation programs. Again, this is an area that remains poorly researched.

In the Pennsylvania State System of Higher Education (PASSHE), three public universities participating in a Preparing Tomorrow's Teachers to Use Technology (PT3) project found that faculty support was successful in providing models of instruction but

the support did not always translate to a change in classroom practice (Brzycki, & Dudt, 2005). The schools, Edinboro, Clarion, and Indiana Universities of Pennsylvania, are NCATE accredited institutions in western Pennsylvania. The project had four primary goals: to support technology infusion in teacher preparation programs, to integrate technology into observations and field experiences, to support faculty acquisition of TPCK, and to enhance the technology infrastructure of the teacher preparation institutions.

A variety of data sources were used, including a content analysis of original and revised syllabi after the implementation of the PT3 project. A study of syllabi revisions showed that more than one-third of faculty members added Internet sources to their syllabi and that the infrastructure at each university was successfully upgraded. However, the study also found that faculty members continue to lack time, support, and infrastructure and did not change instructional practice. Brzycki and Dudt concluded, "…in spite of progress, many faculty in our teacher education programs were still at an early stage of technology usage after three years of the grant" (p. 636). They caution that innovation takes a long time, in part, because it is difficult to change the tradition of accepted practice. A further examination of pedagogy and practice among PASSHE institutions is warranted.

Kurtts, Hibbard, and Levin (2005) conducted a study of collaborative problem solving between preservice elementary and special education teachers through a course management system. They found that preservice teachers were able to use online tools to collaborate and complete required tasks. The study focused specifically on the use of synchronous (real time) discussion in multimodal classrooms. Although both groups were

taking an education course with an integrated field experience, the groups were located at different teacher preparation institutions. In addition, students had positive perceptions of the online collaboration and felt they had benefited from the feedback available from their distant counterparts. The major weakness identified was lack of time to conduct the synchronous chat. The authors concluded that additional inquiry into the use of online discussion and collaborative activities is needed. "Studying these kinds of online collaborations will enhance our own skills as teacher educators as we prepare all teachers for the needs of students in inclusive learning environments" (p. 413).

Typology of Instructional Practices among Internet Using Educators

The review of literature on instructional practices shows that the majority of studies focus on access and use rates or participant perceptions. Additional research into pedagogical uses that support constructivist beliefs and actual classroom practices is a much needed area of research. Returning to the Danielson (1996) framework, it is difficult to conduct a study of pedagogical beliefs (PK) and classroom practices (TPCK) as there has been little research on what Internet activities are appropriate and cognitively engage students. Because Danielson's framework is based on the belief that constructivist environments are appropriate, it is necessary to examine instructional practices in integrating the Internet that align with constructivist beliefs. Using the indicators of constructivist activities identified by Ewing, Dowling, and Coutts (1998), we can examine models of practice and determine the extent of their use in teacher preparation programs.

Virtual Architecture, a typology of Internet activities, provides a source of models of practice that can be used to examine actual classroom practice among teacher educators (Harris, 1998; Harris, 1998b; Harris, 2005). Harris' *Virtual Architecture*

typology was developed after an "informal content analysis of hundreds of educational telecomputing activities that were shared by teacher-designers via the Internet" (2001, p. 435). When considering technological practice, the *Virtual Architecture* can be used to categorize use of Internet content. Harris has continued to study online activities and has recently refined the original activity structures (2005). Harris states, "…there are basically two ways to share information online: *among people* and *between people and remotely located machines*" (Harris, 1998a, p. 21). She developed two categories, *communication* and *inquiry*, to describe types of activities that teachers use in actual practice. Communication activities are those that allow students to interact with others online and fall into four categories: interpersonal exchanges, information exchange, works and experiences exchanges, and strategies exchanges. Inquiry activities engage students in gathering information for higher-order thinking tasks. The four types of inquiry are: information comprehension, information reframing, information application, and information creation.

Using the constructivist indicators described by Ewing, Dowling, and Coutts (1998), each of the activity structures described in Virtual Architecture can be considered constructivist in nature. The activity structures are context-based, emphasize learning through active collaboration, allow personal control over learning, facilitate personal growth in the learner, and provide the learner with an opportunity to engage in higher-order understandings. Although the activity structures described in *Virtual Architecture* have not been used widely to investigate teacher preparation practices, they can be used to describe classroom practice.

Using case study methodology, the activity structures were used to describe a collaborative project between social studies methods courses in two teacher preparation programs (Good, 2004). Five open-ended questions were used to collect data about a course in which students learned social studies methods by collaborating with another group of distant preservice teachers. Content analysis of responses revealed that students described their learning in terms of engagement and knowledge construction, not in terms of Internet use. In other words, while they increased TK, they placed greater value on their increase in PK resulting in an overall increase in TPCK. The study concluded that the use of constructivist pedagogy through collaborative online activities can help teacher educators to rethink and change their instructional practices to align with their constructivist beliefs. The extent to which collaborative online activities are being used in teacher preparation programs today remains unknown.

Summary

The review of literature has revealed repeated recommendations for the study of TPCK in teacher preparation programs. It has also revealed a lack of study of teacher educators' beliefs and practices as they relate to technology use generally, and Internet use specifically. Past studies have primarily been quantitative and focused on access and frequency of use. Only two qualitative studies have examined the use of telecollaborative activities in teacher preparation programs and both were limited in number of participants (Good, 2004; Kurtts, Hibbard, & Levin, 2005). No studies had previously examined teacher preparation programs for the use of constructivist pedagogy and telecollaborative Internet integration.

Because there had not been studies of this topic, the instrument for data collection had to be designed to measure constructivist beliefs and telecollaborative instructional practices. TK can be investigated using the data on use of Harris' (1998) activity structures and can be analyzed using the Danielson (1996) framework to identify relationships among faculty knowledge of resources, instructional goals, and Internet-specific pedagogy as described in Domains 1 and 3. PK can be investigated by determining teacher beliefs as described by the eleven statements developed by Hernandez-Ramos (2005).

Up to this point in time, studies of Internet integration had primarily been paper-based. While paper-based surveys have historically been used, it was time to consider the utilization of a web-based survey to conduct a large-scale study of teacher educators to determine the pedagogical beliefs and Internet integration practices being modeled for preservice teachers. The use of a web-based survey allowed a geographically large area to be surveyed in a professional, timely, and low cost manner (Schonlau, Fricker, & Elliott, 2002; Shannon & Bradshaw, 2002; Tingling, Parent, & Wade, 2003).

In a study examining the usefulness of the Internet as a tool in survey research among regional college faculty, the response time for a Web-based survey was much faster than with a survey delivered and returned by the United States Postal Service. The authors recommended using Web-based surveys for future data collection from regional college faculty (Shannon & Bradshaw, 2002). Therefore, this survey was conduced using an electronic survey.

Purpose Statement

The overall purpose of the study was to examine the relationship between PASSHE teacher educators' pedagogical beliefs and their use of telecollaborative Internet activities in practice. The study describes pedagogical beliefs held by PASSHE teacher educators, identifies the types of telecollaborative activities used in teacher preparation programs, determines which activities are being integrated into instruction most frequently, and determines whether there is a correlation between constructivist beliefs and the use of telecollaborative activities.

Research Hypotheses

First research hypothesis. Based on the emphasis in literature on the use of constructivist pedagogy in teacher education, it was believed that the majority of teacher educators would strongly agree with constructivist beliefs.

Second research hypothesis. It was believed that the majority of teacher educators would strongly agree with collaborative instructional goals.

Third research hypothesis. Telecollaborative activities that mimic traditional collaborative structures, like information collection, would be preferred by faculty over more innovative telecollaborative activities, like strategies exchanges. Of Harris' two telecollaborative activity types, it was believed that telecollaborative inquiry activities would be used in practice more frequently than telecollaborative communication activities.

Fourth research hypothesis. Based on similarities to traditional inquiry activities, it was believed that the information comprehension activities would be used in practice most frequently followed by information reframing, information application, and information creation activities from among the telecollaborative inquiry activities.

Fifth research hypothesis. Based on similarities to traditional communication activities, interpersonal exchanges would be most frequently used followed by works and experiences exchanges, information exchanges, and strategies exchanges from among the telecollaborative communication activities.

Sixth research hypothesis. It was expected that there would be a positive correlation between constructivist beliefs and the use of telecollaborative communication activities in teacher preparation programs.

Seventh research hypothesis. It was expected that there would be a positive correlation between constructivist beliefs and the use of telecollaborative inquiry activities in teacher preparation programs.

Eighth research hypothesis. It was expected that there would not be a significant difference between the respondents' primary certification program affiliation and the use of telecollaborative inquiry activities.

Ninth research hypothesis. It was expected that there would not be a significant difference between the respondents' primary content area affiliation and the use of telecollaborative inquiry activities.

Tenth research hypothesis. It was expected that there would not be a significant difference between the respondents' primary certification program affiliation and the use of telecollaborative communication activities.

Eleventh research hypothesis. It was expected that there would not be a significant difference between the respondents' primary content area affiliation and the use of telecollaborative communication activities.

CHAPTER III

METHODOLOGY

Participants

This chapter examines the methodology for examining pedagogical beliefs and actual practice in the use of telecollaborative activities by teacher educators in the Pennsylvania State System of Higher Education (PASSHE). This sample was moderately large and represented a widespread geographic area. In addition, according to data from the National Center for Education Statistics (NCES) and PASSHE, the sample was representative of race, gender, and job classification of faculty in degree-granting institutions throughout the United States (Pennsylvania State System of Higher Education System Research Office, 2006; Snyder, Tan, & Hoffman, 2006). Data for this study was collected from faculty members in the teacher preparation programs of the PASSHE who were primarily affiliated with Elementary, Middle, Secondary, and Special Education certification programs in the areas of English, mathematics, science, and social studies. Teacher educators whose primary responsibility was to teach instructional technology courses to undergraduates were excluded as the goal of this study was to examine Internet integration external to technology instruction courses. Given these limitations, approximately 581 faculty members of the PASSHE were invited to complete a web-based survey investigating pedagogical beliefs and use of telecollaborative activities.

Instrumentation

The focus of this study was to analyze the pedagogical beliefs and actual practice in the use of telecollaborative activities by teacher educators in the PASSHE. The instrument for this study, designed by the researcher, was separated into three sections: screening questions, pedagogical beliefs, and instructional practices (Appendix A). The first section of the survey asked for faculty information to provide consent for inclusion in the study and to verify their eligibility to participate in the study. Participants were screened to ensure that they taught in the PASSHE, in a teacher preparation program, and in an Elementary, Secondary, or Special Education program for undergraduates. Each participant was also asked whether his/her primary responsibility was to supervise undergraduates or to teach an instructional technology course, a methods course, or other type of course. Participants who indicated a primary responsibility for supervision or teaching an instructional technology course were eliminated from the study as they might have skewed the data since the study examined the integration throughout teacher preparation programs, not within specific courses or experiences. Additionally participants were asked to provide demographic information indicating primary certification program and content area affiliation as well as highest degree completed.

Pedagogical beliefs were measured using belief statements and Likert scale responses. The belief statements, based on prior research instruments, were modified from a previous study conducted by Hernandez-Ramos (2005). Hernandez-Ramos constructed a set of eleven statements to measure constructivist beliefs based on a review of literature. Reliability for the use of the eleven statements as measures of constructivist

beliefs was established by Hernandez-Ramos using Cronbach's alpha (.79). Analysis of the research on constructivist beliefs led to the conclusion that these questions were the most applicable to this study.

To examine the use of telecollaborative activities in teacher preparation programs, Harris' (1998; Harris, 2005) *Virtual Architecture* typology was used to describe two instructional goals and eight types of telecollaborative activities. Goals were examined by indicating agreement with the goals of inquiry and communication as outlined by Harris (1998; Harris, 2005).The first two questions on the final part of the survey examined instructional goals using Harris' two goal statements. The next twelve questions examined the use of telecollaborative inquiry activities. Questions three through five collected data on the use of information comprehension activities. Questions six through eight collected data on the use of information reframing activities. Questions nine through eleven collected data on the use of information application activities. Questions twelve through fourteen collected data on the use of information creation activities. Each question generated a binary response. Finally, twenty-four questions examining the use of telecollaborative communication activities are presented. Questions fifteen through twenty-one collected data on the use of interpersonal exchange activities. Questions twenty-two through twenty-six collected data on the use of information exchange activities. Questions twenty-seven through thirty-two collected data on the use of works and experiences exchange activities. Questions thirty-three through thirty-eight collected data on the use of strategies exchange activities. Again, each question generated a yes or no response.

Methodology

For this study, SurveyMonkey (http://www.surveymonkey.com), an online survey service, was used. A Web-based survey is particularly appropriate for organizations that maintain a list of email addresses for the target population, when the target population represents a small slice of the total population, and when the sample size is moderately large (Best & Krueger, 2004; Schonlau, Fricker, & Elliott, 2002). SurveyMonkey is a service that provides a web address for the survey, hosts the survey, automates the collection of data, and allows it to be exported to statistical analysis software. One of the considerations when choosing this online survey tool was evidence that the tool was tested and found to be stable when used with multiple browsers (e.g. Mozilla Firefox, Internet Explorer, Netscape, Safari). The service uses no plug-ins, works with multiple browsers, and prevents respondents from completing the survey more than one time (SurveyMonkey.com, 2006). These strategies were identified through a review of best practice in electronic surveys (Best & Krueger, 2004; Schonlau, Fricker, & Elliott, 2002; Tingling, Parent, & Wade, 2003).

Upon accessing the survey link, respondents entered a case-sensitive password to ensure that only invited responses were collected. Initially respondents were presented with a consent form that represented the purposes of the study as described in the email invitation. Additionally, it included information about safeguarding their consent to participate. Specifically, participants were instructed to participate with assurance that there would be no personally identifiable information collected. Participants were instructed that they could withdraw consent at any time and that all information collected would be anonymous and confidential. They were informed that the survey tool uses 128

bit SSL encryption for security purposes. Data was downloaded from the secure server by the researcher to be kept for a period of five years at which time it will be destroyed. To provide informed consent, respondents clicked a button to indicate voluntary consent and continued the survey. To withdraw from the survey, respondents were instructed that they could close the browser window at any time.

The first section of the survey was then presented. As suggested by Tingling and colleagues, the first section of the survey contained questions that respondents were expected to be familiar with and then moved to less familiar topics to encourage continuation. For ease of reading and to speed navigation, the survey provided a limited number of questions per screen, required no scrolling, and contained no graphics (Tingling, Parent, & Wade, 2003). Survey progress was indicated to respondents throughout the survey and they were able to interrupt and reenter the survey before completion. Survey responses were indicated by clicking a radio button. Radio buttons have been found to speed completion and reduce incidence of nonresponse to items (Best & Krueger, 2004).

Upon completion, the survey reiterated to respondents that their responses would be submitted using SSL encryption for security purposes. They were informed that they might receive a message about leaving an encrypted Web site and that the message was normal when submitting secure information online. Upon submission, respondents were redirected to a separate non-encrypted website where they could enter their names for inclusion in a drawing for a reward. This provided respondents with notification that their survey has been submitted and further reassurance that their answers would remain confidential.

The face validity of the instrument was first established by asking a panel of content area experts to review the proposed questions for suitability. The instrument was then field tested on a group of doctoral students at Duquesne University and modified as needed before being used for the study to increase validity and reliability. These individuals provided feedback on both content and format. Modifications were based on their recommendations.

Data Collection Procedures

The survey consisted of 58 items that collected screening information, assessed teachers' beliefs, and described practices regarding the use of the Internet in multimodal classrooms. There are fourteen institutions within the PASSHE which provide teacher preparation programs. Email addresses for Elementary, Middle, Secondary, and Special Education teacher educators were collected from the website directory of each PASSHE university. Anyone listed as teaching in the Elementary, Middle, Secondary, or Special Education departments was sent an email invitation to participate in the survey.

Research suggests that a pre-notification email message be sent to potential participants before the invitation to participate is issued (Best & Krueger, 2004; Shannon & Bradshaw, 2002). The pre-notification email was sent to potential respondents on September 6, 2006, five days in advance of the email invitation to participate in the study (Appendix B). The pre-notification email alerted participants to the upcoming study and allowed for invalid email addresses to be removed from the pool. It was expected that fewer than 15% of the email addresses would be invalid as organizational directories have been shown to be a reliable source of valid email addresses (Best & Krueger, 2004; Schonlau, Fricker, & Elliott, 2002). Research also suggested that email correspondence

be sent from a recognizable source. For this study, the researcher used an email address that identified her as an employee of Slippery Rock University, a PASSHE member. Best and Krueger further recommended that emails be sent individually instead of as bulk email to eliminate the filtering of the message into a spam or junk email folder. The pre-notification email message was automated by merging a Microsoft Word document with Microsoft Outlook records using an email with the subject line "Doctoral study of Internet use announced."

Five days after the pre-notification, on September 13, 2006, the email invitation to participate was sent to all valid email addresses using the subject line "Doctoral study of Internet use" (Appendix C). The email invitation described the research, assured participants of their privacy, provided a link to the online survey and included the case-sensitive password for accessing the survey (Schonlau, Fricker, & Elliott, 2002). Because the targeted population was closed, the link to the survey was only provided to select individuals. Through the use of cookies placed on respondent computers, SurveyMonkey ensured that each respondent completed the survey only one time. Participant names were not collected with responses to assure total anonymity. SurveyMonkey provides a privacy statement that describes precautions taken to insure privacy and confidentiality of information handled by the service. They collect and aggregate IP addresses to track where users are located. They do not make a connection between the users and IP addresses. SurveyMonkey has been placed on both the U.S. Department of Commerce and the European Union's Safe Harbor lists. Placement on these lists verifies that SurveyMonkey has an adequate level of privacy protection and does not collect personally identifiable information.

