The Integration of Technology within Physical Education Teacher Education: Perceptions of the Faculty

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THE INTEGRATION OF TECHNOLOGY WITHIN PHYSICAL EDUCATION
TEACHER EDUCATION: PERCEPTIONS OF THE FACULTY
THE INTEGRATION OF TECHNOLOGY WITHIN PHYSICAL EDUCATION TEACHER EDUCATION: PERCEPTIONS OF THE FACULTY

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Kinesiology

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ABSTRACT

In 2008, the national Physical Education Teacher Education (PETE) standards included a more integrated approach to teaching pre-service teachers about technology and stated that teacher candidates should be able to plan and implement technology infused learning experiences that meet lesson objectives. With the inclusion of the 2008 standards, PETE faculty have the task to create instruction that effectively integrates technology. This study investigated the preparedness for technology integration of 198 teacher educators within nationally recognized PETE programs. The study utilized survey research design to identify current technologies used, analyze current level of technology proficiency in relationship to the level of integration, identify factors that aid or hinder the technology infusion process and examine approaches PETE programs use to integrate technology within PETE programs. Roger’s Diffusion Theory (2003) and the Technological Pedagogical Content Knowledge Framework (Mishra & Koehler, 2006) were used as theoretical guides. Results indicated low proficiency and integration levels. On average, proficiency levels were that of basic use of technology and integration levels indicated that PETE professors were aware of the use of technology but often did not integrate it or teach it to the students. In addition, the level of proficiency predicted integration levels significantly. Computer technologies, pedometers and heart rate monitor were tools most often integrated within PETE programs. PETE teacher educators expressed concerns related to the abundance of technologies as well as the limited availability and accessibility of technologies both at the PETE level and within K-12 schools. The results and literature suggest PETE faculty can enhance technology integration by developing a clear vision of technology integration, creating a technology plan, constructing teaching technology labs, and encouraging faculty-practitioner
collaboration. In light of the 2008 national PETE standards, the results suggest that both the national and regional associations as well as PETE administrators should explore various professional development models in the area of both using technology (improving proficiency levels) as well as teaching effective teaching strategies related to technology (enhancing integration levels). Crucially, strategies where technology can assist in the enhancement of the overall quality of PE, in both PETE and K-12 PE, should be the main focus.
This dissertation is approved for recommendation to the Graduate Council.

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A dissertation is never really written on its own. Many people contributed to the completion of this document. I would like to thank my advisor, Dr. Gorman, for his encouragement and support throughout my entire program. I thank Dr. Kern for allowing me to explore my own teaching abilities at the higher education level and help me to understand the complexities PETE holds. I am grateful for the support Dr. Denny provided. Without his knowledge in statistics I would have been lost. Dr. Murphy helped me explore the world of educational technology and I have learned so much from all her classes as well as her guidance throughout the dissertation process. I also wanted to thank Dr. Langsner for helping me ask myself critical questions that helped me grow as a young scholar. To all my committee members, thank you.

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To my friends and family, thank you for the support you all have given me not just through my PhD program but throughout the 30 years it took me to reach this milestone. As I continue my journey, I hope I can make you all proud. Thank you.
DEDICATION

I dedicate this dissertation to my parents, Jeannine Ringoir and Dirk Baert for supporting me, loving me, challenging me, and encouraging me to keep going even when I am across the globe and away from my family. I have never given up on my dreams and I know that is because of you both. I am forever grateful for who you are.

Dankje wel
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CHAPTER 1: INTRODUCTION

Introduction

It is difficult to imagine life without technology. Cell phones, computers, iPods, and the Internet are only a few tools used daily by children and adults all over the world. Since 2007, the Census Bureau reports that 70% of Americans use computers and the Internet at home versus 41.5% in 2000 (U.S. Census Bureau, 2007). As of Fall 2003, all public schools in the United States have Internet access and students have classrooms infused with technology (National Center for Education Statistics, 2007). With the integration of technology in the daily lives of students, there is a concern of how well teachers are prepared to teach with technology (Hasselbring, et al., 2000). Physical Education teachers do not escape this concern. In 1998, DePauw (1998) stated that in every university Kinesiology department in the United States technology is used within instructional programs as a way to inform pedagogy.

Currently, the innovations of computerized gadgets and digital apparatus in physical education are noticed all around the globe. Pedometers count the steps students take each day and motivate them to adopt a more physically active lifestyle (Lubans, Morgan, & Tudor-Locke, 2009). Heart rate monitors provide teachers with vital information on the level of activity output of their students in order to effectively design instruction geared to the needs of specific students (Kirkpatrick & Birnbaum, 1997; Ratey, 2008). Digital video is used to help pre-service teachers observe, assess, and provide specific feedback to children on how to move in space in order to support motor skill development (Fiorentino, 2004; Lim, Pellett, & Pellett, 2009). By including such technologies, Physical Education (PE) teachers are bound to enhance their programs with
alternative lifelong physical activities and innovative fitness programs (Mears, Hansen, Fine, Lawler, Mason, & Richardson, 2009).

While technologies have been found useful within education, studies indicate that teachers do not feel prepared to use technology in their instruction (McGowen, 2003; Milken Exchange, 1999; National Center for Education Statistics, 1997; Willis & Mehlinger, 1996). To encourage the integration of technology, the National Council for Accreditation of Teacher Education (NCATE) together with the International Society for Technology in Education (ISTE) created national standards on how to infuse classrooms with technology (International Society for Technology in Education Accreditation Committee, 1998). In Physical Education Teacher Education (PETE), technology integration was first adopted in the 2001 national standards for beginning teachers (National Association for Sport and Physical Education, 2001). Later, in 2008, new national standards included a more integrated approach to teaching pre-service teachers about technology and stated that “teacher candidates should demonstrate knowledge of current technologies by planning and implementing learning experiences that require students to use technology appropriately to meet lesson objectives” (National Association for Sport and Physical Education, 2008, p. 15).

Statement of the Problem

Guided by national standards, one would think that teacher preparation programs would integrate technology into pedagogy courses and provide professional development for those teachers already in the field. However, according to the National School Health Policies and Programs Study (Lee, Burgeson, Fulton, & Spain, 2007), only 42% of PE teachers have received staff development on the use of physical activity monitoring
devices and 37% on the use of technology overall. Other training on administering fitness tests, assessing students’ performance and developing portfolios was completed by 17% to 48% of physical educators (Lee, et al., 2007). With the inclusion of the 2008 standards for future PE teachers, PETE faculty have the task to create instruction that effectively integrates technology (National Association for Sport and Physical Education, 2008). Consequently, it is questioned whether or not current faculty members of PETE programs are adequately prepared to take on such a task.

While there are various practical research papers on the benefits of using technology in Physical Education, little empirical research has been done to understand the current scope of the perceptions of Physical Education Teacher Education faculty on the integration of technology. What technologies are currently being taught to pre-service teachers? How are these technologies introduced in Physical Education training programs? Understanding how and which technologies are used can provide insight into the need of technology guidance for PETE faculty members. In addition, it is important to understand the factors that may hinder or facilitate the integration of technology by educators so organizations concerned with the preparation of PE teachers (such as the National Association of Sport and Physical Education - NASPE and the American Association for Health, Physical Education, Recreation and Dance - AAHPERD) can assist Physical Education Teacher Education faculty in creating and offering quality programming to PE teacher candidates.

**Concerned Engagement**

As a former physical education teacher and a current graduate student and instructor within a PETE program, I often reflect upon my own practices both as a
teacher and a researcher. During my Masters’ program, I investigated the use of wikis (editable websites that encourage collaborative writing) as a technology that can extend the learning experiences of teacher candidates while gaining a deeper understanding of the concepts around teaching games in Physical Education (Baert, 2008b). That experience allowed me to see the influences technology can have on learning and teaching in Physical Education Teacher Education programs. As I built upon these experiences I began to explore other forms of technology within Physical Education. By attending the national conferences in both Canada and the United States, I began to consider the effects of new technology on teacher education programs. Ellis (1998) refers to this process as an “interpretive inquiry”, or a process of reading a situation to explore, question, and understand before one acts upon that understanding. The question I pose is: “How can I integrate technology in pedagogy courses so that physical education teachers feel prepared to activate today’s digital students?”