Finally, because no personally identifiable information was collected, follow up emails were sent on September 18 and 25, 2006 to prompt a higher response rate (Shannon & Bradshaw, 2002). Tingling, Parent, and Wade (2003) found that response rates for Web-based surveys vary. Some had higher response rates than paper-based surveys and some had lower response rates than paper-based surveys. Schonlau, Fricker, and Elliott (2002) found that contacting a closed population by email for a Web-survey generated a response rate higher than that for open populations or those who were contacted by postal mail to take a Web-based survey. At the end of a two-week period, on September 27, 2006, the survey was de-activated and survey data downloaded from SurveyMonkey to the SPSS Version 14.0 for Windows statistical software (SPSS, 2005).

Data Analyses

The data analysis for this study utilized SPSS software. Returned survey responses were visually inspected for missing values, outliers, and improper responses. Surveys were then analyzed for descriptive data including means, standard deviations, and ranges. The results of the data analysis describe pedagogical beliefs and actual practice in using telecollaborative activities in PASSHE teacher preparation programs.

To determine the level of constructivist beliefs possessed by teacher educators, a composite score was calculated for each respondent. The new score is the total of the eleven Likert-scale responses. Frequency distributions were then examined to determine what level of constructivist beliefs are expressed by PASSHE teacher educators. To determine the degree of agreement with collaborative instructional goals, frequency distributions were examined for questions two and three in the third section of the survey. To determine the total telecollaborative inquiry and communication scores, two new

scores were calculated for each respondent. The first new score is the percent of yes responses to the twelve telecollaborative inquiry scores. The second new score is the percent of yes responses to the twenty-four telecollaborative communication scores. Frequency distributions were also examined to determine which telecollaborative activities as a whole are used more frequently.

To determine the frequency with which each telecollaborative inquiry activities are used, four new scores were calculated for each respondent. The new scores were the percent of yes responses for each of the items representing information comprehension, information reframing, information application, and information creation. Scores were then compared to determine which telecollaborative inquiry activities are used more frequently. To determine the frequency with which each telecollaborative communication activities are used, four new scores were calculated for each respondent. The new scores are the percent of yes responses for each of the items representing interpersonal exchanges, information exchanges, works and experiences exchanges, and strategies exchanges. Scores were then compared to determine which telecollaborative communication activities are used more frequently.

Spearman rho correlations were calculated to examine the relationships between constructivist beliefs and telecollaborative inquiry and communication activities. Descriptive statistics and correlations were computed for the entire set of survey responses. In order to determine if associations exist, a series of chi-square tests were performed. The chi-square test was used because of its ability to denote the existence of associations among variables and if the associations are significant. All calculations were computed using $\alpha = .05$.

A factorial Analysis of Variance (ANOVA) was used to calculate whether there was a significant difference in the use of telecollaborative inquiry activities, the dependent variable, according to the respondents primary certification program affiliation and primary content area affiliation. A second factorial ANOVA was used to calculate whether there was a significant difference in the use of telecollaborative communication activities, the dependent variable, according to the respondents primary certification program area and primary content area affiliation. The two factorial ANOVA calculations were examined at the $\alpha = .05$ level. In order to attain a statistical power of .90 with a medium effect size at the .05 level of significance, the sample size should be 150 participants or more (Kraemer & Thiemann, 1987, p. 110). To achieve this number of participants, reminder notices were sent until 150 or more individuals had completed the survey.

Duquesne University Institutional Review Board. Documentation for the Duquesne Institutional Review Board (IRB) was completed before distribution of the survey. The National Institutes of Health (NIH) training was also completed. IRB approval was received on DATE. IRB approval was granted to the study as an expedited study as it involves minimal risk to subjects, does not involve vulnerable groups of people as subjects is used for a purpose other than information classroom practice. The completed packet for the IRB included a cover page, a transmittal form, an abstract, a copy of the survey instrument, and the NIH training certificate. In addition, consent and assent forms, including an overall description of the purpose and significance of the project, information about the sponsoring institution, a description of participants'

involvement, assurance of voluntary involvement, assurance of confidentiality, a description of risks and benefits to participants, and signature pages, were included.

Limitations. One limitation on the study was the use of electronic files called *cookies*. Cookies allowed SurveyMonkey to recognize repeat visitors so that each respondent was allowed to submit only one survey. Most computers allow cookies to be placed on the hard drive if they are from first party users. There is a chance that some PASSHE teacher educators had disabled the placement of cookies and were not able to participate in the survey. However, it was not anticipated that this would be an issue for the majority of respondents.

Research Purpose and Hypotheses

Purpose Statement

The overall purpose of the study was to examine the relationship between PASSHE teacher educators' pedagogical beliefs and their use of telecollaborative Internet activities in practice. The study describes pedagogical beliefs held by PASSHE teacher educators, identifies the types of telecollaborative activities used in teacher preparation programs, determines which activities are being integrated into instruction most frequently, and determines whether there is a correlation between constructivist beliefs and the use of telecollaborative activities.

Research Hypotheses

First research hypothesis. Based on the emphasis in literature on the use of constructivist pedagogy in teacher education, it was believed that the majority of teacher educators would strongly agree with constructivist beliefs.

Second research hypothesis. It was believed that the majority of teacher educators would strongly agree with collaborative instructional goals.

Third research hypothesis. Telecollaborative activities that mimic traditional collaborative structures, like information collection, would be preferred by faculty over more innovative telecollaborative activities, like strategies exchanges. Of Harris' two telecollaborative activity types, it was believed that telecollaborative inquiry activities would be used in practice more frequently than telecollaborative communication activities.

Fourth research hypothesis. Based on similarities to traditional inquiry activities, it was believed that the information comprehension activities would be used in practice most frequently followed by information reframing, information application, and information creation activities from among the telecollaborative inquiry activities.

Fifth research hypothesis. Based on similarities to traditional communication activities, interpersonal exchanges would be most frequently used followed by works and experiences exchanges, information exchanges, and strategies exchanges from among the telecollaborative communication activities.

Sixth research hypothesis. It was expected that there would be a positive correlation between constructivist beliefs and the use of telecollaborative communication activities in teacher preparation programs.

Seventh research hypothesis. It was expected that there would be a positive correlation between constructivist beliefs and the use of telecollaborative inquiry activities in teacher preparation programs.

Eighth research hypothesis. It was expected that there would not be a significant difference between the respondents' primary certification program affiliation and the use of telecollaborative inquiry activities.

Ninth research hypothesis. It was expected that there would not be a significant difference between the respondents' primary content area affiliation and the use of telecollaborative inquiry activities.

Tenth research hypothesis. It was expected that there would not be a significant difference between the respondents' primary certification program affiliation and the use of telecollaborative communication activities.

Eleventh research hypothesis. It was expected that there would not be a significant difference between the respondents' primary content area affiliation and the use of telecollaborative communication activities.

CHAPTER IV

RESULTS

Introduction

This chapter presents the results of the study analyzing the pedagogical beliefs and actual practice in the use of telecollaborative activities by teacher educators in the Pennsylvania State System of Higher Education (PASSHE). This chapter includes a review of the survey response rate, faculty demographics, research hypotheses, analysis of the data for each research hypothesis, and relationships among variables.

Survey Response Rate

The participants for this study were faculty members in teacher preparation programs of the fourteen Pennsylvania State System of Higher Education (PASSHE) institutions. Potential respondents were identified using email directories published on the website of each of the institutions. To verify valid email addresses and to inform potential respondents of the upcoming survey, an email was sent to 569 individuals on September 6, 2006. In response to this prenotification, eight individuals indicated that they would not participate. Based on the review of literature, it was expected that 15% or fewer of the email addresses would be returned as invalid due to retirements, resignations, and other changes in employment. Seventy-four of the prenotification emails were undeliverable, marked as invalid, and removed from the pool of potential respondents. This 13% reduction in the number of potential respondents was within the expected range and left 487 potential respondents available to participate in the study.

On September 13, 2006, the potential respondents were contacted by email and invited to participate in the study. One-hundred responses were received on the first day of data collection. Thirty-three more responses were received during the first week of the survey. An additional email was sent on September 18, 2006 to prompt a higher response rate. After the first reminder, 45 additional responses were received. Again, it was observed that responses increased on the day that a reminder email was sent and decreased in subsequent days. To further increase response, another email was sent on September 25, 2007. The second email resulted in 43 additional responses, most of which were obtained immediately after the reminder email. No responses were recorded on September 27, 2007 and the survey was closed. At the end of the two-week time, all fourteen institutions were represented by 220 respondents yielding a response rate of 45%. In reviewing the numbers of faculty members who responded to the survey, it was discovered that California University of Pennsylvania had posted an updated email directory on September 18, 2006, after the survey invitation had been sent. The updated list reveals that 30 individuals who received surveys were incorrectly identified as members of a teacher preparation program. All other email directories remained stable during the survey period.

Screening the Data

The 220 surveys were examined and ninety-seven respondents were removed as they were not part of a teacher preparation program (28), not primarily involved in undergraduate education (40), are primarily affiliated with instructional technology courses (12) or are primarily affiliated with supervision (17). An additional three respondents were removed because their surveys were not completed beyond the

demographic information and it is not possible to determine a score for constructivist beliefs or telecollaborative activities. After screening the data, 120 cases remained for use in the study representing 13 of the 14 PASSHE institutions. Cheyney University, with the smallest pool of potential participants (4), had two respondents. However, both respondents were removed from consideration as they identified themselves as primarily associated with graduate programs. All other institutions continued to be represented.

Faculty Demographics

Survey questions one through nine provided information regarding faculty demographics. The questions were also used to screen and remove respondents from the data set. Demographic questions pertained to institutional affiliation, years of experience, degree completed, certification level affiliation, content area affiliation, and primary teaching focus. Using information about respondents' affiliation with teacher preparation programs, undergraduate responsibilities, and instructional technology responsibilities, some of the respondents were removed from further analysis.

Institutional Affiliation

The first survey question asked, "Which institution are you affiliated with?" and allowed respondents to select one of the fourteen PASSHE institutions or enter another institution. With 21 respondents (17.5%) Slippery Rock University (SRU), the researcher's home institution, had the highest response rate. SRU had the third largest pool of potential participants. It should be noted that the researcher did not participate in the study. California University, which had the largest pool of potential respondents, provided the fewest respondents (6). Table 1 illustrates the distribution of the 120 respondents across the PASSHE institutions.

Table 1

Frequency Distribution for Institutional Affiliation of Pennsylvania State System of Higher Education (PASSHE) Respondents

	Frequency	Percent
Bloomsburg	8	6.7
California	6	5.0
Clarion	7	5.8
East Stroudsburg	7	5.8
Edinboro	7	5.8
Indiana	7	5.8
Kutztown	12	10.0
Lock Haven	7	5.8
Mansfield	9	7.5
Millersville	11	9.2
Shippensburg	10	8.3
Slippery Rock	21	17.5
West Chester	8	6.7
Total	120	100.0

University Teaching Experience

The second survey question asked, “How long have you been teaching at the university level?” Respondents representing all four categories of experience, 0-5 years, 6-10 years, 11-15 years, and 16 years or more, replied to the survey. Respondents were fairly equally distributed among the levels of experience with a high of 29.2% at 16 or more years of experience while 28.3% of respondents were in the zero to five year of experience category. Table 2 presents the distribution of respondents across the levels of experience.

Table 2

Frequency Distribution: Number of Years of University Teaching Experience for PASSHE Respondents

	Frequency	Percent
0-5 years	34	28.3
6-10 years	24	20.0
11-15 years	27	22.5
16+ years	35	29.2
Total	120	100.0

Highest Degree Completed

Question three asked respondents to respond to, “What is the highest degree you have completed?” A terminal degree was held by the majority of the respondents (90.0%). One respondent indicated a degree as an Education Specialist. It is unclear whether this is indicative of a trade school, associate, or bachelor degree. Other respondents had obtained a minimum of a Master’s degree. Table 3 shows the frequency with which each degree status was represented.

Table 3

Frequency Distribution: Highest Degree Completed by PASSHE Respondents

	Frequency	Percent
Master's degree	1	.8
Master's degree plus 30 hours	3	2.5
Master's degree plus 60 hours	7	5.8
Doctorate	108	90.0
Other	1	.8
Total	120	100

Certification Program Affiliation

Respondents primarily (50.0%) identified with Elementary Education K-6 programs when asked, “What type of certification program are you primarily affiliated with?” None of the respondents indicated primary program affiliation with Middle Level 7-9 Education and only seven respondents (5.8%) identified their affiliation as Other K-12. Of those who identified their affiliation as Other K-12, one indicated affiliation with K-12 foreign language certifications and one with deaf education. The other five respondents indicated affiliation with all certification programs. Table 4 displays the certification program affiliations for the respondents.

Table 4

Frequency Distribution: Certification Program Affiliation of PASSHE Respondents

	Frequency	Percent
Early Childhood (N-3)	7	5.8
Elementary Education (K-6)	60	50.0
Middle Level Education (7-9)	0	0.0
Secondary Education (7-12)	20	16.7
Special Education (N-12)	26	21.7
Other	7	5.8
Total	120	100.0

Content Area Affiliation

Respondents were asked, “What content area are you primarily affiliated with?” Respondents were able to indicate affiliation with English, mathematics, science, social studies. They were also able to write in a response. Ten percent of respondents did not answer the question while 50% of respondents were unable to choose a primary content area affiliation. Of those who did choose a primary content area affiliation, 12.5% identified with Social Studies followed by English (11.7%). Fewest respondents (9.2%) identified mathematics as their primary area of affiliation. Of the 50% who identified Other as their area of primary affiliation, respondents indicated affiliation with a variety of other areas including special education, reading, and child development. Table 5 represents the content area affiliations of respondents.

Table 5

Frequency Distribution: Content Area Affiliation of PASSHE Respondents

	Frequency	Percent
English	14	11.7
Mathematics	11	9.2
Science	8	6.7
Social Studies	15	12.5
Other	60	50.0
Missing	12	10.0
Total	120	100.0

Primary Instructional Responsibility

Finally, respondents were asked, “Which best describes your primary function?” Respondents were able to choose a primary function of teaching foundational courses, methods courses, or supervisory duties. Most of the respondents (71.7%) teach methods courses while 28.3% teach foundational courses. Table 6 displays the instructional responsibilities of the respondents.

Table 6

Frequency Distribution: Primary Instructional Responsibility of PASSHE Respondents

	Frequency	Percent
Teach Foundational Courses	34	28.3
Teach Methods Courses	86	71.7
Total	120	100.0

Research Purpose and Results

Purpose Statement

The overall purpose of the study was to examine the relationship between PASSHE teacher educators' pedagogical beliefs and their use of telecollaborative Internet activities in practice. The study describes pedagogical beliefs held by PASSHE teacher educators, identifies the types of telecollaborative activities used in teacher preparation programs, determines which activities are being integrated into instruction most frequently, and determines whether there is a correlation between constructivist beliefs and the use of telecollaborative activities.

Results

First research hypothesis. The first research hypothesis stated that the majority of teacher educators would strongly agree with constructivist beliefs. To examine this hypothesis, participants responded to eleven Likert-scale times. The sum of the eleven items was calculated to determine an overall constructivist belief score for each respondent. Scores ranged between 15 and 44 with a mean of 34.5, median of 34, and modes at 32 and 33. Scores between eleven and 22 indicated disagreement with constructivist beliefs while scores between 23 and 44 indicated agreement with constructivist beliefs. Scores in the range of 33 to 44 indicated a strong agreement with constructivist beliefs. The hypothesis was supported because the mean of 34.5 indicated strong agreement with constructivist beliefs. Table 7 describes the distribution of teacher educator constructivist belief scores.

Table 7

Measures of Central Tendency for Constructivist Belief Scores of PASSHE Respondents

	n = 120
Range	29
Maximum	44
Minimum	15
Mean	34.5
Median	34
Modes	32, 33

Second research hypothesis. The second research hypothesis stated that the majority of teacher educators will strongly agree with collaborative instructional goals. Teacher educators responded to two questions to investigate this hypothesis. The first question stated, "A goal of my class is to involve students in collecting, compiling, and comparing different types of information." The second question stated, "A goal of my class is to involve students in communication with individuals and groups." Respondents indicated agreement as "yes" or "no." As Figures 1 and 2 illustrate, a majority of respondents agree that they hold both collaborative inquiry goals and collaborative communication goals.