By accessing the Internet for more information, I found an abundance of technologies that could and should be integrated into a teacher program. In her book: “Using Technology in Physical Education”, Bonnie Mohnsen (2008) lists over 30 different technological devices that can be used to enhance the practice of physical education. These technologies include audio and visual apparatus, aerobic equipment, physical activity monitors, computer programs, instructional software, and online materials. Although there are other sources that offered similar options, these findings are exciting yet disturbing to me. As I prepare to become a new Physical Education Teacher Education faculty member, I wonder about my own preparedness to teach teacher candidates. Realizing the effect a teacher education program can have on the success and
achievement of new teachers, it is imperative to find out how faculty are meeting the need of today’s teacher candidates.

Ellis (1998) asserts that when we wish to get closer to what we need to understand, the study can be viewed as “a series of loops in a spiral (Fig. 1), each loop in the spiral representing a separate inquiry activity within the study, and each loop starts through uncovering the previous loop” (p. 20). As I reflect upon my own practice I used this spiral to understand the needs of teacher candidates and teacher educators in order to design and select activities or instructional tools that meet those needs.

Figure 1. Interpretive inquiry as an unfolding spiral (Ellis, 1998, p. 20).

First, I questioned the current scope of the integration of technology in PETE programs by examining the experiences and perceptions of faculty members in such programs. Finding this information started another loop in the process. In an interpretive inquiry, research begins with such a question and continues with several data collection and analyses stages where new meaning guides the path of further research (Ellis, 1998). It is important to this type of study that the inquirer is vigilant about how he or she interprets each step in the process as new data and interpretation may evolve and
influence the path of the investigation. In combination with my own interpretation, I am guided by theory regarding teaching and learning with technology.

**Theoretical Background**

It is important to understand that technology is here to stay. In fact, new tools emerge each day and it is simply impossible to keep up with all technologies. Consequently, it is vital to locate and examine current teaching practices that demonstrate the effective integration of technology in preparing physical education teachers in the “Digital Age”. In order to investigate effective technology integration, it is fundamental to understand the theory of diffusion. Roger’s Diffusion Theory (2003) and the Technological Pedagogical Content Knowledge Framework (Mishra & Koehler, 2006) were used to guide an understanding of the implications of technology on teaching and learning.

According to Hasselbring et al. (2000), faculty should teach the “skills for the successful use of technology for learning as well as the pedagogical skills associated with the classroom uses” (pp. 22-23). Diffusion theory can help us understand the process of integrating technologies into a social system such as a teacher education program. General diffusion theory originated from Everett Rogers (2003) who conceptualized five distinct stages within the process of diffusion as a relatively linear process from (1) knowledge, (2) persuasion, (3) decision, (4) implementation, to (5) confirmation. This study explored the factors that affect the diffusion process. Numerous diffusion models were discovered through an in-depth literature review and the Technology Learning Cycle (Sprague, Kopfman, & Dorsey, 1998) revealed to be an appropriate model for the
integration of technology within teacher education. However, many diffusion models appeared to hold altered definitions of technology integration.

Within this study, effective technology integration is supported by the understanding that there are relationships that occur between three knowledge systems: content, pedagogy, and technology. An in-depth review of research and literature showed that technology should not be treated as a separate entity and effective teaching constitutes an understanding of how technology relates to the content and pedagogy (Hughes, 2005, Mishra & Koehler, 2006, Neiss, 2005). Mishra and Koehler (2006) enhanced Shulman’s framework of pedagogical content knowledge (Shulman, 1986) to articulate such relationships within what they called the Technological Pedagogical Content Knowledge framework or TPCK. The TPCK framework is used to enhance the chosen diffusion model as conceptualized by Sprague, Kopfman, and Dorsey (1998) and extended by Howland and Wedman (2004). The aforementioned theories and models are described in more detail in the Chapter 2.

**Purpose of the Study**

The purpose of this study was to analyze the current status of technology integration within physical education teacher education programs as perceived by the faculty of such programs. This study aimed to 1) identify the types of technology currently taught to physical education teacher candidates in PETE courses within undergraduate and graduate programs, 2) evaluate the current technological proficiency of PETE faculty (as perceived by the faculty) and 3) its relationship to the level of integration within the PETE courses, and 4) examine the factors that affect technology utilization of PETE faculty within the PETE programs. In conclusion, the intention of this
study was to identify and highlight programs where faculty believed effective integration of technology is used in order to determine the current status of PETE programs with respect to the integration of technology.

**Research Questions**

This study asked: “What are the perceptions and experiences of Physical Education (PE) educators on the inclusion of technology in physical education teacher education programs (PETE)?” The following sub-questions guided the research:

1. What types of technologies are currently included in PETE programs?
2. What do current PE educators believe to be their technological proficiency levels?
3. How are PE educators integrating technology in PETE courses?
4. What factors affect technology use of PETE faculty within the PETE programs?
5. How do PETE programs approach technology integration according to the perceptions of the PETE faculty members?

**Significance of the Study**

Teacher education matters. Research has shown that the quality of teacher education programs are correlated with positive student outcomes (Darling-Hammond, 1999; Darling-Hammond, Chung, & Frelow, 2002). In addition, highly integrated programs have shown to produce teachers who are more effective and more likely to enter and stay in teaching (Darling-Hammond, 2000). Education preparation programs must therefore model best practices for new teachers by preparing faculty to infuse technology throughout the curriculum (CEO Forum on Education & Technology, 1999; Handler, 1993). Since the implementation of the 2008 Initial Standards in Physical Education Teacher Education, the National Association for Sport and Physical Education
(NASPE) requires data collection of evidence that shows that teacher candidates are adequately prepared to integrate technology when teaching physical education (NASPE, 2009).

This study afforded a descriptive overview of the current scope regarding the integration of technology in Physical Education Teacher Education programs within the United States. The findings of this research informed the technological competencies and perceptions faculty members hold in regards to preparing new PE teachers how to create technology enriched physical education lessons. In addition, this study allowed for insights into how well physical educators feel prepared to integrate new technology and the factors that may hinder or facilitate this preparedness. PETE faculty members were able to determine their own and their students’ technology proficiency and utilization levels. The results of this study can guide future professional development opportunities as well as future research directions.

**Definition of Terms**

PETE: In the U.S., Physical Education Teacher Education (PETE) is a common term used to define preparation programs for Physical Education teachers.

PETE Faculty: Faculty teaching in North American Physical Education teacher education programs and who are members of the American Association for Health, Physical Education, Recreation and Dance (AAHPERD). The programs included in this study are NCATE certified. The only requirement to be included in this study would be that faculty members teach at least 1 PE pedagogy course.
Technology(ies): Pedagogical tools used for effective delivery of instruction such as various devices, computer programs (software and hardware), multimedia, Internet and Web-based resources.

PETE faculty’s level of technological proficiency: The knowledge and skill of technology of PETE faculty members as perceived by PETE faculty members.

Technology utilization/integration: The level to which PETE faculty use and encourage teacher candidates to use technology in PE programs. A more in depth look at technology integration is provided in the literature review.

Factors affecting technology utilization: factors hindering or facilitating the integration of technology by faculty members.

**Limitations and Delimitations**

As defined by Fraenkel and Wallen (2003, p. G4), limitations are “aspects of the study that the researcher knows may influence the results or generalizability of the results, but over which she or he has no control.” Given that this research included a survey, the following characteristics may constrain the generalizability of the findings: the response rate, clearly articulated questions, and the trustworthiness of respondents to answer questions accurately and honestly.

Delimitations are defined as the characteristics that define the boundaries of the study determined as the variables to be included or excluded throughout the development of the study (Fraenkel & Wallen, 2003). The following delimitations exist: the faculty population is defined as those who work within an NCATE accredited PETE program and teach PE pedagogy courses. Not all Physical Education Teacher Education Faculty
members in the USA are members of these programs which limits the generalization of the study.
CHAPTER 2: REVIEW OF RELEVANT LITERATURE

Introduction

This chapter reviewed the literature related to technology inclusion in physical education teacher education programs. As noted in chapter 1, relatively few studies have been completed on the inclusion of technology within physical education teacher education. Therefore, this literature review informed the following questions:

- What is educational technology and what does it look like within a PETE program?
- What is technology integration?
- What are the current theories and models used to describe the integration of educational technologies?
- What are the factors that affect technology integration?
- What does the research say regarding the perceptions of faculty on the integration of technology?
- What are the current uses of technology in Physical Education?

In preparing for this literature search, the questions were reviewed and the following online databases were explored: Proquest: Physical Education Index, Dissertations, and Direct, Ebsco Host: Eric, PsychInfo, and Academic Search Premier, JSTOR, and Google Scholar. Several combinations of the following terms were used to search for articles: “physical education teacher education”, “PETE programs”, “physical education”, “educational technology”, technology, technologies, “technology AND inclusion OR integration OR infusion OR diffusion”, “higher education”, “instructional design”, “instructional technology”, “learning technology”, “teacher education”, “teacher
preparation”, “pre-service”, “faculty”, “teacher educators”, “attitudes” and “perceptions”,
In addition to journal articles, books related to instructional design and technology as
well as books on technology in physical education were drawn upon.

**Educational Technology**

Educational technology, according to the current definition of the Association for
Educational Communications and Technology (AECT) is "...the study and ethical
practice of facilitating learning and improving performance by creating, using, and
managing apprpriate technological processes and resources" (Januszewski & Molenda,
2008, p. 1). While most see instructional technologies as an equivalent to educational
technologies, the AECT views educational technology as a construct that is larger than
instructional technology, as education is more than instruction. This definition
emphasizes the oldest claim that education should facilitate learning, and therefore
technology should promote the efficiency in learning (Kerr, 2005). As argued by Roblyer
(2003), "Technology is everywhere and therefore in education" (p. 10). As a result,
teachers should make technology part of the learning process and focus on how to adopt
technology to facilitate learning not the other way around. According to Foster and
Hollowell (1999), in order to be successful in facilitating learning, teachers must have a
clear understanding of the relationship between learning and technology.

**Benefits of Educational Technology**

Rohrer and Moore (1997) argue that technology is needed in education for various
reasons. They state that students will be the users of technology and the technology
decision makers of tomorrow. They point out that as consumers students will acquire a
wide variety of technology, implement and develop new technology, and have to deal
with many issues such as suitability and reliability. According to Barron, Orwig, Ivers, and Lilavois (2001), technology provides an excellent avenue for student exploration, motivation, and instruction in a multi-sensory diverse world. They observe that technology touches many aspects of our daily lives. They further argue that the integration of technology into the school curriculum is no longer a luxury, rather “it is a means to survival in the future that will be driven and supported by technology” (Barron, et al., 2001, p. 17).

In general, Barron et al. (2001) report that including technology in education can hold the following benefits:

1. Promoting active learning
2. Promoting critical thinking
3. Offering diversity and self-paced learning and individual growth
4. Motivating and inspiring students by making learning exciting and relevant
5. Providing flexibility for students with special needs
6. Promoting cooperative learning and increases teacher-student interaction
7. Enhancing communication skills
8. Supplying information through multi-sensory channels (supporting students with various learning styles and
9. Helping students to build cultural bridges. (Baron et al., 2001, p. 3-8)

**Technology in Higher Education**

The inclusion and utilization of technologies has been a challenge for higher education institutions (Kirkup & Kirkwood, 2005; Ross, 2006). Higher education institutions come with cultures and climates that naturally resist change (Boyce, 2003;
Elton, 199). When including technology for teaching and learning, an organization may require new hardware, software, skill sets, policy, culture, and attitudes (Abercrombie, 2008). Faculty and instructors are being challenged to learn and implement new technologies in pedagogically sound ways that address the changing needs of learners and the testing demands of the learning industry (Abercrombie, 2008).

While there are a variety of technologies, the research around technology in higher education has focused mainly on the inclusion of the Internet and computer technology in higher education (DelTufo, 2000). Several benefits to teaching and learning with computers in higher education are: facilitation of academic learning; increasing teacher efficiency and productivity; development of student-centered instruction; fostering collaborative learning; augmenting computer and literacy skills; and enhancing the communication with students, administrators and co-workers (Davis, Preston, & Sahin, 2009; DelTufo, 2000; Handler, 1993).

**Technology in Teacher Education**

In order to prepare tomorrow’s teachers, teacher education programs continue to include technology in their courses (Beck & Kosnik, 2002; Beyerbach, Walsh, & Vannatta, 2001; Bielefeldt, 1999). Hansen (2003) highlights the importance of technology in teacher preparation, pointing out three benefits: (1) technology can be a powerful tool for helping individuals achieve personal and shared goals; (2) technology promotes social justice and alleviates human suffering to help people make a difference in their worlds; and (3) technology can help foster the knowledge and skills to evaluate and decide appropriate courses of action when confronted with problems. The uses of multimedia technology in higher education are manifold. In the humanities, for example,
students use technology for the exploration of visual and textual media, the evaluation of differences and similarities between spoken and written texts, the relationship between literature and media, and the analysis of non-text media. Technology is incorporated in the curricula of varying disciplines, such as: fashion, communication, history, nursing, business, special education, teacher preparation/education, student affairs, sport management, and physical education. In addition, the educational standards of many fields have been updated to include appropriate guidelines for the use of technology (e.g., American Association for the Advancement of Science, National Council of Teachers of Mathematics, and International Society for Technology in Education).

**Technology in Physical Education Teacher Education**

The international Society for Technology in Education (ISTE) created technology standards for teachers and students. The National Council for Accreditation of Teacher Education (NCATE) and the National Association for Sport and Physical Education (NASPE) have used such standards to set their own guidelines for effective technology inclusion in physical education teacher education programs. In 2009, NAPSE put forth a position statement to encourage the introduction and application of technology in physical education (Mears, Hansen, Fine, Lawler, Mason, & Richardson, 2009). It is noted that physical education environments use a variety of technologies to enhance the activity level and skill development of K-12 students. However, in spite of the potential to transform the field of education, evidence exist that physical education teachers are less likely to use technology than their subject-matter counterparts (Vahey & Crawford, 2002). To encourage teacher candidates to become proficient in using technology,
NASPE outlines four guidelines for appropriate use of instructional technology in physical education:

1) The use of instructional technology in physical education is designed to provide a tool for increasing instructional effectiveness.

2) The use of instructional technology in physical education is designed to supplement, not substitute for, effective instruction.

3) The use of instructional technology in physical education should provide opportunities for all students, versus opportunities for few.

4) The use of instructional technology in physical education can prove to be an effective tool for maintaining student data related to standards-based curriculum objectives. (Mears, et al., 2009, pp. 2-4)

NASPE recommends that physical education teacher candidates use information technology to enhance learning as well as their own personal and professional productivity (National Association for Sport and Physical Education, 2008). Castelli and Fiorentino (2008) point out that as the accessibility of technology in K-12 schools continues to increase, PETE programs must facilitate the teachers’ need to model technology-rich lessons. Research indicates however that pre-service teachers do not feel prepared to integrate technology into physical education (Liang, Walls, Hicks, & Clayton, 2006). In order to reflect upon the current state of technology integration within PETE programs a clear vision and definition of technology must be examined.
Technology Integration

In this study, the level of integration of technology within PETE programs by faculty was studied. This section first considers the definitions related to the integration of technology followed by a review of the current theories and models used to explain and address the integration of technology in higher education. Finally, the factors and perceptions that influence technology integration were explored.