Figure 1

Agreement with Inquiry Goals

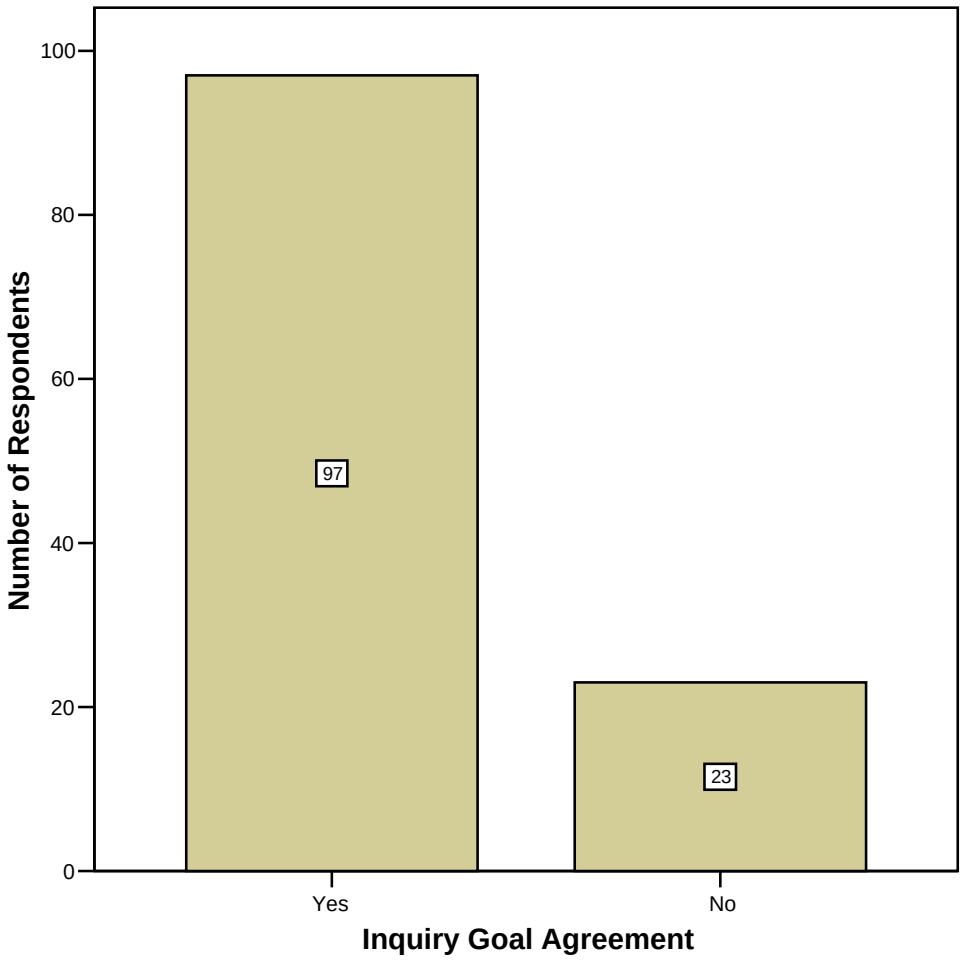
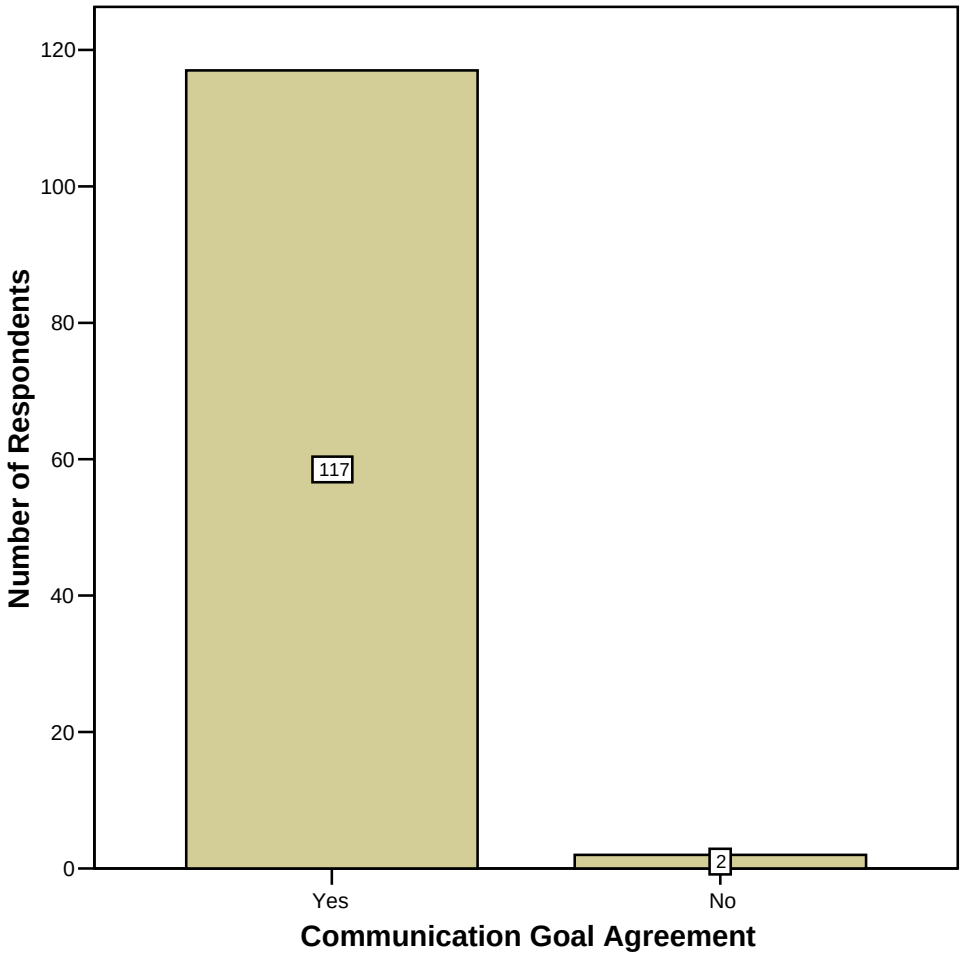


Figure 2

Agreement with Communication Goals



A Chi-square test reveals that there is a statistically significant difference between the observed frequencies and the expected frequencies. Table 8 displays the Chi-square values. As shown on the table, the reported Chi-square values for inquiry goals ($\chi^2 = 45.63$; $p < .05$) and communication goals ($\chi^2 = 111.13$; $p < .05$) support the hypothesis and it can be concluded that respondents embrace both collaborative inquiry and collaborative communication goals.

Table 8

Chi-Square Test: Agreement with Collaborative Goals

	n	Chi-Square	*df*	*p*
Inquiry Goals	120	45.633	1	.000
Communication Goals	119	111.134	1	.000

Third research hypothesis. The third research hypothesis stated that telecollaborative activities that mimic traditional collaborative structures, like information collection, would be preferred by faculty over more innovative telecollaborative activities, like strategies exchanges. Of the two telecollaborative activity types, it was believed that telecollaborative inquiry activities would be used in practice to a greater extent than telecollaborative communication activities. The study found that 91.67% of respondents use telecollaborative inquiry activities and 82.61% of respondents use telecollaborative communication activities. Table 9 displays the descriptive statistics for the distributions of percent agreement with the two types of telecollaborative activities.

Table 9

Distribution of Telecollaborative Inquiry and Communication Activity Percent of Agreement Scores for PASSHE Respondents

	Inquiry	Communication
Maximum	91.67	82.61
Minimum	0	0
Mean	50.42	19.75
Median	50.00	17.39
Modes	50.00	13.04

A t-test was used to compare the mean inquiry and communication scores. As Table 10 shows, $t_{(117)} = 16.851$ ($p < .001$). Based on the results from this test, the hypothesis is accepted and it can be concluded that inquiry activities are more frequently used in practice than communication activities.

Table 10

t-Test: Telecollaborative Inquiry and Communication Activities

	M	SD	SM	*t*	*df*	*p*
Inquiry-Communication	30.67428	19.77401	1.82034	16.851	117	.000

In addition to examining the overall descriptive statistics, the scores for the individual activity types were examined and it was determined that of the 36 activity types the top five are types of telecollaborative inquiry activities and eight of the top ten are inquiry activities. Of the inquiry activities, the activity used in practice by the greatest percentage of respondents was having students use information available online to explore a topic. The activities used by the lowest percentage of respondents are creating an online survey to collect data and operating a remote device. Table 11 lists the telecollaborative inquiry activities in order of reported use and describes the overall rank of each type of activity.

Table 11

Reported Percent Use Scores and Overall Ranks for Telecollaborative Inquiry Activities

Activity Type	Percent Use Score	Overall Rank
Use information available online to explore a topic	89.0	1
Gather and use online information available online to understand a topic	85.5	2
Gather information available online to answer a question	72.6	3
Evaluate and synthesize information available online from multiple sources	68.6	4
Produce a literature review which includes online resources	55.1	5
Use online tools to generate data to investigate a research question	52.5	7
Use information accessed online to solve problems or persuade others	52.1	8
Compare or contrast perspectives found online about a specific topic	50.0	10
Prepare a position paper incorporating information found online	41.9	13
Complete an online problem-based inquiry activity	33..6	15 (tie)
Create an online survey and collect data	4.2	31
Operate a remote device (e.g. telescope, robot)	2.6	33

Of the communication activities, the activity with the greatest percentage of use among respondents was involving students in some type of cooperative or collaborative problem solving where they attend to their own and others problem solving processes as part of their learning. Having students participate in online communication with someone who is portraying a character or while portraying a character, a telecollaborative communication activity, was the only activity that was not reported in practice by any of the respondents. Table 12 lists the telecollaborative communication activities in order of reported percent use and describes the overall rank of each type of activity.

Table 12

Reported Percent Use Scores and Overall Ranks for Telecollaborative Communication Activities

Activity Type	Percent Use Score	Overall Rank
Some type of cooperative or collaborative problem solving	53.8	6
Electronically collecting, compiling, and comparing information	51.7	9
Talk electronically with other individuals in one-to-one or group-to-group exchanges	45.8	11
Share information electronically collected using online communication	42.4	12
Share texts, images, soundtracks, multimedia creations and/or experiences virtually with others	37.6	14
Display individual work online	33.6	15 (tie)
Produce materials for display in virtual galleries and/or exhibits for viewing and use by others	25.9	16

Table 12 (continued)

Activity Type	Percent Use Score	Overall Rank
Compare and contrast information electronically collected and shared in online forums	24.6	17
Participate in virtual lessons to learn about curriculum-related topics	20.7	18
Provide constructive responses to others online (e.g. peer editing or writer's workshops online)	19.7	19
Participate in virtual visits (online field trips and expeditions)	17.2	20
Pair off to communicate one-to-one online	15.3	21
Organize data and share it in online forums	13.6	22
Mentoring by subject-matter experts	12.0	23
Solve curriculum-based problems and compare, contrast, and discuss their varying problem solving strategies with students at distant locations	7.7	24
Produce materials for electronic publications (e.g. ezines, electronic newspapers, blogs, podcasts)	6.1	25
Use online ask-an-expert service to find answers to their course-related questions	6.0	26

Table 12 (continued)

Activity Type	Percent Use Score	Overall Rank
Communicate with another class from a different location about a specific topic during a previously specified time period	5.1	27
Communicate with an online guest who is a subject matter expert	5.1	28
Collaboratively solve curriculum-based problems with students at distant locations	4.3	29
Electronically survey, collect data, share responses, analyze data, and share findings in online forums	4.3	30
Create a common written text or shared visual image with students at distant locations (e.g. progressive stories)	3.4	32
Assume virtual identities and solve problems in simulated online scenarios (e.g. role playing)	1.7	34
Participate in online communication with someone who is portraying a character or while portraying a character	0	35

Fourth research hypothesis. Based on similarities to traditional inquiry activities, it was believed that the information comprehension activities would be used in practice by a greater percentage of respondents than the other activity types. It was believed that information comprehension activities would be followed by information reframing, information application, and information creation activities from among the telecollaborative inquiry activities. To determine the use of each type of telecollaborative inquiry activity, four new scores were calculated for each respondent. The scores represented the percentage of respondents who reported using each type of telecollaborative inquiry activity. The new scores were the percent of yes responses in the categories of information comprehension, information reframing, information application, and information creation for 118 respondents. Table 13 ranks the activity types by percentage of respondents reporting use of each activity.

Table 13

Telecollaborative Inquiry Activities Ranked by Percent of Respondents Reporting Use

Activity Type	Percent of Respondents Reporting Use
Information comprehension	81.92
Information reframing	57.91
Information application	42.09
Information creation	19.77

The Analysis of Variance revealed a significant difference in the use of information comprehension ($F(11, 106) = 22.440$, $p < .001$, $\eta^2 = 0.700$), information reframing ($F(11, 106) = 37.265$, $p < .001$, $\eta^2 = 0.795$), information application ($F(11, 106) = 30.887$, $p < .001$, $\eta^2 = 0.762$), and information creation activities ($F(11, 106) = 7.975$, $p < .001$, $\eta^2 = 0.453$). Table 14 provides the results of the Analysis of Variance calculations for the four subgroups of telecollaborative inquiry activities.

Using a post hoc Scheffé test, the subgroups were further examined for significant differences. According to the results from this test, there is a significant difference between use of the information comprehension and information reframing activities, between the use of the information comprehension and the information application activities, and between the information reframing and information application activities. Due to the small group sizes, the Scheffé test statistic could not be computed for the information creation activities. However, using the post hoc results that were computed, the hypothesis is supported as information comprehension activities are used in practice by a greater percentage of respondents than the other activity subgroups.

Table 14

Analysis of Variance Results: Differences between Telecollaborative Inquiry Activities

Source		*SS*	*df*	*MS*	*F*	*p*	η^2
Information comprehension	Between Groups	70959.675	11	6450.880	22.440	.000	0.700
	Within Groups	30471.587	106	287.468			
	Total	101431.262	117				
Information reframing	Between Groups	119054.029	11	10823.094	37.265	.000	0.795
	Within Groups	30785.896	106	290.433			
	Total	149839.925	117				
Information application	Between Groups	107433.027	11	9766.639	30.887	.000	0.762
	Within Groups	33518.009	106	316.208			
	Total	140951.036	117				
Information creation	Between Groups	23383.163	11	2125.742	7.975	.000	0.453
	Within Groups	28255.255	106	266.559			
	Total	51638.418	117				

Fifth research hypothesis. Based on similarities to traditional communication activities, it was believed that interpersonal exchanges would be most frequently used followed by works and experiences exchanges, information exchanges, and strategies exchanges from among the telecollaborative communication activities. To determine the percentage of use of the four types of telecollaborative communication activities, new scores were calculated for each respondent (n = 118). The new scores were the percent of yes responses for the categories of interpersonal exchanges, works and experiences exchanges, information exchanges, and strategies exchanges. Table 15 shows that the ranking of each telecollaborative communication strategy by percent of respondents reporting use of the activity types.

Table 15

Telecollaborative Communication Activity Types Used by Respondents Ranked by Mean

Activity Type	Percent of Respondents Reporting Use
Information exchanges	27.29
Works and experiences exchanges	23.36
Strategies exchanges	15.10
Interpersonal exchanges	12.71

The Analysis of Variance (ANOVA) revealed a significant difference in the use of interpersonal exchange ($F(16, 101) = 12.390$, $p < .001$, $\eta^2 = 0.662$), information exchange ($F(16, 101) = 14.834$, $p < .001$, $\eta^2 = 0.701$), works and experiences exchange ($F(16, 100) = 22.194$, $p < .001$, $\eta^2 = 0.780$), and strategies exchange activities ($F(16, 100) = 12.789$, $p < .001$, $\eta^2 = 0.672$). Table 16 provides the results of the ANOVA calculations for the four subgroups of telecollaborative communication activities. Using a post hoc Scheffé test, the subgroups were further examined for significant differences. Due to the small group sizes, however, the Scheffé test statistic could not be computed for the telecollaborative communication activities.

Table 16

Analysis of Variance Results: Difference between Telecollaborative Communication Activities

Source		*SS*	*df*	*MS*	*F*	*p*	η^2
Interpersonal exchanges	Between Groups	18598.892	16	1162.431	12.390	.000	0.662
	Within Groups	9476.168	101	93.823			
	Total	28075.061	117				
Information exchanges	Between Groups	58176.341	16	3636.021	14.834	.000	0.701
	Within Groups	24755.863	101	245.108			
	Total	82932.203	117				
Works and experiences exchanges	Between Groups	46841.978	16	2927.624	22.194	.000	0.780
	Within Groups	13191.260	100	131.913			
	Total	60033.238	116				

Table 16 (continued)

Source		*SS*	*df*	*MS*	*F*	*p*	η^2
Strategies exchanges	Between Groups	20145.373	16	1259.086	12.789	.000	0.672
	Within Groups	9845.131	100	98.451			
	Total	29990.503	116				

Sixth research hypothesis. It was expected that there would be a positive correlation between constructivist beliefs and the use of telecollaborative communication activities in teacher preparation programs. To determine whether there is a relationship between constructivist beliefs and telecollaborative communication activities, Spearman rho correlations were calculated. While constructivist beliefs appear to be significantly correlated (r_s = .287, n = 118, p <.05) to the telecollaborative communication activities, the hypothesis is rejected as not all categories of telecollaborative communication activities are significantly correlated to constructivist beliefs and the correlations that do exist are weak. Analysis reveals that there is not a significant correlation between strategies exchanges and constructivist beliefs (r_s =.126, n = 117, p = .126). Table 17 displays the outcome of the correlation calculations.

Table 17

Spearman Rho Correlation Matrix for Constructivist Beliefs and Telecollaborative Communication Activities

	Interpersonal exchanges	Information exchanges	Work and experience exchanges	Strategies exchanges	Communication activities overall
Constructivist beliefs	.359(**)	.161(*)	.170(*)	.126	.287(**)
Interpersonal exchanges		.329(**)	.362(**)	.381(**)	.666(**)
Information exchanges			.476(**)	.316(**)	.744(**)
Work and experiences exchanges				.443(**)	.808(**)
Strategies exchanges					.650(**)

** Correlation is significant at the 0.01 level.

* Correlation is significant at the 0.05 level.