Definitions

Providing a current definition of technology integration is not an easy task. A search to find an accurate and validated definition of technology integration provides the reader with a multitude of definitions. Consequently, there is much confusion within research around technology integration (Sterling, 2009). According to the National Forum on Educational Statistics (NFES) (1998), technology integration is defined as:

“The incorporation of technology resources and technology-based practices into the daily routines, work, and management of schools. Technology resources include computers and specialized software, network-based communication systems, and other equipment and infrastructure. Practices include collaborative work and communication, Internet-based research, remote access to instrumentation, network-based transmission and retrieval of data, and other methods” (NFES, 1998, p. 1).

The International Society for Technology in Education (ISTE), a leader in providing support and leadership in the effective use of technology within K-12, provides a different definition:
"Curriculum integration with the use of technology involves the infusion of technology as a tool to enhance the learning in a content area or multidisciplinary setting... Effective integration of technology is achieved when students are able to select technology tools to help them obtain information in a timely manner, analyze and synthesize the information, and present it professionally. The technology should become an integral part of how the classroom functions — as accessible as all other classroom tools. The focus in each lesson or unit is the curriculum outcome, not the technology." (NETS-S; ISTE, 2002, pg. 6)

The above definitions of technology integration indicate that technology integration is context specific. Within education, a curriculum drives the implementation of technology and not the other way around (Whitehead, 2001, Dockstader, 1999). Other definitions illustrate the integration of technology as a process.

Mills and Tincher (2003) characterize technology integration as a developmental process that includes five stages; entry, adoption, adaptation, appropriation and invention. They explain that in the entry stage, the teacher uses text-based materials and instruction to support teacher directed activities. In the adoption stage, teachers use technology for keyboarding, word-processing or drill and practice software. Adaptation means that teachers integrate new technologies into classroom practice and students use word processors, databases, graphic programs and computer assisted instruction. Appropriation includes teachers' beginning to understand the usefulness of technology and students' work at computers fluently as project based instruction begins to take place. Lastly, in the invention stage, Mills and Tincher (2003) explain that learning becomes more student-
centered as multidisciplinary, project-based, peer-tutoring and individual instruction occurs.

Other researchers argue that technology integration in education is a ‘model’ of educational reform and such models assist in the adoption of technologies by administrators, faculty members and teachers (Rogers, 2003, 2004; Surry, Ensminger, & Jones, 2005). The ‘Diffusion Theory” is a common theory that forms the foundation for such models (Rogers, 2003; Surry & Ely, 2007; Valente & Rogers, 1995). In history, anthropologists are one of the first to investigate the diffusion of innovations such as boiling water and horses within tribes (Rogers, 2005). The characteristics, consequences, and roles of diffusion were defined and analyzed through research within sociology, education, public health, communication, marketing, management, and geography. Everett Rogers was the pioneer to synthesize such findings in writing within his widely known textbook “Diffusion of Innovations” (Rogers, 1962). Within this book, currently in the fifth edition, he describes the history and elements, and consequences of diffusion, the types of innovation decisions, the adoption process, the rates of adoption, and adopter categories (Rogers, 2003). Diffusion is defined by Rogers (2003) as “the process in which an innovation is communicated through certain channels over time among the members of a social system” (p. 5). He further explains that diffusion is a particular type of communication that focuses on the exchange of new ideas and concepts.

General Diffusion Theory

Diffusion theory is important to understanding why certain technologies are accepted and adopted by members of a community. While there are different theories of diffusion, Rogers’ “Innovation Decision Process Theory” remains among the most used
and well known theories. Rogers (2003) conceptualizes five distinct stages within the process of diffusion as a relatively linear process from (1) knowledge, (2) persuasion, (3) decision, (4) implementation, to (5) confirmation. When a new innovation exists, the individual will first learn how it functions (knowledge). Next, the individual will form positive or negative opinions regarding the new innovation (persuasion). In the decision phase, the individual will decide to either adopt or reject the innovation. If adopted, the innovation will be used (implementation). Finally, the individual will search for some type of reinforcement of the innovation decision that was made (confirmation). There are four main factors that influence the diffusion of technology: (1) the innovation itself, (2) how information about the innovation is communicated, (3) the time it takes to learn the innovation, and (4) the nature of the social system in which it is being introduced (Rogers, 1995).

Rogers (2003) explains innovation as “an idea, practice, or object that is perceived as new by an individual or unit of adoption” (p. 12). Rogers (2003) explains how in research the words innovation and technology are often used as synonyms. He defines technology as “a design for instrumental action that reduces the uncertainty in the cause-effect relationship involved in achieving a desired outcome” (p.13). In this study, the innovations are the specific technologies that are used within the instruction of physical education as outlined later in the review of literature.

In his “Perceived Attributes Theory” Rogers identified five specific attributes to the rate of adoption: relative advantage, compatibility, complexibility, trialability, and observability (Rogers, 1995). Relative advantage is the degree to which the new idea has an advantage over using other ideas. Compatibility explains the degree in which the
innovation is compatible with existing practices. Complexity means that the
innovation cannot be too difficult to understand and use. Trialability explains that before
an innovation is adopted, it should be tried and observability means that the adoption of a
new idea should provide noticeable results. The factors above as well as other elements
were investigated within this study in order to understand the effects on the rate of
adoption of technology.

Communication is a central theme within the diffusion of technology as diffusion
can only happen if there is an exchange of information between individuals. The process
of innovation therefore includes (1) the innovation, (2) an individual that has knowledge
of, or has experience using the innovation, (3) another person, or unit that does not have
the knowledge of, or experience with the innovation, and (4) a communication channel
connecting the two units (p.18). Within this study, the research is interested specifically
in how technologies are being introduced into PETE courses. One communication
channel faculty members can use is a technology plan. Such a plan can create a bridge
between the general curriculum and specific classroom practices, including the use of
technology. This forms as a means to communicate the inclusion of technology between
all members of the PETE faculty. While a technology plan is a way of communicating,
the members within a PETE faculty make up a social system as described by Rogers
(2003).

Rogers (2003) defines a social system as a “set of interrelated units that are
engaged in joint problem solving to accomplish a common goal” (p. 23). Diffusion
occurs within a social system and in order to understand the diffusion process within
PETE faculties, questions related to the effect of other faculty members and the way the
faculty discusses technology integration were asked within this study. According to Rogers (2003), there are three main types of innovation-decisions that can be formed within social systems. *Optional innovation-decisions* are choices to integrate a technology that are made by an individual, independent from the others within the social structure. An example of an optional innovation-decision would be when a PETE faculty member decides to integrate pedometers in a fitness class and does this without any collaboration with or input from others or from a technology plan. It can be assumed that such decisions maybe made more often in a faculty without a technology plan or where it has been decided that instructors integrate technology where they see fit.

*Collective innovation-decisions* are decisions that are made by consensus of an entire social system. For example, when PETE faculty members decide to look at different curricula of the different methods courses and agree on where and who will integrate certain technologies, they collectively made those decisions. It can be assumed that if such decisions are made, a type of technology plan or guide exists. However, a technology plan can also be created by one person. In this case, *authority innovation-decisions* are created. Such decisions are often made by someone in power or with high technical knowledge and expertise. For example, a technology plan may be created by a PETE faculty member who has expertise in instructional technology as well as in PE curriculum design. The final type of innovation-decisions as explained by Rogers (2003) is a combination of two or more of the above decisions. *Contingent innovation-decisions* are choices to adopt or reject after the prior innovation-decisions have been made. Deciding to change a technology plan would be an example of such decisions.
Through a study on the diffusion of farm practices, Rogers (2003) identified that people within a social system may adopt innovations at different rates and outlined five categories within a normal distributed bell curve: innovators, early adopters, early majority, late majority, and laggards (Fig. 2).