Seventh research hypothesis. It was expected that there will be a positive correlation between constructivist beliefs and the use of telecollaborative inquiry activities in teacher preparation programs. To determine whether there is a relationship between constructivist beliefs and telecollaborative inquiry activities, Spearman rho correlations were calculated. The hypothesis is accepted as all types of telecollaboration inquiry activities significantly correlated with constructivist beliefs. Information comprehension was most highly correlated with constructivist beliefs (r_s = .356, n = 118, p <.05). Table 18 displays the results for the correlations between constructivist beliefs and telecollaborative inquiry activities.

Table 18

Spearman Rho Correlation Coefficients for Constructivist Beliefs and Telecollaborative Inquiry Activities

	Information comprehension	Information reframing	Information application	Information creation	Inquiry activities overall
Constructivist beliefs	.356(**)	.247(**)	.313(**)	.275(**)	.356(**)
Information comprehension		.543(**)	.418(**)	.366(**)	.693(**)
Information reframing			.629(**)	.470(**)	.884(**)
Information application				.414(**)	.842(**)
Information creation					.643(**)

** Correlation is significant at the 0.01 level.

Eighth and ninth research hypotheses. The eighth research hypothesis stated that there would not be a significant difference between the respondents' primary certification program affiliation and the use of telecollaborative inquiry activities. The ninth research hypothesis stated that there would not be a significant difference between the respondents' primary content area affiliation and the use of telecollaborative inquiry activities. To investigate these hypotheses a two-factor Analysis of Variance (ANOVA) was used. The dependent variable was respondent's use of telecollaborative inquiry activities. The independent variables were primary certification program affiliation and primary content area affiliation. For the section of the survey regarding telecollaborative inquiry and communication activities, 107 individuals provided data. The remaining surveys were incomplete and were not considered in the factorial ANOVA.

Group sizes were found to be unequal. The largest group (26) represented in the study was K-6 educators who did not identify a specific content area affiliation. Within the K-6 group, English (9) was the content area identified most frequently after "other." English was followed by math (8) and social studies (8). Among the K-6 group, those affiliated with English had the highest mean telecollaborative inquiry score (56.25). In the study, the second largest group (21) was special education educators who did not identify a specific content area affiliation. The mean telecollaborative inquiry score of this group (55.39) was close to the K-6 English affiliated individuals. In the group of 7-12 affiliated educators, the content area most frequently identified with was social studies (6) followed by English (5) and other (5).

Among the 7-12 affiliated individuals, the highest mean telecollaborative inquiry score was among those affiliated with the English content area (79.17). Of those who did

identify a content area affiliation, the English (14) and social studies (15) content areas were most heavily represented among respondents affiliated with K-6 and 7-12 certification programs while science educators (8) were least represented among respondents. No respondents identified with the 7-9 certification programs and only three identified with the N-3 certification programs. Five individuals indicated affiliation with both a certification program and content area other than the predetermined choices.

The two-factor ANOVA showed no significant main effect for either the Certification Program factor ($F = 2.378$, $p = .058$, $\eta^2 = .095$) or the Content Area factor ($F = 0.583$, $p = .676$, $\eta^2 = .025$). In addition, there was not a significant interaction effect ($F = 0.705$, $p = .667$, $\eta^2 = .051$). Based on these results, the eighth and ninth research hypotheses were accepted as there was not a significant difference between respondents' use of telecollaborative inquiry activities based on their primary certification program affiliation and content area affiliation. Table 19 summarizes the results of the factorial ANOVA.

Table 19

Two-factor ANOVA for Telecollaborative Inquiry Activities used by Certification Program and Content Area

Source	*df*	*F*	Partial η^2	*p*
		Between subjects		
Certification Program (A)	4	2.378	.095	.058
Content Area (B)	4	.583	.025	.676
A x B	7	.705	.051	.667
Error	91	(554.750)		
Corrected Total	106			

Note. Values enclosed in parentheses represent mean square errors.

$p < .05$

Tenth and eleventh research hypotheses. The tenth research hypothesis stated that there would not be a significant difference between the respondents' primary certification program affiliation and the use of telecollaborative communication activities. The eleventh research hypothesis stated that there would not be a significant difference between the respondents' primary content area affiliation and the use of telecollaborative communication activities. To investigate these hypotheses a two-factor ANOVA was used. The dependent variable was respondent's use of telecollaborative communication activities. The independent variables were primary certification program affiliation and primary content area affiliation. Thirteen surveys were incomplete and were not considered in the factorial ANOVA (n = 107).

Again, group sizes were found to be unequal. The largest group (26) represented in the study was K-6 educators who did not identify a specific content area affiliation. Among those who did identify a content area affiliation, the mean telecollaborative scores ranged from 11.30 to 60.87 with K-6 social studies affiliated individuals (20.65) and 7-12 English affiliated individuals (39.13) having the highest means observed in their certification program categories. Those educators had the highest mean telecollaborative communication score. Within the K-6 group, English (9) was the content area identified by the greatest number of respondents followed by math (8) and social studies (8). Those affiliated with other content areas had the highest mean telecollaborative communication score (23.58) among the K-6 group. In the study, the second largest group (21) was special education educators who did not identify a specific content area affiliation. The mean telecollaborative communication score of this group (15.32) was close to the K-6 English affiliated individuals. In the group of 7-12 affiliated educators, the content area

most frequently identified with was social studies (6) followed by English (5) and other (5). Those individuals affiliated with social studies education had the overall highest telecollaborative mean communication scores (24.93) followed closely by those affiliated with English (24.84).

The two-factor ANOVA showed a significant interaction effect ($F = 3.059$, $p = .006$, $\eta^2 = .191$) for the Certification Program and Content Area factors. Additionally, there was a significant main effect for both the Certification Program factor ($F = 3.698$, $p = .008$, $\eta^2 = .140$) and the Content Area factor ($F = 2.548$, $p = .045$, $\eta^2 = .101$). Based on these results, the tenth and eleventh research hypotheses are rejected as there are significant differences between respondents' use of telecollaborative communication activities based on their primary certification program affiliations and primary content area affiliations. Table 20 summarizes the results of the factorial ANOVA.

Table 20

Two-factor ANOVA for Telecollaborative Communication Activities used by Certification Program and Content Area

Source	*df*	*F*	Partial η^2	*p*
Between subjects				
Certification Program (A)	4	3.698	.140	.008
Content Area (B)	4	2.548	.101	.045
A x B	7	3.059	.191	.006
Error	91	(241.282)		
Corrected Total	106			

Note. Values enclosed in parentheses represent mean square errors.

$p < .05$

Relationships among Variables

Crosstabs were used to describe the respondents and to compare certification program affiliation, content area affiliation, years of experience, and constructivist beliefs. In order to determine if associations exist, a series of chi-square tests were performed. The chi-square test was used because of its ability to denote the existence of associations among variables and if the associations are significant. All calculations were computed using $\alpha = .05$. Constructivist belief scores of respondents were found to be related to both certification program affiliation and content area affiliation.

Certification Program Affiliation.

Fifty percent of respondents (n = 120) are affiliated with K-6 certification programs, 16.7% with Secondary Education certification programs, and 21.7% with Special Education certification programs. Very few cases (7) were affiliated with Early Childhood programs and none were identified a primary affiliation with Middle Level Education. Seven respondents identified an "other" certification program affiliation. Institutional affiliation and years of teaching varied among the certification programs.

Nearly half (42%) of the fifty-seven K-6 affiliated respondents were employed at Slippery Rock (11), Kutztown (8), or Millersville (6). All other PASSHE institutions reporting had fewer respondents, between 2 and 5. Respondents affiliated with K-6 certification programs reported either 0-5 years or 16+ years of experience teaching at the university level. Most respondents (27) affiliated with the K-6 certification program were unable to identify a content area affiliation. Those that did identify a content area affiliation were nearly evenly divided among English (9), mathematics (8), and social

studies (9). Science was the content area least represented in this group with only five respondents.

Of the twenty 7-12 affiliated respondents, 50% were employed at Shippensburg (4), Millersville (3), or Slippery Rock (3). Seventy-five percent of respondents affiliated with 7-12 certification programs reported 6-15 years of experience teaching at the university level. One quarter of the 7-12 affiliated respondents were unable to identify a content area affiliation. The majority of the respondents identified with English (5) or social studies (6). Fewer of the respondents identified with mathematics (2) or science (2). Respondents affiliated with 7-12 certification programs exhibited higher constructivist belief scores than those affiliated with other certification programs. The Chi-square test yields a large value (86.42) indicating that there is a relationship between certification program affiliation and constructivist belief scores. The Contingency Coefficient also indicates a moderately strong relationship (.657).

Fifty-seven percent of respondents affiliated with Special Education were employed at Slippery Rock (7), Bloomsburg (4), or Mansfield (4). Those affiliated with Special Education programs, like those affiliated with K-6 programs, reported either 0-5 years or 16+ years of experience teaching at the university level. Only one of the respondents affiliated with Special Education chose a content area affiliation (mathematics).

Certification Program and Content Area Affiliation

Fifty-five percent of respondents (n = 120) identified a content area affiliation as "other" than English, mathematics, science, or social studies. Of those who did identify a content area affiliation, English (14) and social studies (15) content areas accounted for

26.9%, or one-quarter, of the respondents. Individuals affiliated with mathematics education accounted for 10.2% and those affiliated with science education accounted for 7.4%. Respondents affiliated with English and social studies exhibited higher constructivist belief scores than those affiliated with mathematics or science. The Chi-square test yields a large value (92.37) indicating that there is a relationship between content area affiliation and constructivist belief scores. The Contingency Coefficient also indicates a moderately strong relationship (.679).

Half (7) of the English education affiliated respondents were employed at Slippery Rock or Millersville. More than half (64%) of the individuals affiliated with English education programs reported being employed at the university level for 0-10 years. Of the mathematics education affiliated respondents, one-third were employed at Slippery Rock or Kutztown. The individuals affiliated with mathematics education were evenly distributed among the years of experience descriptors. Among the respondents affiliated with science education programs, more than half (62.5%) were employed at Slippery Rock or Indiana. As with the individuals affiliated with mathematics education, science educators were nearly evenly distributed among the years of experience descriptors. Sixty percent of the respondents affiliated with social studies education were employed at Slippery Rock, Shippensburg, Millersville, or Kutztown. As with the individuals affiliated with English education, more than half (53%) of the individuals affiliated with social studies education programs reported being employed at the university level for 0-10 years.

Summary

Chapter four examined the results of the study analyzing constructivist beliefs and the use of telecollaborative activities among teacher educators in the Pennsylvania State System of Higher Education. The data was collected via an electronic survey with a return rate of 45.0%. A summary of faculty demographics revealed that the typical educator in the study holds a terminal degree and teaches a course in methods of instruction. Fifty percent of the respondents identified with elementary education certification programs and 50% had difficulty identifying a content area affiliation. The study examined constructivist beliefs and use of telecollaborative activities.

The data reveal that teacher educators strongly agree with constructivist beliefs and they embrace collaborative inquiry and communication goals. Examining the use of telecollaborative activities, it is observed that telecollaborative inquiry activities are used in practice more frequently than telecollaborative communication activities. Of the inquiry activities, the activity most frequently used in practice is having students use information available online to explore a topic. The least used types of inquiry activities are creating an online survey to collect data and operating a remote device. Of the communication activities, the most frequently reported strategy was involving students in some type of cooperative or collaborative problem solving where they attend to their own and others problem solving processes as part of their learning. Having students participate in online communication with someone who is portraying a character or while portraying a character, a telecollaborative communication activity, was the only activity that was not reported in practice by any of the respondents.

It was expected that there would be a positive correlation between constructivist beliefs and the use of telecollaborative inquiry and communication activities in teacher preparation programs. While all types of telecollaborative inquiry activities significantly correlated with constructivist beliefs, not all categories of telecollaborative communication activities were found to significantly correlate with constructivist beliefs.

Results indicated that while there is not a significant difference between respondents use of telecollaborative inquiry activities, there is a significant difference between respondents use of telecollaborative communication activities. Respondents affiliated with elementary education certification programs were found to use telecollaborative communication activities less frequently than those affiliated with special education or other K-12 certification programs. In addition, respondents affiliated with early childhood certification programs were found to use telecollaborative communication less frequently than those affiliated with other K-12 certification programs.

CHAPTER V

DISCUSSION

Introduction

This chapter presents a summary of the study which examined pedagogical beliefs and actual practice in the use of telecollaborative activities by teacher educators in the Pennsylvania State System of Higher Education (PASSHE). In addition, this chapter presents the findings as they relate to literature, important conclusions, and implications for action. Finally, the chapter provides recommendations for further research.

Summary of the Study

There have been many calls for research examining Internet-specific pedagogy and practice (Brzycki, & Dudt, 2005; Good, 2004; Kurtts, Hibbard, & Levin, 2005; U.S. Department of Education, 2004; U.S. Department of Education's Office of Educational Research and Improvement, April 2002; Wang, 2002; Yang, 2003). In the field of instructional technology, researchers have long promoted the use of constructivist pedagogy (Danielson, 1996; Harris, 1998; Jonassen, 1996; Papert, 1993a, 1993b). Constructivist strategies include an emphasis on problem-based learning, deep student engagement with content, critical thinking, and relevant and authentic learning activities. According to Jonassen (1996), telecollaborative uses of the Internet are most appropriate as they are constructivist in nature. While past studies have examined constructivist beliefs and K-12 teacher uses of the Internet, no similar data had been previously

collected regarding the use of telecollaborative activities and constructivist beliefs in teacher preparation programs. It is critical to examine the relationship between pedagogical beliefs and technology use as teacher educators develop the Technological Pedagogical Content Knowledge (TPCK) necessary to prepare future teachers to appropriately integrate digital content into instruction.

To accomplish the goal of collecting data on Internet use in teacher preparation programs, PASSHE teacher educators replied, via a web-based survey, to a set of statements describing constructivist beliefs and types of telecollaborative activities. The statements regarding constructivist beliefs were taken from prior studies and those relating to telecollaborative activities were taken from a typology developed by study of practice among K-12 educators (Harris, 2000). This study collected data to describe pedagogical beliefs held by PASSHE teacher educators, identified the types of telecollaborative activities used in PASSHE teacher preparation programs, determined which activities were being integrated into instruction, and determined whether a correlation existed between constructivist beliefs and the use of telecollaborative activities. PASSHE teacher educators were chosen because they represent a moderately large group and a widespread geographic area. In addition, according to data from the National Center for Education Statistics (NCES) and PASSHE, the sample is representative of race, gender, and job classification of faculty in degree-granting institutions throughout the United States (Pennsylvania State System of Higher Education System Research Office, 2006; Snyder, Tan, & Hoffman, 2006). Finally, PASSHE teacher educators were selected due to the presence of a shared culture in terms of systemic goals, program requirements and contractual obligations.

Data for this study were collected from faculty members in the teacher preparation programs of the PASSHE who were primarily affiliated with Elementary, Middle, Secondary, and Special Education certification programs in the areas of English, mathematics, science, and social studies. Teacher educators whose primary responsibility was to teach instructional technology courses to undergraduates were excluded as the goal of this study was to examine Internet integration outside of technology instruction courses. Descriptive statistics, rankings, Spearman rho correlations, and two-factor ANOVA calculations were computed to examine the data regarding Internet use in PASSHE teacher preparation programs.

Statistical analyses revealed that PASSHE teacher educators strongly agree with constructivist beliefs. In addition, the study found that telecollaborative inquiry and communication activities are being integrated into teacher preparation programs to some degree. While PASSHE teacher educators hold constructivist beliefs and there is evidence of constructivist strategies being put into practice, there was not a correlation between constructivist beliefs and the use of all telecollaborative activities. A correlation was found, however, to exist between constructivist beliefs and the use of telecollaborative inquiry activities but was not established between constructivist beliefs and the use of telecollaborative communication activities. Finally, the study revealed differences in the use of telecollaborative activities among educators affiliated with different certification programs and content areas.

Findings Related to Literature

First Research Hypothesis

The first research hypothesis investigated the pedagogical beliefs of PASSHE teacher educators. Examination of the distribution of constructivist belief scores clearly indicated that PASSHE teacher educators have adopted a constructivist mindset as advocated by theorists and researchers (Alesandrini & Larson, 2002; Bennett & Soule, 2005; Chung, 2004; Dwyer, Ringstaff, & Sandholtz, 1991; Gales & Yan, 2001; Hunter, Gambell, & Randhawa, 2005; Iran-Nejad, 1995; Krockover, Shepardson, Adams, Eichinger & Nakhleh, 2002; Liang & Gabel, 2005; Milbrandt, Felts, Richards, & Abghari, 2004; Naiser, Wright, & Capraro, 2004; National Council of Teachers of Mathematics, 2000; National Research Council, 1996; Papert, 1993a; Papert, 1993b; Sandholtz, Ringstaff & Dwyer, 1997). Scores in the present study were clearly aligned with strong constructivist beliefs about the use of technology in learning. According to prior studies, constructivist beliefs must precede constructivist practice (Brewer & Daane, 2002) and holding constructivist beliefs increases the likelihood of using the Internet (Becker, 1999; Becker & Ravitz, 1999). In addition, the teacher educators who expressed fewer constructivist beliefs can be influenced to adopt constructivist beliefs through professional development that introduces constructivist practice (Fosnot, 1989; Fosnot, 1996; Gibson & Skaalid, 2004).

Second Research Hypothesis

The second research hypothesis examined the instructional goals of respondents. Ninety-seven percent of respondents agreed with the statement, “A goal of my class is to involve students in communication with individuals and groups.” Similarly, eighty

percent of respondents agreed with the statement, "A goal of my class is to involve students in collecting, compiling, and comparing different types of information." This represents a significant degree of agreement with both inquiry and communication goals. One of the surprising results was a greater agreement with communication goals than with inquiry goals. As previously noted, constructivist strategies include an emphasis on problem-based learning, depth of interaction with content, and critical thinking, all of which are aligned with inquiry goals (Jonassen, 1996; Papert, 1993a, 1993b). Therefore, it would seem that inquiry goals should have a greater degree of agreement than communication goals. On the other hand, this may be a manifestation of the nature of inquiry activities. Inquiry activities promote active learning and questioning to engage in problem solving. A component of inquiry, then, is communication through questioning and discussion while engaged in those problem solving activities. This use of communication may be the reason for the greater agreement with communication goals.

Third Research Hypothesis

The third research hypothesis explored the presence of telecollaborative inquiry and communication activities in the instructional practice of PASSHE teacher educators. In the study respondents were asked to identify telecollaborative inquiry and communication activities being required in their courses. As noted by Brzycki and Dudt (2005), there has been movement toward incorporating technology into several PASSHE teacher education programs. This stands in contrast to earlier findings that faculty members primarily use the Internet for personal productivity (Wang & Cohen, 1998). Consistent with Brzycki and Dudt's prior findings, the current study confirms that

technology is being integrated into teacher education programs to some degree. Results reveal that both telecollaborative inquiry and communication activities are present in the practice of some teacher educators.

Unlike these prior studies, this study went beyond confirming the presence of technology incorporation into teacher education programs and focused on constructivist use of the Internet for instruction. Results indicate that telecollaborative inquiry activities are more prevalent than telecollaborative communication activities. This finding coincides with research on higher education showing that faculty members expect students to primarily use the Internet for research purposes (Wang & Cohen, 1998; Warburton, Chen, & Bradburn, 2002). The results also indicate that the majority of PASSHE teacher educator respondents were in the adaptation stage of technology adoption as described by ten-year ACOT study (Sandholtz, Ringstaff, and Dwyer, 1997). Teacher educators emphasized personal productivity uses of the Internet, such as finding information, over uses that emphasize student engagement through telecollaborative communication.

This finding is interesting when contrasted against the results for agreement with instructional goals of inquiry and communication. While respondents indicated stronger agreement with communication goals, they indicate use of telecollaborative inquiry activities over telecollaborative communication activities in practice. Respondents in the current study reported, “I require my students to use information available online to explore a topic” as the most common use of telecollaborative activities. Telecollaborative inquiry activities such as gathering information and creating a literature review are also clearly related to similar to traditional research tactics used in teacher

education programs. The greater use of telecollaborative inquiry activities may be a reflection of prior research finding that teacher educators create lessons primarily focused on information research activities when making use of the Internet for instructional purposes (Jonassen, Howland, Moore & Marra, 2003). On the other hand, lack of time to conduct chat activities may be an explanation for the difference in use (Kurtts, Hibbard, & Levin, 2005). Teacher educators who use synchronous discussion for online collaboration during face-to-face classes have indicated that although students benefit from online discussion, it is difficult to incorporate chat into the timeframe allotted for classroom instruction.

Respondents indicated that telecollaborative inquiry activities are used in practice more than telecollaborative communication activities. It is worthwhile to note that the least used telecollaborative activities, out of both the inquiry and communication types, were the inquiry activities of using online surveys for data collection and operating a remote device. While this type of information has not been previously collected, Brzycki and Dudt's (2005) previous finding indicate that teacher educators may not be able to appropriate strategies for use in their instructional repertoire without exposure to models for integration. Therefore, these infrequently used activities most likely received low rankings due to fewer models of the activity type being accessible to PASSHE teacher educators.

Although teacher educators agreed more strongly with communication goals than with inquiry goals, it is interesting that telecollaborative communication activities accounted for only two of the top ten activities in practice. "Some type of cooperative or collaborative problem solving" was the telecollaborative communication activity reported

most commonly in use among PASSHE teacher educators. This was an expected result as the educators reported constructivist beliefs and constructivism makes use of cooperative and collaborative problem solving. The other top-ten telecollaborative communication activity was electronically collecting, compiling, and comparing information. Again, this was expected as it mirrors the finding of Jonassen, Howland, Moore, and Marra (2003) that faculty in higher education primarily incorporates information searching strategies. It also provides evidence that the majority of teacher educators are in the adaptation stage of adopting telecollaborative strategies (Dwyer, Ringstaff, & Sandholtz, 1991; Sandholtz, Ringstaff & Dwyer, 1997). The next stage identified is that of appropriation in which educators engage students in active, social, authentic tasks. In the appropriation stage, educators put constructivist beliefs into practice. As described in the ACOT study, it appears that teacher educators have moved beyond personal productivity to involve students in productivity uses of the Internet and are currently at a point where they could progress further with the appropriate professional development.

Current results also revealed several types of infrequently used activities. First, the telecollaborative activity of participating in online communication with someone who is portraying a character or while portraying a character was not used by any of the respondents. Also infrequently employed in practice were the activities of assuming virtual identities and solving problems in simulated online scenarios (e.g. role playing). Creating a common written text or shared visual image with students at distant locations (e.g. progressive stories) was another infrequently used activity. Jonassen, Howland, Moore, and Marra (2003) identified frequently used strategies. To date, however,

research identifying infrequently used activities has not previously been completed in a teacher education program. Therefore, the findings represent new knowledge in the field of teacher education and technology integration.

Investigation of this hypothesis has confirmed a gap between theory and practice that has been noted in several studies (Moursund & Bielefeldt, 1999; Strehle, Whatley, Kurz, & Hausfather, 2002; Windschlitl, 1999; 2002). In the past, researchers have recommended using an integrated approach to developing technological and pedagogical knowledge (Moursund & Bielefeldt, 1999). In addition, Fosnot (1989; 1996) found that gaps like this could be addressed through professional development that helps educators align beliefs and practices.

Fourth and Fifth Research Hypotheses

The fourth and fifth research hypotheses considered which telecollaborative inquiry and communication activities are being implemented by teacher educators. Activities within the telecollaborative inquiry group were broken into subgroups of activity types. Four subgroups of telecollaborative inquiry activities were identified: information comprehension, information reframing, information application, and information creation (Harris, 2005). Results revealed a significant difference in the use of the activity subgroups in the practice of teacher educators of the PASSHE. According to the results, information comprehension activities are incorporated into practice to a greater degree than the other subgroups of telecollaborative inquiry activities. Information comprehension activities include topic exploration and using online information to investigate a question. Information creation activities are incorporated

into practice least frequently. These activities require students to generate data through the use of online surveys or remote manipulation.

Once more, this finding echoes prior research revealing that teacher educators create lessons focused on information searching activities as opposed to creating lessons focused on telecollaborative inquiry activities that require higher order thinking (Jonassen, Howland, Moore, Marra, 2003). Because research on the use of telecollaborative inquiry subgroups among teacher educators has not been conducted in the past, this is another contribution of new knowledge to the field of teacher education and technology integration. In addition, this contribution meets the needs of the National Educational Technology Plan (U.S. Department of Education, Office of Educational Technology, 2004).

The fifth research hypothesis considered which telecollaborative communication activities are being implemented by teacher educators. The four subgroups of telecollaborative communication activities were: interpersonal exchanges, works and experiences exchanges, information exchanges, and strategies exchanges (Harris, 2005). Again, results revealed a significant difference in the use of the activity subgroups. According to the results, information exchange activities were incorporated into practice to a greater degree than the other subgroups of telecollaborative communication activities. Information exchange activities include electronic discussion and data analysis. In these activities students share information they have collected. In contrast, interpersonal exchange activities are incorporated into practice least frequently. These activities require students to engage in online talk, which may occur either synchronously or asynchronously.

Relatedly, finding a significant difference in the use of the activity subgroups is not surprising. It is most likely due to the similarity between the activity structure and traditional practice as this finding echoes research concluding that when pedagogical goals were clear, faculty members were more likely to use technology (Beck & Wynn, 1998). It is surprising, however, that information exchange activities are used in practice to a greater degree than interpersonal exchanges. 97% of respondents indicated that a goal of their teaching is to engage students in communication yet interpersonal exchange, the activity type that involves "chat," is least likely to be employed in practice. As previously stated, lack of time to conduct chat activities may be an explanation for the difference in use (Kurtts, Hibbard, & Levin, 2005). Conversely, this may be related to the frequent use of information comprehension activities which represent the activities reported to be most frequently used in practice. These activities include topic exploration and using online information to investigate a question. Communicating the information would be a logical extension of these types of activities and may be the cause for information exchanges being integrated into practice to a greater extent than other telecollaborative communication activities.

Finally, it may be that there are other factors inhibiting the integration of telecollaborative communication activities. Access, connection speed, and professional development, and authentic experiences have previously been identified as factors that facilitate or impede the integration of the Internet into instruction (Harris, & Grandgenett, 2002; Kleiner & Farris, 2002; Lanahan, 2002; Norris, Sullivan, Poirot, & Soloway, 2003; Parsad & Jones, 2005; Schofield & Davidson, 1997; Schofield & Davidson, 2002). In addition, while access and connection speed are less likely to be barriers today, lack of

professional development and authentic experience may be responsible for the less frequent use of some types of telecollaborative activities.

Sixth and Seventh Research Hypotheses

The sixth and seventh research hypothesis looked for correlations between beliefs and practices. The results so far have indicated that PASSHE teacher educators embrace constructivist beliefs and that they are using constructivist activities, albeit to different degrees. However, prior research has not been done to determine whether a correlation between constructivist beliefs and telecollaborative inquiry activities exists. In this study, the Spearman rho correlation results established that, in a broad sense, constructivist beliefs were shown to weakly correlate with the use of telecollaborative inquiry activities. Three of the four subgroups of telecollaborative activities showed a positive correlation with constructivist beliefs. However, closer examination revealed that there was not a correlation between constructivist beliefs and the telecollaborative communication subgroup of strategies exchange activities. This is surprising because strategies exchange activities were the third most used telecollaborative communication activity and a positive correlation to constructivist beliefs existed with the other communication activity subgroups. Strategies exchange activities include activities where students are engaged in solving a problem together, creating material together, and providing feedback to one another. While surprising, this result falls in line with Harris and Grandgenett's (1999) study which did not reveal a correlation between beliefs and Internet use. The result of this examination provides evidence that teacher educators are still struggling to align beliefs and practices. As seen in the ACOT study, teachers are at different points on a continuum as they develop TPK (Dwyer, Ringstaff, & Sandholtz, 1991; Sandholtz,

Ringstaff & Dwyer, 1997). While some may have adopted several of the telecollaborative activities, many are still at entry level and have a need for professional development in the use of telecollaborative activities.

The seventh research hypothesis also looked for a correlation between beliefs and practices. In contrast to the telecollaborative inquiry results, a positive correlation between constructivist beliefs and telecollaborative communication activities was been established using the Spearman rho calculation. Although the correlations are weak, this is in line with prior studies that found that constructivist pedagogy increased the likelihood of K-12 teachers using the Internet (Becker, 1999; Becker & Ravitz, 1999).

Eighth and Ninth Research Hypotheses

To further investigate teacher educators' use of telecollaborative inquiry activities, the eighth and ninth research hypotheses examined whether there is a difference between use based on certification program and content area affiliations. For hypothesis eight, differences in use of telecollaborative inquiry activities was examined by certification program affiliation. Respondents indicated primary affiliation with Early Childhood (P-3), Elementary (K-6), Middle (7-9), Secondary (7-12), Special Education (N-12) or Other K-12. In the study the Middle (7-9) group had no respondents while only three indicated affiliation with Early Childhood (P-3) and eight with Other K-12. The results of the factorial ANOVA reveal that there is no significant difference in use of inquiry activities by certification program affiliation.

For hypothesis nine, differences in use of telecollaborative inquiry activities were examined by certification program affiliation. Respondents indicated primary affiliation with English, Mathematics, Science, Social Studies, or Other content areas. Again, the

results of the factorial ANOVA revealed no significant difference in use of inquiry activities by content area affiliation. While results indicate that respondents affiliated with English and Social Studies certification programs were more likely to use telecollaborative inquiry activities in practice than mathematics or science education certification programs, the differences were not significant.

The results for hypotheses eight and nine were expected as inquiry activities can be used across all curricular areas as evidenced in the development of Harris' *Virtual Architecture* typology (2001). The typology was developed after an "informal content analysis of hundreds of educational telecomputing activities that were shared by teacher-designers via the Internet" (p. 435). In addition, *How People Learn* (HPL), which provides a broad review of research on learning (Bransford, Brown, & Cocking, 2000), also indicates that constructivist practices are effective across content areas.

Tenth and Eleventh Research Hypotheses

To further investigate teacher educators use of telecollaborative communication activities, the tenth and eleventh research hypotheses examined whether there is a difference between use based on certification program and content area affiliations. To examine these variables a two-factor ANOVA was once again used. For hypothesis ten, differences in use of telecollaborative communication activities was examined by certification program affiliation. The results of the factorial ANOVA reveal that there is a significant difference in use of communication activities by certification program affiliation. Teacher educators affiliated with Special Education (N-12) and Other K-12 certification programs were significantly more likely to use telecollaborative communication activities in practice than those who identified K-6 affiliation. In

addition, those teacher educators affiliated with Early Childhood (N-3) programs were significantly less likely to use telecollaborative communication activities in practice than those affiliated with Other K-12 certification programs. These results are similar to Hunter's (2002) study finding that elementary teachers did not integrate constructivist uses of the Internet.

For hypothesis eleven, differences in use of telecollaborative communication activities was examined by content area affiliation. The results of the two-factor ANOVA reveal that there is a significant difference in use of communication activities by content area affiliation. Respondents affiliated with Social Studies certification programs engage in significantly more telecollaborative communication activities than those affiliated with Other K-12 certification programs. The results for hypotheses ten and eleven were unexpected and stand in contrast to the finding that there is no difference in use of inquiry activities by content area affiliation. Yet again this represents new knowledge for the teacher education and technology integration fields.

Conclusions

Constructivist Beliefs and Instructional Goals

Exemplary teacher preparation institutions incorporate technology throughout their teacher preparation programs (Flake, 2001; Hofer, 2005; Wang, 2002). Thus, all teacher educators share responsibility for using technology in coursework. As teacher educators wrestle with how to best accomplish this integration of technology into coursework, they will most likely choose strategies that are clearly aligned with their pedagogical beliefs (Beck & Wynn, 1998). This study identified weaknesses and gaps in the TPCK of teacher educators. The following conclusions are based on the TPCK

weaknesses and gaps that have been discovered and impact the decision to integrate constructivist Internet activities.

The finding that most teacher educators hold strongly constructivist beliefs is encouraging and leads to the conclusion that pedagogical beliefs supporting the use of constructivist strategies are already in place. This also suggests that the progress toward continuing development of TPK among faculty members will meet with less resistance since pedagogical beliefs supporting technology integration are already present. In addition, it appears that PASSHE teacher educators have adopted instructional goals that can be met through the use of telecollaborative activities. This also supports the conclusion that the foundation is in place to adopt constructivist practices. It can be concluded that there is not a need to develop constructivist beliefs or instructional goals when extending the PK of PASSHE teacher educators.

Use of Telecollaborative Activities

The results also indicate that telecollaborative inquiry and communication activities are making their way into the instructional practice of teacher educators. While some activities are more woven into practice than others, the results demonstrate that the movement toward incorporating digital content into teacher education programs extends beyond the three institutions previously investigated by Brzycki and Dudt (2005) and into PASSHE institutions to some degree. As noted by Brzycki and Dudt, the movement is slow but it has begun and there is evidence of TPK development occurring in teacher educators. Based on this evidence, it can be concluded that some models for integrating telecollaborative strategies do exist among teacher educators. In particular, teacher

educators appear to have developed TPK in the use of telecollaborative inquiry activities that require information comprehension, reframing and application.

Although respondents appear to have incorporated several telecollaborative inquiry activities into practice, the presence of only two telecollaborative communication activities in the top-ten leads to the conclusion that PASSHE teacher educators are not achieving their communication goals through the constructivist use of Internet activities. It could be concluded that those activities which have not been widely moved into practice, such as the use of online surveys to collect data, participating in online role-play and character portrayal, are specific activities to introduce to teacher educators in order to impact both their TK and PK.

However, instead of targeting specific activities for exposure to teacher educators, it is more powerful to examine subgroups of activity types to help teacher educators connect prior knowledge and experience to the incorporation of telecollaborative activities. In examining the inquiry and communication subgroups, a significant difference in the use of the inquiry and communication activity subgroups was revealed. Clearly, the inquiry activity of information creation and the communication activities of information exchange and interpersonal exchange are the activity types that have been least incorporated into practice and represent specific areas of TPK to be developed in teacher educators.