![Figure 2. Rogers (2003) model for adopter categorization.](image)

Rogers (2003) explains that even though exceptions against these categories exist, these five categories are “ideal concepts based on empirical investigations in order to make comparisons possible” (p. 282). Each category has its own characteristics and values and it is important to understand these in order to enhance the adoption process.

**Innovators** are venturesome and are able to cope with a high level of uncertainty about an innovation when he or she decides to adopt one. They are daring and willing to try new ideas. They are unique in that they often find new innovations. Within the social system, innovators can become change agents or advocates for the integration of innovations and are therefore extremely important to the integration process.

**Early adopters** are often those who have the highest degree of leadership and respect within most systems. They are those who people look at before adopting a new tool or innovation. They often serve as role models. They are different from innovators in
that they will decrease uncertainty about a new tool by adopting it and will relate his or her evaluation of the innovation back to the system in order to provide advice and information about the innovation.

*Early majority* are those individuals who adopt new ideas just prior to the average members of the system. Early majority make up one third of all the members and while their innovation-decision process is longer than the innovators or early adopters, they will often follow others in the adoption.

*Late majority* are often skeptical at first and take a fairly long time to adopt a new idea. Like early majority, they too take up a third of the members. They are cautious and will not adopt the new idea until the many others have convinced them of the value of the innovation. Late majority members must feel it is safe to adopt.

*Laggards* are the last in the social system to adopt a new idea. They tend to fear change and are resistant to new ideas. They must often see the product in action before they will adopt it.

Rogers (2003) is greatly recognized for defining the process of adoption. However, Surry & Ensminger (2006) explain that the focus of integrating technologies into social systems has shifted focus from adoption to implementation. That shift can be identified within several other models of technology diffusion.

**Diffusion of Technology Theories**

One of the most prominent researchers in the area of implementation of an innovation in an organization is Donald P. Ely (Surry & Ensminger, 2006). Ely (1990) did not develop a model, but explains eight conditions that facilitate the implementation
of educational technology. Ely’s (1990) eight conditions are: dissatisfaction with the status quo, knowledge and skills, resources, time, rewards, participation, commitment, and leadership. These conditions can be found in several diffusion models. While this model can help to investigate the factors that aid or hinder the integration of technology, it does not address the process of how faculty integrate technology. Consequently, other models were reviewed.

Hall and Hord (1987) developed a concerns-based adoption model (CBAM), a model that applies to anyone who experiences change. This model focuses on the perceptions of faculty into how they adopt new technology. It helps to identify differences between faculty members in their adoption patterns. The model includes seven stages of concern describing how an individual might perceive an innovation and how they feel about it. These levels range from nonuse, orientation, preparation, mechanical use, routine, to refinement, integration, and renewal. Nonuse explains that the user has no interest. Orientation means that the user is taking some initiative into learning more about the innovation. Preparation explains the planning procedures that users instill to begin using the innovation. Mechanical use refers to the changes one makes to enhance their use of the technology. Routine explains how the use of the innovation exhibits itself in an established pattern. As the user now thinks about the outcomes when employing the innovation, he or she changes the way it is implemented (refinement). Integration is when the user makes efforts to coordinate and communicate with others regarding the innovation. The final stage of renewal explains how the user searches for alternative ways to use the innovation. While this model directly relates to this research project in that it helps to investigate the perceptions of faculty members regarding the use of technology,
it focuses on faculty outside of teacher education. Given that teacher educators have the role to instruct pre-service teachers how to teach with technology, this model does not address that specific need.

A similar model was found in the work of Sprague, Kopfman, and Dorsey (1998), who explained five components to teaching faculty about technology. The process-oriented cycle of technology learning consists of five phases: (a) awareness of and exposure to new technologies, (b) exploration and filtration to consider the usefulness of the technology in the field, (c) learning of the new technology, (d) personal and professional application of the technology, and (e) sharing and reflecting on teaching with the technology (Marra, et al., 2003). In contrast to the Hall and Hord (1987) CBAM model, Sprague, Kopfman, and Dorsey (1998) include the notion of professional application of the technology as well as helping faculty think about how the technology is used within education.

Howland and Wedman (2004) sought to expand the two previous models by identifying technologies of value in education and assessing faculty use of technology in their classrooms. The “Technology Learning Cycle” of TLC is a conceptual framework based on learning phases that encourage teaching and learning using emerging technologies (Marra, Howland, Wedman, & Diggs, 2003). Howland and Wedman (2004) were inspired by the Sprague, Kopfman, and Dorsey’s (1998) five phase cycle of technology learning as described above. They created a five phase cycle that consisted of (1) nonuse, (2) awareness, (3) exploration and learning, (4) application, and (5) sharing and reflection.
They categorized the technologies according to the seven practices for undergraduate teaching: communication, social learning, inquiry-based learning, feedback and metacognition, problem-solving skills, content knowledge, and diversity of learners and learning styles. These seven practices originated from the work of Ron Edmonds (1979) on effective schools and were adapted to the application of technology. The final seven practices that provided the framework for technology integration in undergraduate education are as follows:

1. Good practice encourages contacts and communication between students and faculty.
2. Good practice recognizes that learning is social and develops reciprocity and cooperation among students.
3. Good practice uses active, inquiry-based learning and meaningfully engaged time.
4. Good practice gives prompt feedback and encourages metacognition – reflections about one’s learning.
5. Good practice communicates high expectations by encouraging the development of students’ authentic, real world, problem-solving and decision-making skills.
6. Good practice develops content knowledge and deep understanding by promoting student connections to prior knowledge and other disciplines.
7. Good practice respects diversity of thought, culture, learning styles, and multiple intelligences in enriching student learning experiences and in student
demonstrations of learning. (Howland, Pfannenstiel, Wedman, & Marra, 2010, pp. 118-119)

Within each of these practices, Howland and Wedman (2004) identified specific applicable technologies which educators might use. For each of the technologies, educators would respond to their level of integration as: (1) not applicable, (2) none (no use in course), (3) some, and (4) well-integrated (a natural part of the course). They designed an instrument around these seven practices and the technologies postulated as appropriate to these practices. Their instrument measured both 1) personal knowledge of the technology and 2) perceived value of the technology to teaching and learning (Howland & Wedman, 2004).

According to research, the TLC is an appropriate and successful way of advancing faculty use of technology (Howland & Wedman, 2004; Pfannenstiel, Howland, Wedman, Diggs, & Marra, 2004). The TLC includes the individualized needs of faculty and learners to support lifelong learning as new technologies emerge. In reviewing the literature on technology in education, Howland and Wedman’s (2004) work most closely related to the research questions addressed in this study. As such, Howland and Wedman’s (2004) survey was more closely examined for potential use in this study.
The Missing Link

The above examples of cycles on how teachers can integrate technology have elements in common. Most models start with an individual/teacher being unaware of a tool. Once they become aware of it they will either reject it or will pursue to learn more about it. Once they have learned how to use the tool, they may choose again to either reject it or use it within the classroom. Most models have one to three stages making up the application phase. This phase is used to explain what happens when the technology is brought into the classroom, a crucial point within teacher education. Sprague, Kopfman, and Dorsey (1998) speak to the fact that teachers can apply technology within their personal and professional activities. Sherry, Billig, Tavalin, and Gibson (2000) state that the teacher acts first as an adopter and second as a co-learner of the technology within the classroom. Hall and Hord (1987) have three different steps that indicate the complexity of integrating the technology within the classroom setting. They explain that teachers must
first explore how to better organize the use of the technology before he or she establishes a routine within their teaching. Once that is completed, the teacher can make changes in order to increase the outcomes and finally coordinate with others to use the technology.

The problem in finding the best theory that would explain the level of integration in teacher education lies with the interpretation of the word integration. Previously in this literature review it was noted that technology integration must be defined within a specific context. Within this context, technology is integrated in PETE programs by PETE faculty in order to teach future PE teachers how to integrate technology within their classrooms. As noted within the NCATE standards for physical education teacher education, the integration of technology refers to helping “PE teacher candidates plan and implement developmentally appropriate learning experiences aligned with local, state, and national standards to address the diverse needs of all students” (NASPE, 2009, p.27). Sheingold & Hadley (1990) stated that integrating technology is not about helping people use computers; it is about helping teachers integrate technology as a tool for learning. This means that teacher educators should not only know how to use technology in their lessons, they should teach the pre-service teachers how to create activities with such technologies. This critical piece of information cannot be assessed using any of the above models. An additional framework was examined to justify this missing link.

**Pedagogical Content Knowledge**

Lee Shulman (1986) conceptualized that teaching is complex and that teacher’s draw on multiple kinds of knowledge to create a highly dynamic learning environment. He outlines three knowledge systems that can work separately yet together. Historically, teacher education researchers and scholars focused on two types of knowledge: content
and pedagogy. Content knowledge refers to the knowledge teachers have about the content to relay information to students on what content must be studied. Pedagogical knowledge explains the pedagogical classroom practices that must be in place independently from the content area. Shulman (1986) progressed this notion by arguing that teacher education programs should blend the two knowledge systems in order to provide future teachers with a more holistic “understanding of how particular topics, problems, or issues are organized, represented, and adapted to the diverse interests and abilities of learners, and presented for instruction” (p.8). He proposed the notion of pedagogical content knowledge or PCK to embody the knowledge of what teaching approaches fit with different content in order to help students learn (Fig. 4).

![Figure 4](image)

**Figure 4.** Content knowledge and pedagogy knowledge combine to create pedagogical content knowledge.

**Technological Pedagogical Content Knowledge**

Mishra and Koehler (2006) explain that while technology was not specifically stated within this framework, it does not mean that it was not considered. They reason that technologies in traditional classrooms were often commonplace tools and were not considered technologies. However, the use of technologies has changed in the sense that they have become more available and diverse and that they have a broader potential to
change the nature of the classroom. They explain that technologies can make content more accessible and comprehensible and should play a critical role in both content knowledge as well as pedagogical knowledge. That is why they propose technology to be added as a third knowledge system (Fig. 5). Technology is viewed as a separate set of knowledge and skills that must be acquired by teachers in relation to the content and pedagogy of a certain subject. Mishra and Koehler (2006) enhanced Shulman’s framework to articulate the relationship between content, pedagogy, and technology and outline these as pedagogical content knowledge (PCK), technological pedagogical knowledge (TPK), pedagogical content knowledge (PCK), and the completely combined technological pedagogical content knowledge (TPCK) (Fig. 5).

![Figure 5. Technological pedagogical content knowledge (TPCK). Content, pedagogy, and technology, overlap to create four more types of knowledge.](image)

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While such a relationship is deemed to be complex in nature, inappropriate use of technology can greatly affect teaching and learning. Scholars agree that technology should not be treated as a separate entity and effective teaching constitutes an understanding of how technology relates to the content and pedagogy (Hughes, 2005; Mishra & Koehler, 2006; Neiss, 2005). When investigating the integration of technology within teacher education programs, it is vital to understand the relationships that occur between such knowledge systems as well as how such are developed. Before outlining specifically what is missing in most diffusion models as described before, each knowledge system is explained in relation to the instruction of pre-service physical education students.

Content knowledge (CK) is the knowledge about a subject that is to be taught. For example, the content within an anatomy course will be different from a course in health concepts. Before teachers can teach a student about health topics, the teacher must have knowledge of the subject.

Pedagogical knowledge (PK) is the knowledge about the processes and practices of teaching and learning. Within PETE, teacher educators must provide general information about how classrooms are managed and organized, how lessons are developed and implemented, and how students are evaluated. Such pedagogical knowledge is universal to education and can be applied to any subject whether it is physical education or social studies. It requires that students obtain an understanding of the developmental theories of learning and how such are applied within the classroom.
Pedagogical content knowledge (PCK) is the type of knowledge related to pedagogy that is specific to a certain subject. For example, pre-service teachers in physical education often take a course in teaching elementary PE as well as teaching secondary PE because it involves knowledge of specific teaching strategies that include appropriate representations in order to address the needs specific to diverse learners.

Technology knowledge (TK) is the knowledge about certain technologies such as computers, Internet, video, and many others. This involves not only knowing what certain technologies do but also knowing how to use the technology. The NCATE guide for PETE states that “teacher candidates should demonstrate mastery of current technologies” (NCATE, 2009, p.15). In order to entice such mastery in PE teacher candidates, faculty should have certain knowledge of basic technologies such as computers and projectors but also about technologies that may be used to increase physical activity levels such as heart rate monitors or pedometers.

When someone begins to learn how such technologies are used within their discipline, they develop technological content knowledge (TCK). Teacher educators realize that different technologies can be used for different purposes within the realm of teaching physical education. This may include knowledge of how the Fitness Gram can be used to assess and report the fitness level of the students while wikis can be used to involve students in collaborative writing projects.

Technological pedagogical content knowledge (TPCK) goes beyond content, pedagogy, and technology and requires “an understanding of pedagogical techniques that use technologies in constructive ways to teach content” (Mishra & Koehler, 2006, p.
The argument that Mishra and Koehler (2006) provide is that “there is no single technological solution that applies to every teacher, every course, or every view of teaching” (p. 1029). Effective teaching therefore must hold an understanding of the relationship between the content, pedagogy, and technology. Within PETE, if teacher educators have a high level of TPCK, they should be able to instruct pre-service teachers how to teach technology rich physical education lessons. They should also be aware of how technology can be incorporated to strengthen the curriculum.

One may question how TPCK is developed in teachers. From a technocratic perspective, one may simply have to demonstrate their proficiency with current technologies. However, this view reflects the separation of technology, content and pedagogy and observes technology as a single identity. Viewing technology within isolation does not constitute quality teaching (Mishra & Koehler, 2006). Studies have shown that teaching technology within a separate course within teacher education does not provide future teachers with the experiences they need to effectively integrate technology within their lessons (Milken Exchange on Education Technology, 1999). That is why organizations such as the International Society for Technology (ISTE), the National Council for Accreditation of Teacher Education (NCATE), the American Association for Health, Physical Education, Recreation and Dance (AAHPERD), and the National Association for Physical Education (NASPE) have moved from teaching basic technology skills to integrating technology within the overall curriculum.

According to the NCATE 2007 unit standards (NCATE, 2007), physical education teachers should “use information technology to enhance learning and to enhance personal and professional productivity” (p. 64). More specifically, the 2008
National Initial Physical Education Teacher Education standards (AAHPERD/NASPE, 2008) state that teacher candidates will “demonstrate knowledge of current technology by planning and implementing learning experiences that require students to appropriately use technology to meet lesson objectives” (p. 2). These standards indicate that teacher education programs must integrate technology within all PETE courses in order to provide authentic learning experiences where pre-service teachers can learn to create lessons that appropriately integrate technology.

**TPCK and Diffusion of Technology**

Frameworks and theories help us make sense of what we already know and what is still unknown. They provide us with direction and guidance as we try to understand how things work. The TPCK framework is used to enhance the chosen diffusion model as conceptualized by Sprague, Kopfman, and Dorsey (1998) and extended by Howland and Wedman’s (2004). The Howland and Wedman (2004) survey included a list of technologies and asked teacher educators to explain their level of skill and knowledge for each technology. The five cycle scale that was used included (1) nonuse, (2) awareness, (3) exploration and learning, (4) application, and (5) sharing and reflection. In addition, the scale used to measure their level of integration for each technology included (1) not applicable, (2) none (no use in course), (3) some, and (4) well-integrated (a natural part of the course). Both scales must be modified to adhere to the broad definition of technology integration and to investigate the TPCK of PETE educators for an assortment of technologies. In addition, the Learning Technology Cycle (TLC) was created mainly for the purpose of professional development for teacher educators in general. As Mishra and Koehler (2006) assert, specific content knowledge and its relationship to pedagogy and
technology must be considered. Chapter three outlines how the scale used for the survey within this study was modified to suit the specific context and participants.