Correlations between Beliefs and Practices

To determine if a relationship between pedagogical beliefs and instructional practices exists, a Spearman rho correlation coefficient was calculated for telecollaborative inquiry and collaboration subgroups. Calculations show that

constructivist beliefs are significantly correlated with all types of telecollaborative inquiry activities. However, the results also reveal that there is not a significant correlation between constructivist beliefs and the telecollaborative communication subgroup of strategies exchanges. Based on these results, it can be concluded that even those teacher educators who espouse constructivist beliefs have not yet incorporated constructivist practices into their instructional repertoire. Although it can be demonstrated that there is some movement toward incorporating constructivist uses of the Internet into instruction, it can be concluded that, at this time, the adoption of constructivist practices is incomplete. Activities such as strategies exchanges, which are not currently widely used in practice, can be interpreted as evidence of a gap between constructivist beliefs and practices. This demonstrates a need for professional development that moves educators beyond the adaptation level and into appropriation of telecollaborative activities. To make this movement, professional development must focus on developing the TPK of teacher educators.

Differences among Certification Programs and Content Areas

Thus far, the study clearly documents a gap between pedagogical beliefs and instructional practices. The gaps were further analyzed in terms of affiliation with certification programs and content areas. The study revealed no difference in the use of telecollaborative inquiry activities by either certification program or content area affiliation. This clearly indicates that teacher educators throughout the PASSHE have not yet fully developed their TPK. Regarding telecollaborative communication activities, while the majority (97%) of teacher educators indicated agreement with communication goals, the study reveals that Early Childhood (N-3) and Elementary (K-6) teacher

educators may have difficulty developing telecollaborative communication activities. In addition, when examining content area affiliation, those educators who are affiliated with social studies education appear to have less difficulty in developing telecollaborative communication activities than those teacher educators affiliated with Other K-12 certification programs. However, given the unequal and sometimes small group sizes, it can be concluded that TPK needs to be developed among teacher educators affiliated with all certification programs and content areas.

Wallace (2004) identified specific aspects of TK that impact teacher use of the Internet for instruction. Using Wallace's findings, it can be concluded that teacher educators may lack knowledge of what quality and quantity of content is available, how to locate authoritative and valid resources, and how to evaluate information and resources. Thus, that there is a need to develop TK among teacher educators by sharing strategies for determining quality and quantity of content is available, locating authoritative and valid resources, and evaluating information and resources. In addition, the study shows that professional development targeting the incorporation of telecollaborative activities can be offered to educators across certification programs and academic disciplines.

Implications for Action

This study is one of the first to examine the constructivist use of digital content in teacher preparation programs. The study collected data about PASSHE teacher educators' pedagogical beliefs and instructional practices in order to make recommendations for action among teacher preparation programs. While it is known that exemplary teacher preparation institutions incorporate modeling of technology

integration throughout their teacher preparation programs (Hofer, 2005), the results of this study clearly prove that there is a lack of faculty modeling effective Internet integration uses in the PASSHE.

The implication of this mismatch in beliefs and practices is that there must be a movement to align the currently held constructivist beliefs with additional constructivist practices. The gap revealed in this study is important to close as the practice of teacher educators has been shown to be important in forming the practice of teacher candidates and inservice teachers (Brouwer & Korthagen, 2005). Only when the constructivist beliefs are put into practice will the gap between beliefs and practices begin to close among not only teacher educators but educators throughout SCDEs. To address the need for alignment of beliefs and practices, the TPK of teacher educators must be extended. TPK is composed of PK and TK. In the following sections the implications for the development of PK, TK, and TPK are discussed in greater detail.

Development of Pedagogical Knowledge

Pedagogical knowledge of teacher educators encompasses both beliefs and practices. The study proves that PASSHE teacher educators embrace constructivism. This is an encouraging condition that merits continued support to avoid stagnation or backsliding. This study also proves there is work to be done in adopting practices that align with constructivist beliefs and, as recommended by the U.S. Department of Education (2004), incorporate digital content. Until now, research did not exist on the use of specific constructivist telecollaborative practices in teacher preparation programs.

This study identified specific types of activities as lacking in the practice of teacher educators. Specifically, the inquiry activity of information creation and the

communication activities of information exchange and interpersonal exchange are the activity types that have been least incorporated into practice and represent specific areas of PK to be developed in teacher educators. Accordingly, teacher preparation institutions must provide professional development opportunities that address these practices through hands-on experience with these and other infrequently used telecollaborative inquiry and communication activities. These professional development programs must be designed to provide on-going support as opposed to single-serving training (Wetzel & Williams 2004-05). If support is not ongoing faculty members will not internalize the new beliefs and will continue to struggle with technology integration (Marion, 2003).

Development of Technological Knowledge

Based on the results of this study, respondents were identified as being in the adaptation stage of technology adoption as described by ten-year ACOT study (Sandholtz, Ringstaff, and Dwyer, 1997). In this stage emphasis is on personal productivity uses of the Internet, such as finding information, over uses that emphasize authentic engagement with content. In order to move past the adaptation stage, teacher educators must continue to develop not only PK but also TK. Thus, this study proves that there is a need for development of TK as it relates to the use of the Internet for constructivist activities.

As described by Wallace (2004), TK of the Internet is composed of the knowledge of boundaries, authority, and stability. Because the Internet has no boundaries in terms of what quality and quantity of content is available, teachers must have some degree of technological proficiency in assisting students as they navigate the Internet. In addition, teachers must have some technological proficiency in locating

authoritative and valid resources for students as well has being able to help students evaluate information and resources. Finally, teachers must consider the stability of Internet resources. Wallace's study indicates that teachers must possess some technological knowledge of how to access sites that have been moved or how to find new sites to replace ones that no longer exist. Based on the results of this study and Wallace's prior work, it is clear that teacher educators must receive professional development that includes developing technological proficiency in navigation, evaluation, and location of Internet resources.

Development of Technological Pedagogical Knowledge

Finally, to extend the TPK of teacher educators, and thereby close the gap between beliefs and practices, PASSHE teacher preparation programs must provide ongoing professional development experiences that make explicit connections to the rationale behind constructivist practices. In order for the intervention to provide sustained change, the PK and TK of teacher educators must be extended through engagement in authentic telecollaborative experiences. Because PASSHE institutions share the same goals and vie for the same resources, the development of TPK can best be achieved if teacher preparation programs throughout the PASSHE collaborate to create and model activities for teacher educators and their students to actively experience. Through systemic collaboration, authentic experiences with the telecollaborative activity structures can be facilitated for teacher educators.

Limitations

The study has several limitations in terms of data collection from respondents. The existence of unequal group sizes among certification programs and content areas is

one limitation. It is worthy to note that 50% of respondents were unable to choose a primary content area affiliation while 0% identified an affiliated with Middle Level 7-9 education. It was obvious that teacher educators affiliated with Elementary K-6 programs did not view themselves as subject matter experts (SMEs). In each PASSHE institution, SMEs can be found in the liberal studies programs. This represents yet another limitation on correctly identifying respondents as belonging to one group or another. Finally, the number of faculty who primarily identified with graduate education was larger than anticipated and presents another limitation as they were removed from analysis.

Recommendations for Further Research

The results of this study will help to guide SCDEs as they seek to meet the NETP (2004) recommendation for increased use of digital content in a pedagogically sound manner. One of the recommendations for future research is to continue studying PASSHE institutions as they implement recommendations to integrate digital content. Using this study to provide a baseline for future comparison and study, the development of TPCK and its components can be tracked. Based on the number of teacher educators who identified primary affiliation with graduate education programs, similar research should be completed to compare undergraduate and graduate teacher education programs. Furthermore, additional study of the reasons for lack of telecollaborative activities is indicated. As previously stated, the lack of telecollaborative communication activities may be due to due to fewer models of the telecollaborative communication activities being accessible to PASSHE teacher educators. However, it may also be an indicator of how SCDEs are coping with confidentiality and safety issues in the online environment.

Both require a significant amount of advance preparation and require online communication with a "secret" identity. As SCDE's struggle with confidentiality and safety issues, it may be that there is an unwillingness to commit to these types of interactions. Again this may be due to lack of models or it may be related to policies designed to protect students from plagiarizing one another. Further study on the relationship of confidentiality and safety policies and Internet activities used by teacher educators is indicated. Indicators for other factors which may inhibit Internet integration, such as access, connection speed, time allotted for implementation, professional development, and authentic experiences, could be added to future surveys to provide more concrete conclusions about the use or lack of use of telecollaborative activities.

Finally, to improve this study it would be wise to replicate the study with an even larger pool of participants from a more widespread geographic era to verify or refute the findings. In addition, future studies should attempt to examine equal numbers of participants selected based on content area affiliation. An examination of liberal arts content area specialists should also be conducted to determine what experiences with telecollaborative activities students are having outside of the teacher preparation coursework.

Summary

The overall purpose of the study was to examine the relationship between PASSHE teacher educators' pedagogical beliefs and their use of telecollaborative Internet activities in practice. The goal of this examination was to address the U.S. Department of Education's Office of Educational Research and Improvement (April 2002) call for collecting data about how digital content is being used and to make recommendations for

action. To meet these needs, a tool for collecting the data was developed. The study collected data about pedagogical beliefs held by PASSHE teacher educators, identified the types of telecollaborative activities used in teacher preparation programs, determined which activities are being integrated into instruction most frequently, determined whether there is a correlation between constructivist beliefs and the use of telecollaborative activities, and explored differences by certification program and content area. Based on the findings, gaps in the TPCK of teacher educators were identified and conclusions were reached that pinpoint areas of Internet-specific PK and TK to be developed in PASSHE teacher educators. Key characteristics of effective professional development programs were presented as well.

After completing the study, it is clear that there is room for additional development of TPCK among teacher educators as they grapple with the constructivist integration of digital content. It is interesting to note that several PASSHE teacher educators contacted the researcher about the survey and vehemently objected to the idea that the telecollaborative activities could be incorporated into teacher preparation programs. Several stated that the strategies were not appropriate for either the certification program or content area with which they primarily identified. This crystallized, in the mind of the researcher, the importance of collaborating with other institutions to develop and present authentic examples of telecollaborative activities to teacher educators. In this way, theory and practice can be aligned to meet the needs of those who are struggling to understand how to best train their students in the integration of the Internet into instruction. As shown by Brouwer & Korthagen (2005) teacher education programs can make a difference in the practice of recently graduated teachers

by modeling good practice to facilitate development of TK and PK. After all, the true goal of impacting teacher education programs is the movement of constructivist strategies into the practice of pre-service and in-service teachers.

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APPENDIX A

IRB Approval

DUQUESNE UNIVERSITY

INSTITUTIONAL REVIEW BOARD

424 RANGOS BUILDING ♦ PITTSBURGH, PA 15282-0202

Dr. Paul Richer
Chair, Institutional Review Board
Phone (412) 396-6326 Fax (412) 396-5176
e-mail:

August 8, 2006

Ms. Leighann Forbes
8930 Ennis Drive
Erie PA 16509

Re: Internet use in teacher preparation programs: the relationship between pedagogy and practice in the Pennsylvania state system of higher education (Protocol # 06-89)

Dear Ms. Forbes:

Thank you for submitting your research proposal.

Based upon the recommendation of IRB member, Dr. David Delmonico, along with my own review, I have determined that your research proposal is consistent with the requirements of the appropriate sections of the 45-Code of Federal Regulations-46, known as the federal Common Rule. The intended research poses no greater than minimal risk to human subjects. Consequently, under rules 46.101 and 46.110, your proposed research is approved on an **expedited** basis.

This approval must be renewed in one year as part of the IRB's continuing review. You will need to submit a progress report to the IRB in response to a questionnaire that we will send.

In any correspondence about this study, please refer to the protocol number following the title above.

If, prior to the annual review, you propose any changes in your procedure or consent process, you must inform the IRB Chair of those changes and wait for approval before implementing them. In addition, if any procedural complications or adverse effects on subjects are discovered before the annual review, they immediately must be reported to the IRB Chair before proceeding with the study.

When the study is complete, please provide us with a summary, approximately one page. Often the completed study's Abstract suffices. Please keep a copy of your research records, other than those you have agreed to destroy for confidentiality, over a period of five years after the study's completion.

Thank you for contributing to Duquesne's research endeavors.

If you have any questions, feel free to contact me at any time.

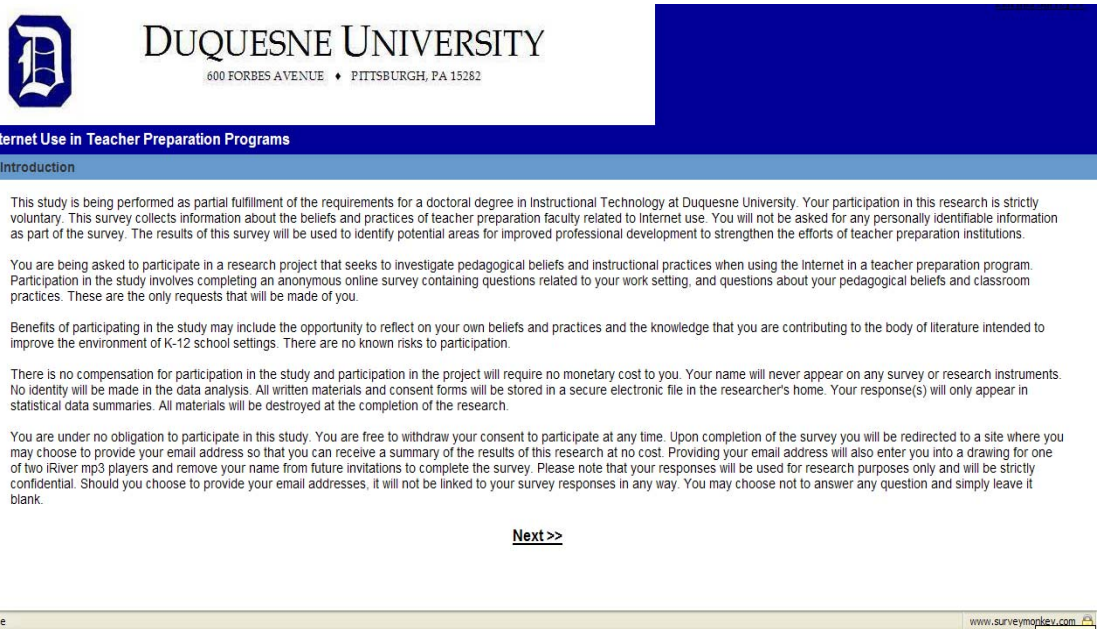
Sincerely yours,

Paul Richer, Ph.D.
IRB Chair

C: Dr. David Delmonico
Dr. Joseph Kush
IRB Records

APPENDIX B

Consent form



DUQUESNE UNIVERSITY

600 FORBES AVENUE ♦ PITTSBURGH, PA 15282

Internet Use in Teacher Preparation Programs

1. Introduction

This study is being performed as partial fulfillment of the requirements for a doctoral degree in Instructional Technology at Duquesne University. Your participation in this research is strictly voluntary. This survey collects information about the beliefs and practices of teacher preparation faculty related to Internet use. You will not be asked for any personally identifiable information as part of the survey. The results of this survey will be used to identify potential areas for improved professional development to strengthen the efforts of teacher preparation institutions.

You are being asked to participate in a research project that seeks to investigate pedagogical beliefs and instructional practices when using the Internet in a teacher preparation program. Participation in the study involves completing an anonymous online survey containing questions related to your work setting, and questions about your pedagogical beliefs and classroom practices. These are the only requests that will be made of you.

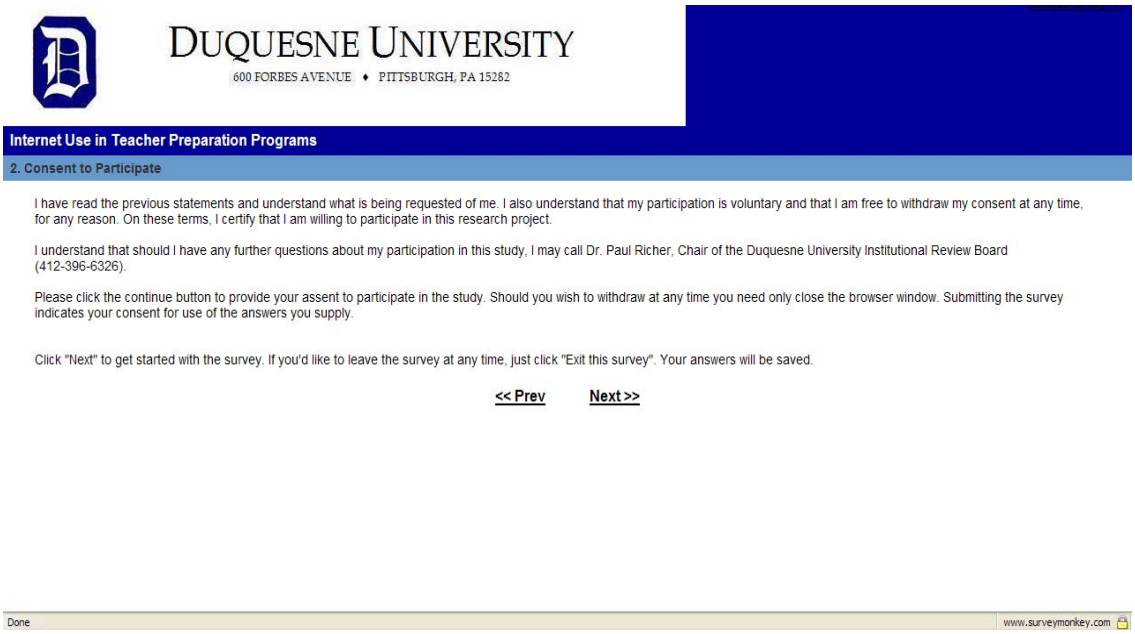
Benefits of participating in the study may include the opportunity to reflect on your own beliefs and practices and the knowledge that you are contributing to the body of literature intended to improve the environment of K-12 school settings. There are no known risks to participation.

There is no compensation for participation in the study and participation in the project will require no monetary cost to you. Your name will never appear on any survey or research instruments. No identity will be made in the data analysis. All written materials and consent forms will be stored in a secure electronic file in the researcher's home. Your response(s) will only appear in statistical data summaries. All materials will be destroyed at the completion of the research.

You are under no obligation to participate in this study. You are free to withdraw your consent to participate at any time. Upon completion of the survey you will be redirected to a site where you may choose to provide your email address so that you can receive a summary of the results of this research at no cost. Providing your email address will also enter you into a drawing for one of two iRiver mp3 players and remove your name from future invitations to complete the survey. Please note that your responses will be used for research purposes only and will be strictly confidential. Should you choose to provide your email addresses, it will not be linked to your survey responses in any way. You may choose not to answer any question and simply leave it blank.

Next >>

Done www.surveymonkey.com



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Internet Use in Teacher Preparation Programs

2. Consent to Participate

I have read the previous statements and understand what is being requested of me. I also understand that my participation is voluntary and that I am free to withdraw my consent at any time, for any reason. On these terms, I certify that I am willing to participate in this research project.

I understand that should I have any further questions about my participation in this study, I may call Dr. Paul Richer, Chair of the Duquesne University Institutional Review Board (412-396-6326).

Please click the continue button to provide your assent to participate in the study. Should you wish to withdraw at any time you need only close the browser window. Submitting the survey indicates your consent for use of the answers you supply.

Click "Next" to get started with the survey. If you'd like to leave the survey at any time, just click "Exit this survey". Your answers will be saved.

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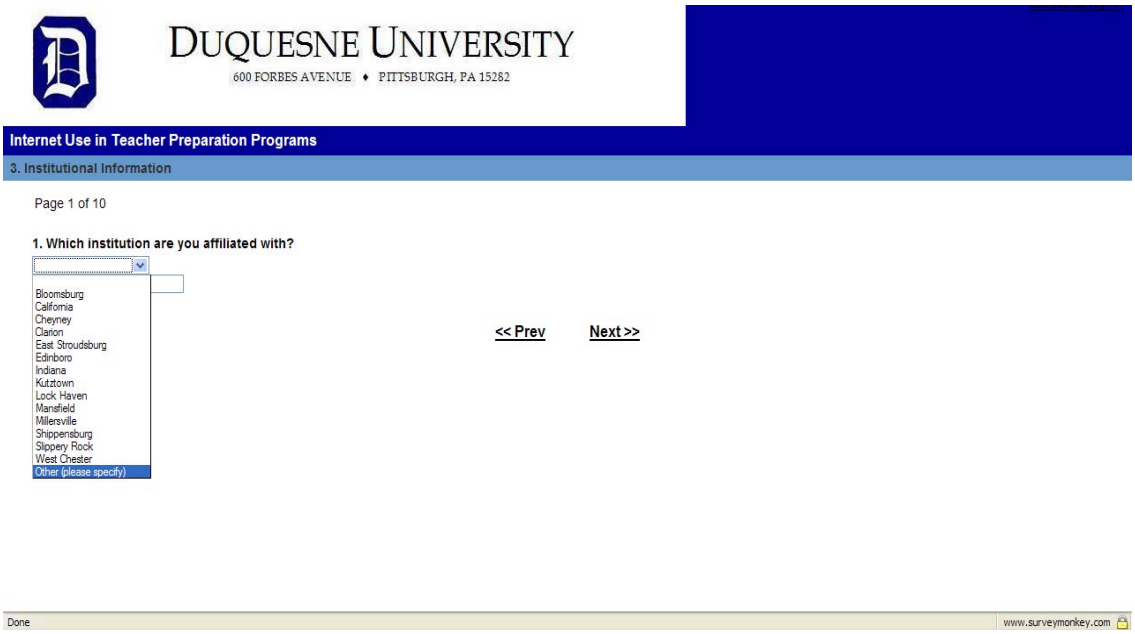
APPENDIX C

Pedagogy and Practice Survey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Internet Use in Teacher Preparation Programs
3. Institutional Information
Page 1 of 10
1. Which institution are you affiliated with?
Bloomsburg
California
Cheyney
Clarion
East Stroudsburg
Edinboro
Indiana
Kutztown
Lock Haven
Mansfield
Millersville
Shippensburg
Slippery Rock
West Chester
Other (please specify)
<< Prev
Next >>
Done
www.surveymonkey.com


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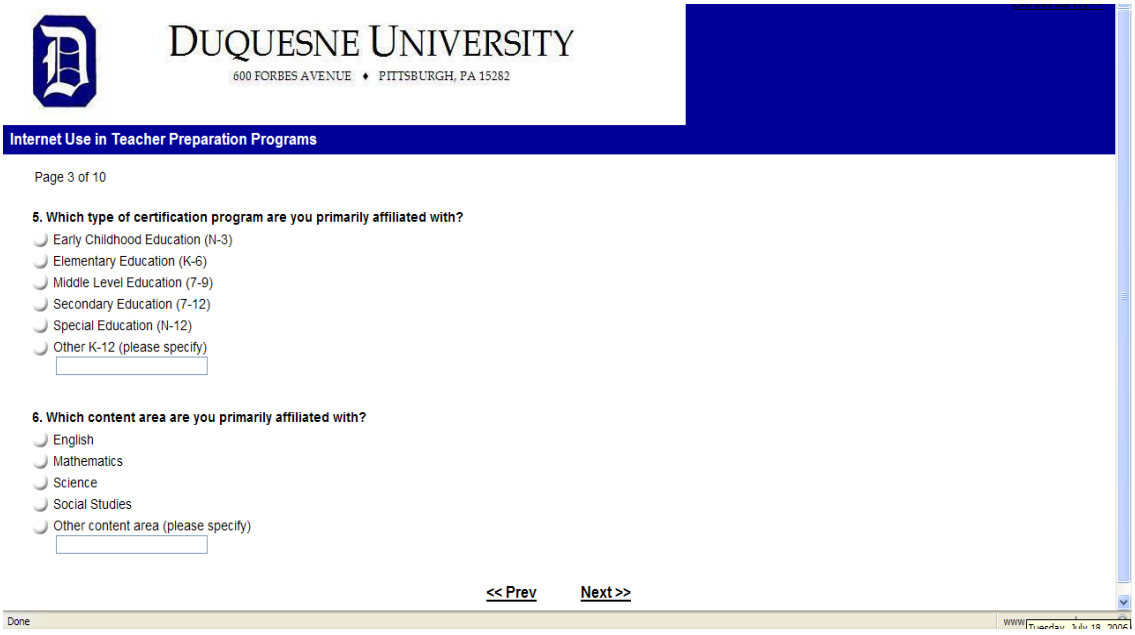
Page 2 of 10
2. How long have you been teaching at the university level?
0-5 years
6-10 years
11-15 years
16+ years
3. What is the highest degree you have completed?
Master's degree
Master's degree plus 30 hours
Master's degree plus 60 hours
Doctorate
Other (please specify)
4. Are you a faculty member in a teacher preparation program?
Yes
No
Done
www.surveymonkey.com



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Internet Use in Teacher Preparation Programs

Page 3 of 10

5. Which type of certification program are you primarily affiliated with?

- Early Childhood Education (N-3)
- Elementary Education (K-6)
- Middle Level Education (7-9)
- Secondary Education (7-12)
- Special Education (N-12)
- Other K-12 (please specify)

6. Which content area are you primarily affiliated with?

- English
- Mathematics
- Science
- Social Studies
- Other content area (please specify)

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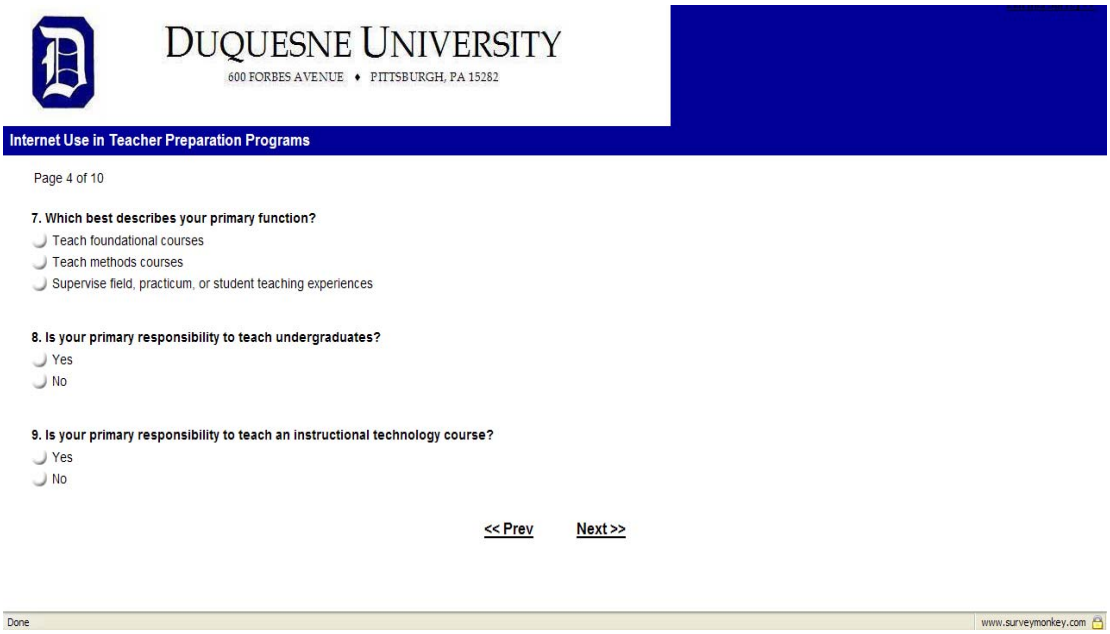
Done



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Internet Use in Teacher Preparation Programs

Page 4 of 10

7. Which best describes your primary function?

- Teach foundational courses
- Teach methods courses
- Supervise field, practicum, or student teaching experiences

8. Is your primary responsibility to teach undergraduates?

- Yes
- No

9. Is your primary responsibility to teach an instructional technology course?

- Yes
- No

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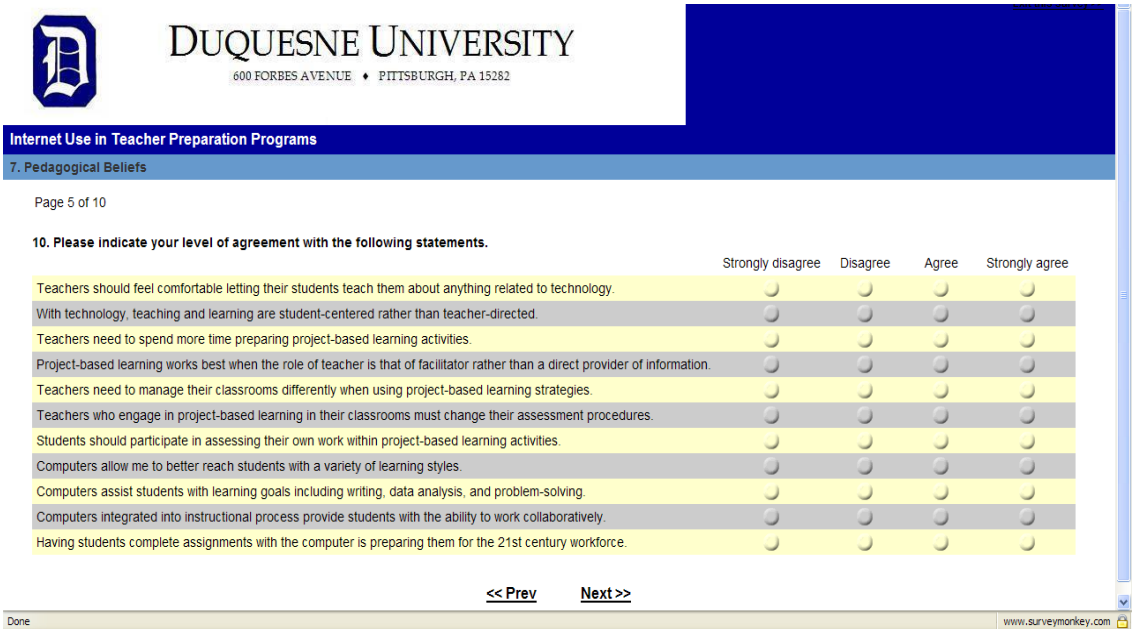

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Internet Use in Teacher Preparation Programs

7. Pedagogical Beliefs

Page 5 of 10

10. Please indicate your level of agreement with the following statements.

	Strongly disagree	Disagree	Agree	Strongly agree
Teachers should feel comfortable letting their students teach them about anything related to technology.	○	○	○	○
With technology, teaching and learning are student-centered rather than teacher-directed.	○	○	○	○
Teachers need to spend more time preparing project-based learning activities.	○	○	○	○
Project-based learning works best when the role of teacher is that of facilitator rather than a direct provider of information.	○	○	○	○
Teachers need to manage their classrooms differently when using project-based learning strategies.	○	○	○	○
Teachers who engage in project-based learning in their classrooms must change their assessment procedures.	○	○	○	○
Students should participate in assessing their own work within project-based learning activities.	○	○	○	○
Computers allow me to better reach students with a variety of learning styles.	○	○	○	○
Computers assist students with learning goals including writing, data analysis, and problem-solving.	○	○	○	○
Computers integrated into instructional process provide students with the ability to work collaboratively.	○	○	○	○
Having students complete assignments with the computer is preparing them for the 21st century workforce.	○	○	○	○

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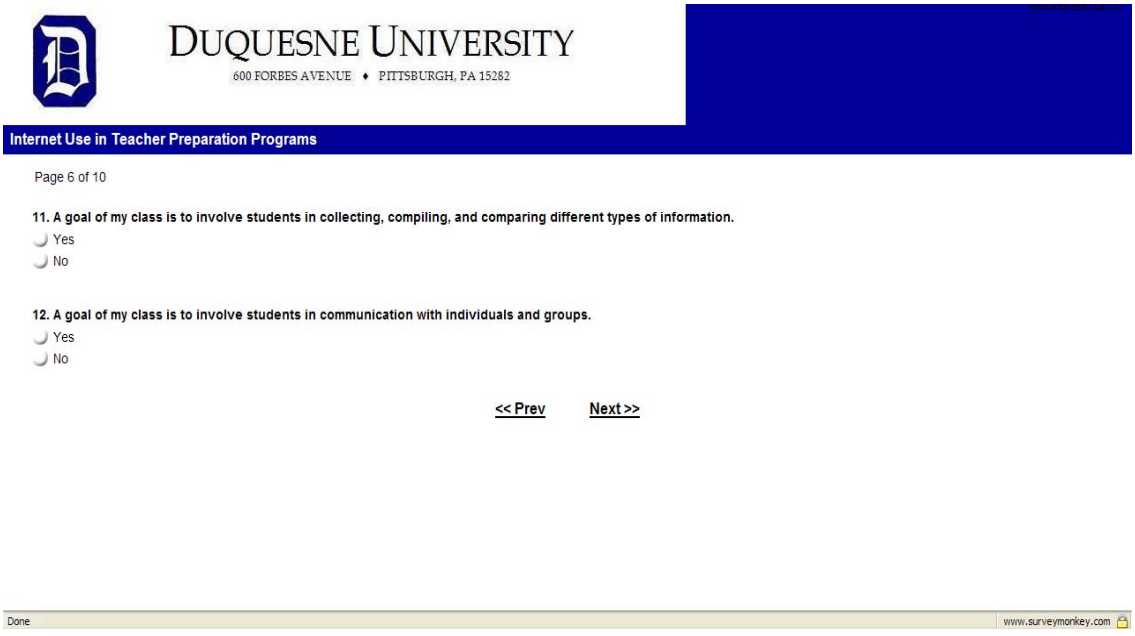

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Internet Use in Teacher Preparation Programs

Page 6 of 10

11. A goal of my class is to involve students in collecting, compiling, and comparing different types of information.

○ Yes
○ No

12. A goal of my class is to involve students in communication with individuals and groups.

○ Yes
○ No

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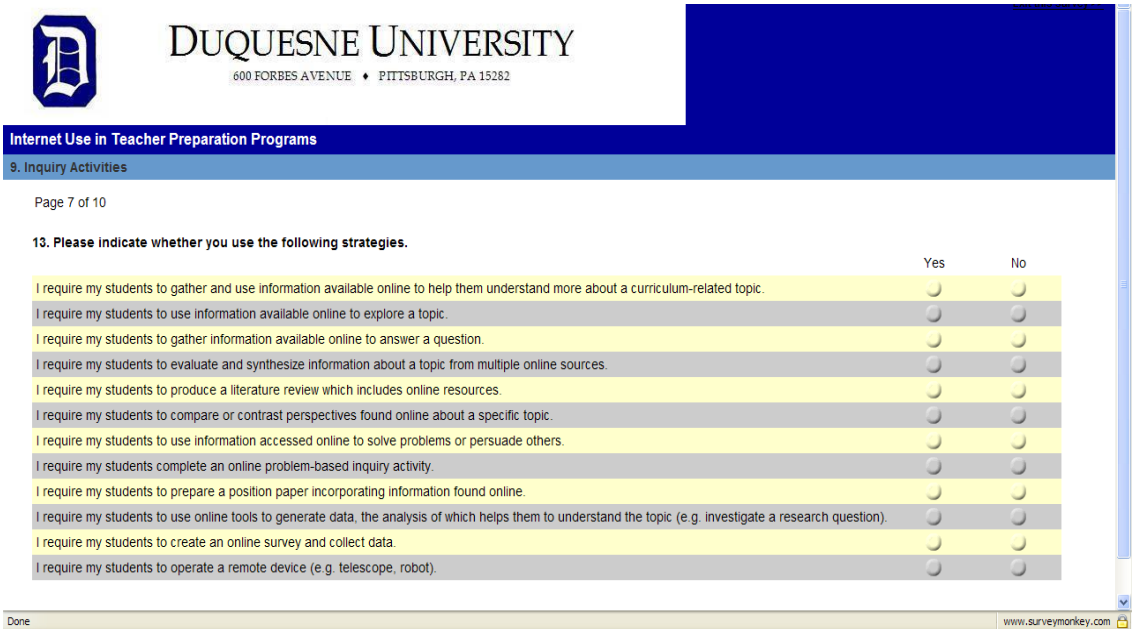