**Approaches to Technology Integration**

The approaches of integrating technology in PETE have changed over the years. As more technologies are used within the field of physical education, teacher educators are looking at different ways to diffuse the technologies within the teacher education programs. Initially, courses in computer technology were the focus of technology development of teacher education programs (Reiser & Dempsey, 2007). Later, realizing that using technology is context specific, some universities offered specific courses on technology in physical education (Mohsen, 1995). Since 2009, the new standards for teacher education ask for a more integrated approach to infusing technology in physical education (Mears, et al., 2009). However, research shows that different approaches still exist to integrating technology in teacher education (Castelli & Fiorentino, 2008).

Gillingham and Topper (1999) mention four approaches: single courses approach (Hargrave & Hsu, 2000), technology infusion (Morley, 1999), student performance assessment (Jones & Garrahy, 2001), and case-based integration (Gillingham & Topper, 1999). The single course approach uses a core technology course with lectures and lab demonstrations that teach teacher candidates the understanding of integrating technology in education. Several books exist that can be used in physical education teacher education technology courses (Castelli & Fiorentino, 2008; Felker & Bradley, 2009; Mohsen, 2008).

The student performance approach places most of the responsibility of learning different technologies on the student rather than the instructor. At different times in their program,
students are to demonstrate technology competency. This student centered method allows both students and faculty to learn together; however, it makes it difficult to assess the performance of the students (Gillingham & Topper, 1999). The case study approach links theory to practice. Teachers model the use of technology in their teaching and students reflect upon that knowledge by examining a variety of case studies. Because the case study approach is based on reading and reflecting, students may have difficulty transferring that knowledge into real practice (Gillingham & Topper, 1999). Finally, full infusion of technology exists when a whole program is designed to be infused with technology (Castelli & Fiorentino, 2008). Each course integrates technology where needed. Instructors model the use of technology and students practice their use in class. This approach can assist students in incorporating technology in their teaching experiences but it is limited to the technology competencies of the instructor (Lindauer, 2004). Modeling the technology within teaching and across curriculum is often a best practice to technology infused instruction as reported by many researchers (Castelli & Fiorentino, 2008; L. Hall, 2006; Keiper, Harwood, & Larson, 2000; Mitchell & McKethan, 2003; Moursund & Bielefeldt, 1999; Persichitte, et al., 1999).

A study by Moursund and Bielefeldt (1999) investigated the approaches to technology training in teacher education programs and found that the single course approach had a low correlation with technology competency to the integration of technology into methods courses and teaching. They identified 5 recommendations in their report:

1. Instructional technology (IT) instruction should be integrated into all classes.
2. Institutions should engage in technology planning that focuses not only on facilities but on the integration of IT in teaching and learning.

3. Student teachers need more opportunities to apply IT during field experiences under qualified supervision.

4. Faculty should be encouraged to model and integrate technology.

5. In order to provide models for change, researchers, professional societies, and education agencies should, on an ongoing basis, identify, study, and disseminate examples of effective technology integration that reflect the current needs of both teacher education and K-12 schools. (Moursund & Bielefeldt, 1999, pp. 22-23)

A study done by Bayerbach, Walsh, and Vannatta (2001) examined the integration of technology in K-12 schools and teacher education programs and found that technology integration methods should be introduced earlier in the program so that teacher candidates can develop their technology competency over several years. This strengthens the notion that when teachers are comfortable with technology, they are more likely to integrate known and new technologies into their teaching (Castelli & Fiorentino, 2008). For the purpose of this study, it is important to investigate in what way technologies are integrated within current PETE programs. Different integration approaches may provide clarity to the perceived levels of technology integration as provided by PETE faculty members.

Factors Influencing Technology Integration

When studying technology integration into teacher education programs it is vital to understand the barriers that hinder the facilitation of technology infusion as well as the
enabling factors that ease the process. Identification of factors that promote or inhibit teachers from possessing a positive attitude towards the integration of technology is useful information to obtain (Christensen, 2002; Migliorino & Maiden, 2004).

Surry, Ensminger, and Haab (2005) outlined a holistic approach to implementing technology in higher education, which they call RIPPLES. RIPPLES is an acronym that stands for resources, infrastructure, people, policies, learning, evaluation, and support. This model focuses on reducing implementation barriers and suggests that in order to integrate technology in higher education institutions, one must have the financial resources to invest in technology, the hardware, software, facilities, and network capabilities to focus on technology, the right people on board and the end users in mind, the policies and procedures in place to support the use of technologies, a culture which views technology as responding to specific learning goals, processes for continual assessment of the technology, and finally training, technical support, pedagogical support, and administrative leadership. All such factors can influence the integration of technology. Bielefeldt (1999) did a study to find the factors that contribute to high capacity technology users and found six common factors that aid the integration process: (1) commitment to integration, (2) professional development opportunities, (3) including technology specific course requirements, (4) integration of technology in field experiences, (5) high level of facilities and support, and (6) adequate funding.

Moursund and Bielefeldt (1999) found that instructional technology competencies are positively correlated with the implementation of a technology plan and that the best predictor of technology integration is the level of technology proficiency. In a study done by Lindauer (2004), of 534 colleges/universities with a physical education teacher
education program, 93.5% of the respondents stated that their institution integrated technology into the overall curriculum, yet only 26.5% indicated that the institution possessed a technology integration plan. Other researchers (Barron, et al., 2001; Davis & Fill, 2007; Haughey, 2007; Hayes & Silberman, 2007; Williams, 1998) have found technology plans to be an integral part of the successful adoption of technology into the curriculum.

The level of integration of PETE educators can have an impact on whether K-12 PE teachers will integrate technology; therefore, it is important to provide evidence of such studies. Research also indicates the importance of pedagogical beliefs and attitudes in the selection and integration of technology (Becker, 1991; Christensen, 2002; Vannatta & Fordham, 2004; Zhao, Pugh, Sheldon, & Byers, 2002). Evidence shows that beliefs and attitudes of pre-service teachers play a role in the successful integration of technology (Hardy, 1998, 1999; Wallinger, 1997). Teachers’ willingness to devote time to learning and implementing technologies can play a role in the integration of technology (DelTufo, 2000; Vannatta & Fordham, 2004). Administrative, technical, and financial supports are also factors that can facilitate the diffusion process (Barron, et al., 2001; DelTufo, 2000; Persichitte, Caffarella, & Tharp, 1999). The lack of technology implementation may be related to budget concerns as software and hardware for teaching physical activity is costly (Hayes & Silberman, 2007).

Kerr (2005) states that even though there is evidence about the benefits of technology integration, many issues may impede that process such as: how easy the hardware is to use, how well it is supported in schools, how well organized are circumstances on which technology is brought to bear, how well designed is the software,
how well prepared and confident a teacher is in his/her ability to work using technology in a technology-rich environment, how student learning will be appropriately assessed, and how ready parents and community are to accept new models of learning and assessment. Constant change in technologies and the resistance to change have also been factors that limit the level of integration of technology (DelTufo, 2000; Martin, 2003).

Shuldman (2004) points out that a great deal of accumulated evidence has identified obstacles that impede teachers' ability to adopt and integrate technology into their teaching. These obstacles include the lack of time, expertise, access, resources, and support. He argues that the most inhibiting factor to successful inclusion of technology in the classroom is the lack of understanding of technology integration by teachers. He states that is related to the fact that the impact of technology integration on student learning only appears after teachers have sufficient skills, a clear understanding of how various technologies can be used as cognitive tools, and if they are able to merge technology experiences into their daily practice (Shuldman, 2004).