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Internet Use in Teacher Preparation Programs

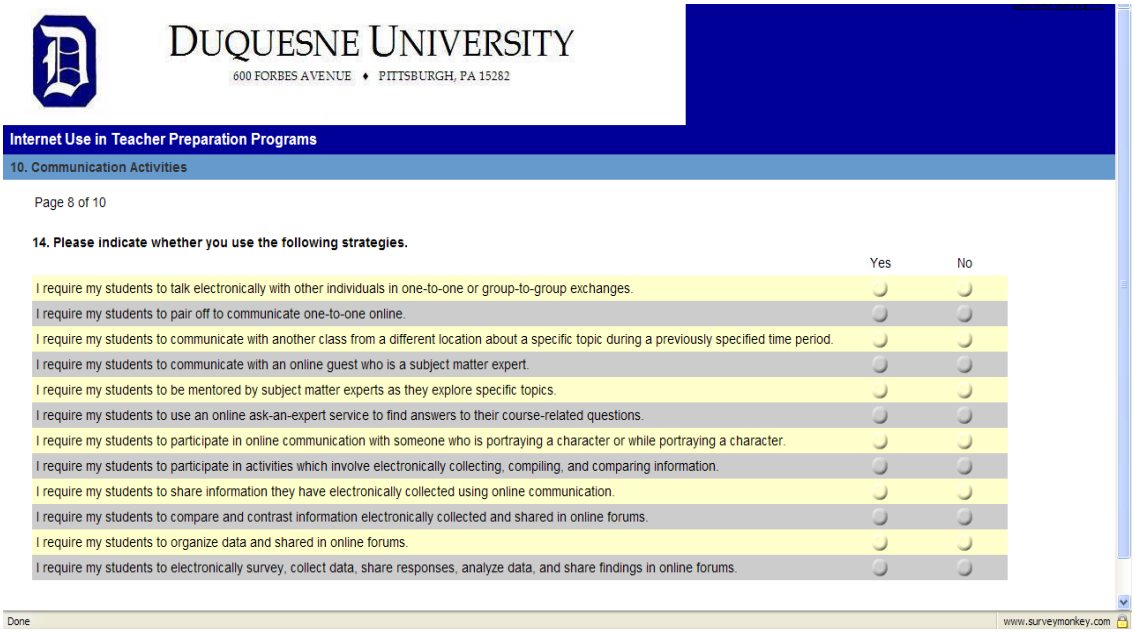
9. Inquiry Activities

Page 7 of 10

13. Please indicate whether you use the following strategies.

	Yes	No
I require my students to gather and use information available online to help them understand more about a curriculum-related topic.	○	○
I require my students to use information available online to explore a topic.	○	○
I require my students to gather information available online to answer a question.	○	○
I require my students to evaluate and synthesize information about a topic from multiple online sources.	○	○
I require my students to produce a literature review which includes online resources.	○	○
I require my students to compare or contrast perspectives found online about a specific topic.	○	○
I require my students to use information accessed online to solve problems or persuade others.	○	○
I require my students complete an online problem-based inquiry activity.	○	○
I require my students to prepare a position paper incorporating information found online.	○	○
I require my students to use online tools to generate data, the analysis of which helps them to understand the topic (e.g. investigate a research question).	○	○
I require my students to create an online survey and collect data.	○	○
I require my students to operate a remote device (e.g. telescope, robot).	○	○

Done www.surveymonkey.com



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Internet Use in Teacher Preparation Programs

10. Communication Activities

Page 8 of 10

14. Please indicate whether you use the following strategies.

	Yes	No
I require my students to talk electronically with other individuals in one-to-one or group-to-group exchanges.	○	○
I require my students to pair off to communicate one-to-one online.	○	○
I require my students to communicate with another class from a different location about a specific topic during a previously specified time period.	○	○
I require my students to communicate with an online guest who is a subject matter expert.	○	○
I require my students to be mentored by subject matter experts as they explore specific topics.	○	○
I require my students to use an online ask-an-expert service to find answers to their course-related questions.	○	○
I require my students to participate in online communication with someone who is portraying a character or while portraying a character.	○	○
I require my students to participate in activities which involve electronically collecting, compiling, and comparing information.	○	○
I require my students to share information they have electronically collected using online communication.	○	○
I require my students to compare and contrast information electronically collected and shared in online forums.	○	○
I require my students to organize data and shared in online forums.	○	○
I require my students to electronically survey, collect data, share responses, analyze data, and share findings in online forums.	○	○

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Internet Use in Teacher Preparation Programs

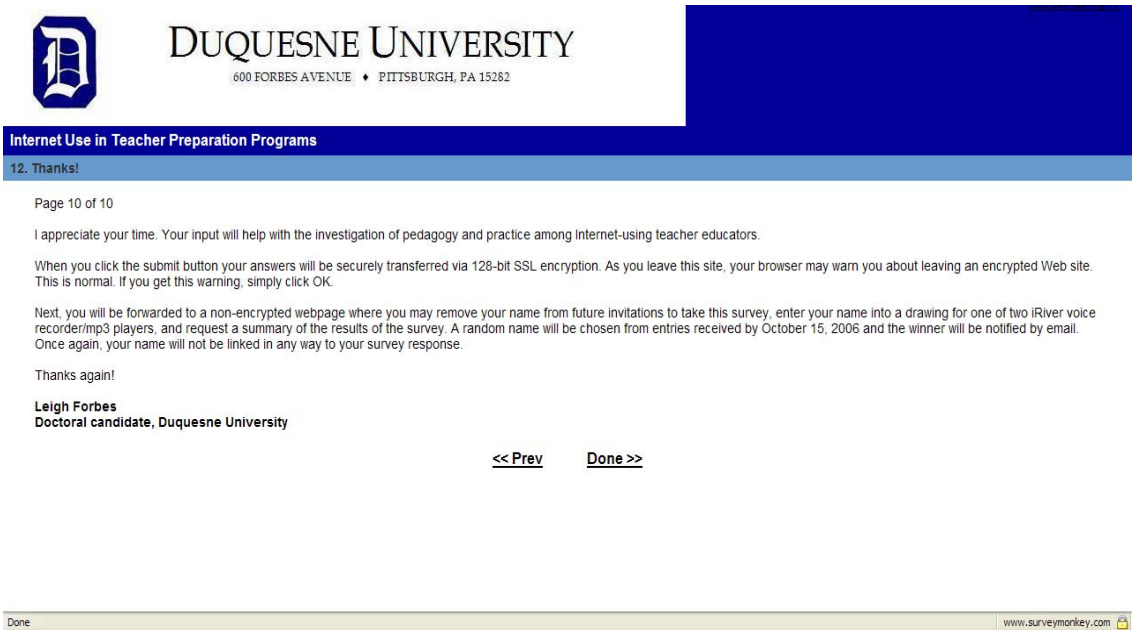
11. Communication Activities (continued)

Page 9 of 10

15. Please indicate whether you use the following strategies.

	Yes	No
I require my students to share their texts, images, soundtracks, multimedia creations and/or experiences virtually with others.	○	○
I require my students to produce materials for display in virtual galleries and/or exhibits for viewing and use by others.	○	○
I require my students to display individual works online.	○	○
I require my students to produce materials for electronic publications (e.g., ezines, electronic newspapers, blogs, podcasts).	○	○
I require my students to participate in virtual lessons to learn about a curriculum-related topic.	○	○
I require my students to participate in virtual visits (online fieldtrips and expeditions).	○	○
I require my students to be involved in some type of cooperative or collaborative problem solving where they attend to their own and others' problem solving processes as part of their learning.	○	○
I require my students to solve curriculum-based problems and compare, contrast, and discuss their varying problem solving strategies with students at distant locations.	○	○
I require my students to collaboratively solve curriculum-based problems with students at distant locations.	○	○
I require my students to create a common written text or shared visual image with students at distant locations (e.g. progressive stories).	○	○
I require my students to provide constructive responses to others online (e.g. peer editing or writer's workshops online).	○	○
I require my students to assume virtual identities and solve problems in simulated online scenarios (e.g. role playing).	○	○

Done www.surveymonkey.com



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Internet Use in Teacher Preparation Programs

12. Thanks!

Page 10 of 10

I appreciate your time. Your input will help with the investigation of pedagogy and practice among Internet-using teacher educators.

When you click the submit button your answers will be securely transferred via 128-bit SSL encryption. As you leave this site, your browser may warn you about leaving an encrypted Web site. This is normal. If you get this warning, simply click OK.

Next, you will be forwarded to a non-encrypted webpage where you may remove your name from future invitations to take this survey, enter your name into a drawing for one of two iRiver voice recorder/mp3 players, and request a summary of the results of the survey. A random name will be chosen from entries received by October 15, 2006 and the winner will be notified by email. Once again, your name will not be linked in any way to your survey response.

Thanks again!

Leigh Forbes
Doctoral candidate, Duquesne University

<< Prev **Done >>**

Done www.surveymonkey.com

APPENDIX D

Pre-notification E-mail

From: Forbes, Leighann S.
Sent: Wednesday, September 6, 2006 9:07 AM
To: respondent@institution.edu
Subject: Doctoral Study of Internet Use

Fall 2006

Dear [*name of respondent*]:

As a teacher educator in the Pennsylvania State System of Higher Education, you will soon be invited to participate in a research project entitled "Internet Use in Teacher Preparation Programs: The Relationship between Pedagogy and Practice in the Pennsylvania State System of Higher Education." This project is designed to examine how teacher educators across Pennsylvania integrate the Internet into instruction. In my third year as a faculty member at Slippery Rock University, I am conducting this study as part of my doctoral dissertation research at Duquesne University. The study is being conducted by under the supervision of Joseph Kush, Ph.D., from Duquesne University, Department of Instruction and Leadership. Your invitation to participate will arrive in one week via email.

Your participation in this study will make a valuable contribution to the body of research about the beliefs and practices of teacher educators' uses of the Internet for instruction. As researchers gain more understanding of teacher educators' experiences using the Internet for instruction, identification of areas for improved professional development can be determined. Your participation in this research survey may help to accomplish these goals and thus may benefit future generations of teachers.

This project has been approved by the Duquesne University Human Subjects Institutional Review Board on August 8, 2006. While your responses will be confidential, you have an opportunity to supply your email address so that you can be entered into a drawing for one of two iRiver voice recorder/mp3 players. If you have any questions, please feel free to contact Leighann Forbes, the principal investigator, at PHONE or email@sru.edu, Dr. Joseph Kush, my dissertation chairperson, at PHONE or email@duq.edu, or Dr. Paul Richer, Chair of the Duquesne University Institutional Review Board PHONE or email@duq.edu. I hope that you will consider participating in the upcoming survey. Again, your invitation to participate will arrive via email in one week.

Sincerely,

Leighann S. Forbes
Slippery Rock University

APPENDIX E

Invitation to Participate E-mail

From: Forbes, Leighann S.
Sent: Wednesday, September 13, 2006 9:48 AM
To: respondent@institution.edu
Subject: Doctoral Study of Internet Use

Fall 2006

Dear Firstname Lastname:

Recently you were contacted about participating in a study of teacher educators in Pennsylvania. The study is a part of my dissertation research at Duquesne University. While I know that this is a busy time of year, I would appreciate your taking a few moments to complete the survey. Responding to the 58 question survey will take approximately 10 minutes to complete. The time it takes to complete the survey is the only anticipated inconvenience or risk of participation. The survey **is available at: https://www.surveymonkey.com/s.asp?u=867261713714**. You will be directly linked to the survey and should enter the case-sensitive **password: Wolverine**.

This survey collects information about the beliefs and practices of teacher preparation faculty related to Internet use. Based on the survey results, I hope to identify areas for improved professional development and strengthen the efforts of teacher preparation institutions as they strive to meet the needs of students. Your participation in this research survey may help to accomplish these goals and may benefit future generations of teachers.

Your participation in this research is strictly voluntary. You will not be asked for any personally identifiable information as part of the survey. Upon completion of the survey you will be redirected to a site where you may choose to provide your email address so that you can be entered into a drawing for one of two iRiver voice recorder/mp3 players. However, please note that **your responses will be used for research purposes only and will be strictly confidential**. Should you choose to provide your email address, it will not be linked to your survey responses in any way.

If you have received more than one invitation to participate in this project, please do not respond to the survey more than one time (i.e., submitting more that one survey via the Internet). You may choose not to answer any question and simply leave it blank. If you choose not to participate in this survey, you may close out the webpage without submitting your responses. Submitting the survey indicates your consent for use of the answers you supply.

Participation in the study involves completing a confidential online survey containing questions related to your work setting, and questions about your pedagogical beliefs and classroom practices. Benefits of participating in the study may include the opportunity to reflect on your own beliefs and practices and the knowledge that you are contributing to the body of literature intended to improve the environment of K-12 school settings.

Your participation is important to the success of this survey project. The survey will remain available through September 27, 2006. This project has been approved by the Duquesne University Human Subjects Institutional Review Board on August 8, 2006. If you have any questions, please feel free to contact Leighann Forbes, the principal investigator, at PHONE or email@sru.edu, Dr. Joseph Kush, my dissertation chairperson, at PHONE or email@duq.edu, or Dr. Paul Richer, Chair of the Duquesne University Institutional Review Board PHONE or email@duq.edu. Upon request, I would be pleased to supply you with a summary of the results.

Thank you!
Leighann Forbes
Slippery Rock University

APPENDIX F

First Reminder to Participate E-mail

From: Forbes, Leighann S.
Sent: Monday, September 18, 2006 2:38 PM
To: respondent@institution.edu
Subject: Doctoral Study Invitation

Hello,

I want to thank those of you who have taken the time to complete my "Internet Use in Teacher Preparation Programs: The Relationship between Pedagogy and Practice in the Pennsylvania State System of Higher Education" survey for my dissertation. I really appreciate it.

It's not too late if you still haven't completed the survey. I know this is an extremely busy time for you, but if you could please complete the survey by September 27th, I would be most appreciative. Your input is very important. The survey is available at

https://www.surveymonkey.com/s.asp?u=867261713714.

You will be directly linked to the survey and should enter the **case-sensitive password:**

Wolverine

Your participation is important to the success of this survey project. The survey will remain available through September 27, 2006. This project has been approved by the Duquesne University Human Subjects Institutional Review Board on August 8, 2006.

If you have any questions, please feel free to contact Leighann Forbes, the principal investigator, at PHONE or email@sru.edu, Dr. Joseph Kush, my dissertation chairperson, at PHONE or email@duq.edu, or Dr. Paul Richer, Chair of the Duquesne University Institutional Review Board PHONE or email@duq.edu. Upon request, I would be pleased to supply you with a summary of the results.

Thank you for your time!

Leighann Forbes
Slippery Rock University

APPENDIX G

Second Reminder to Participate E-mail

From: Forbes, Leighann S.
Sent: Monday, September 25, 2006 9:58 AM
To: respondent@institution.edu
Subject: Doctoral Study of Internet Use Follow Up

Dear Firstname Lastname,

If you have taken the time to complete my "Internet Use in Teacher Preparation Programs: The Relationship between Pedagogy and Practice in the Pennsylvania State System of Higher Education" survey, I really appreciate it. I wanted to let you know that the winners of the iRiver mp3 players will be announced via email on October 10.

If you still haven't completed the survey it's not too late. I know this is an extremely busy time for you, but if you could please complete the survey by midnight September 27th, I would be most appreciative. Responding to the survey will take approximately 10. The survey is available at

https://www.surveymonkey.com/s.asp?u=867261713714.

You will be directly linked to the survey and should enter the **case-sensitive password:**

Wolverine

This survey collects information about the beliefs and practices of teacher preparation faculty related to Internet use. Based on the survey results, I hope to identify areas for improved professional development and strengthen the efforts of teacher preparation institutions as they strive to meet the needs of students. Your participation in this research survey may help to accomplish these goals and may benefit future generations of teachers. Your participation is important to the success of this survey project. The survey will remain available through September 27, 2006. This project has been approved by the Duquesne University Human Subjects Institutional Review Board on August 8, 2006.

If you have any questions, please feel free to contact Leighann Forbes, the principal investigator, at PHONE or email@sru.edu, Dr. Joseph Kush, my dissertation chairperson, at PHONE or email@duq.edu, or Dr. Paul Richer, Chair of the Duquesne University Institutional Review Board PHONE or email@duq.edu. Upon request, I would be pleased to supply you with a summary of the results.

Again, thank you for your time!

Leighann Forbes
Slippery Rock University