From research, in no particular order, the following factors appear to be inhibiting the integration process of technology in teacher education (Beyerbach, et al., 2001; Bielefeldt, 1999; Christensen, 2002; DelTufo, 2000; Ely, 1990; Gillingham & Topper, 1999; Hasselbring, et al., 2000; Liu & Szabo, 2009; Persichitte, et al., 1999; Topp, Mortensen, & Grandgenett, 1995):

1. Lack of time to learn the technology
2. Limited access to hardware, software, and support
3. Insufficient leadership
4. Lack of common vision or rationale for technology use
5. Limited training and support for faculty
6. Faculty resistance
7. Lack of funding
8. Level of fear and hesitancy from students
9. Lack of understanding of technology
10. Lack of faculty expertise
11. Lack of a department wide technology plan

The above factors and others were included in this study to find out which factors either aid or hinder the integration process of current PETE faculty members.

**Faculty Perceptions on the Integration of Technology**

According to Silverman (1997), it is important to consider the attributes and attitudes of the teachers when technology integration is evaluated. To better understand the integration process, it is therefore vital to study the perceptions of teachers about preparation programs, professional development, and their current practices related to their integration methodology (Gibbone, 2009; Scott & Hannafin, 2000). Depending on teaching preferences and instructional beliefs, individual teachers may include technology more often and differently than others (Albion & Ertmer, 2002; Judson, 2006). Teachers’ beliefs are related to their intended actions and have as a result been identified as an underlying predictor for curricular decisions (Kulinna, Silverman, & Keating, 2000; Pajares, 1992). Teachers’ perceptions affect their educational philosophy, the learning and teaching goals they aim for, and it can distinguish how they teach (Behets & Vergauwen, 2004, 2006; Kulinna, et al., 2000). Therefore, the decision to
select and integrate technology to facilitate learning is driven by the teachers’ personal and pedagogical values (Ennis, 1996).

Positive attitudes toward computers have been significantly linked with an individual's amount of experience with computer technology (Christensen, 2002; Migliorino & Maiden, 2004). Other studies also concluded that teachers’ attitude and experience are factors associated with computer use (Scott & Hannafin, 2000; Vannatta & Fordham, 2004; Zhao, et al., 2002). In a study investigating physical education teachers’ perceptions towards computer technology, LaMaster (1998) found that teachers have positive attitudes and high self-efficacy scores related to using word-processing skills.

Russell (2007) investigated physical education teachers’ knowledge, experience and anticipated usage of nine specific exergames in physical education. The study indicated that younger teachers have more positive attitudes towards technology than older teachers. In addition, Russell (2007) points out that if teachers perceive to lack the knowledge to use technology, they are less likely to try it out in their practice. This finding is a testament to the importance of adequate training in technology to elevate the positive attitudes of teachers in regard to enriching the gymnasium with technology.

The process of successful integration of technology depends on factors such as: self-confidence, self-efficacy, and the willingness to change (Pajares, 1992; Vannatta & Fordham, 2004; Watson, 2006). However, simply using technology tools may not predict innovative practices (Gibbone, 2009). It is crucial to evaluate the entire technology learning process to grasp the full scheme of successful technology infusion.
Technology Tools in Physical Education

When investigating the use and integration of technology in physical education teacher education, it is imperative to examine the technologies currently used in K-12 physical education classrooms and PETE programs. As practice within public school drives the practice by teacher education programs, investigating the current technologies used within K-12 schools provide us an idea of what technologies should be implemented at the PETE level. Physical education journals have published articles related to the implementation of technology (LaMaster, Williams, & Knop, 1998), as well as provide ideas related to the use of an assortment of innovative technologies such as the Internet (Elliot et al., 2007), exergaming (Hicks & Higgins, 2010), and tablet PC’s (Nye, 2010). Strategies, a journal for physical and sport educators, offered a 6-part technology series that reviewed the potential technologies have to enhance instruction within PE and PETE (Mears, 2009a, 2009b, 2009c, 2009d; Mears & Hansen, 2009; Mears, 2010). While the potential uses of technology will continue to expand in the areas of instruction, monitoring, data recording, video, and communications, one may ask whether or not physical education faculty will be able to apply and model these technologies in practice. Due to the fact that there is not much evidence regarding the use of technology by PETE faculty, this section briefly reviewed the tools most commonly written about in professional and empirical physical education journals.

Computer Technology

Most research regarding the integration of technology has been on the inclusion of the Internet and computer technology in K-12 and higher education. Physical educators integrate computer technology through a variety of approaches. These approaches include
the use of word processing, content-based software programs, desktop publishing, databases, web pages, multi-media systems and visual presentations (Mohnsen, 2008). Traditionally chalkboards were used in the gymnasium to display information, but projection systems, smart boards and wireless transmission (WiFi and Bluetooth) have allowed for new methods to display and transfer of information (Mears, et al., 2009). In order to provide effective instruction with such tools, it is vital that set-up and implementation does not impede student activity time. Effective modeling of these technologies in PETE programs is essential.

DeTufo (2000) examined the use of computer technology in PETE programs and found that computer technology can enhance the instruction of physical education as a resource and a tool. He compared the uses and availability of computer technology between different size institutions but discovered no significant difference. The most common computer applications used by PETE faculty were word processing, spreadsheets, databases, presentation software, assessment software, the Internet, and video analysis (DelTufo, 2000).

LaMaster (1998) examined examples of technology implementation in physical education teacher education programs and noted that Email, the Internet and Web pages and electronic portfolios were beneficial in the instruction of physical education.

Mills (1997) offers additional information regarding the use of portfolios and the Internet. He observed that students use the Internet frequently to complete research assignments and electronic portfolios were used to measure student learning. In PETE, teacher candidates have indicated that creating an electronic teaching portfolio was useful to master technology skills, demonstrate what they learned, and help them find jobs.
Baert (2008a) explored the use of wikis in PETE programs to extend the learning environment of teacher candidates. The study found that teacher candidates were successful in engaging in collaborative projects that deepen their understanding about teaching games in physical education. Baert (2008a) further pointed out that wikis can provide PETE faculty members a venue to share important resources, interact with students, enhance the writing and computer literacy levels of the students, and acquire knowledge through exploration and collaboration. Because wikis do not require teachers to know complicated computer coding, wikis can have multiple uses in physical education: collaborative writing projects, teacher websites, online portfolios, and PE dictionaries or encyclopedias (Baert, 2009).

Silverman (1997) states that software programs such as the FITNESSGram can be beneficial in assessing both the teacher and the students. The FITNESSGram was designed for children by the Cooper Institute for Aerobics Research (CIAR) as a way to measure the fitness levels of youth (Dorman, 1998). While teachers record fitness data and generate report cards for the students, it provides the teacher with feedback that can assist in the instruction of physical education.

Gibbone (2009) investigated the integration of technology in secondary physical education classes. The most accessed items in schools were: school and district websites, email, Internet search engines, word processing, and digital videos/You Tube. The PE teachers reported that word processing, computer generated handouts, homework, tests, Internet search engines, educational CD ROM/DVD's, and electronic grading were the tools they used most frequently. On the other hand, teachers reported that they least used tools such as wikis or blogs, podcasting, IEP software, Polar Tri-Fit Technology,
advanced website design, spreadsheet software, active video games, digital portfolios, Smart Boards and educational management software. This indicates that even though such tools have been found useful within physical education, current PE teachers do not use them.

According to Lepczyck (2009) and Block (2008), Youtube, iPod, and cellphone software has been very beneficial in teaching dance. Penrod (2005) suggests that it is time for dance educators, particularly in universities, to address how the dance curriculum can be infused with technology to fully embrace dynamic interactions between the arts and sciences to benefit everyone, particularly emerging young dance artists.

**Online PE**

In the field of physical education there is the current explosion of online physical education courses. The Florida Virtual School (www.flvs.net) has offered online PE since 1997 yet in 2004 it bloomed with an enrollment of 4500 students. While Florida Virtual Schools mainly offer PE and Health courses for high school students, it is currently developing online courses for middle year students. Online courses offer the type of interactive student/teacher exchange that occurs in the face-to-face classroom through the use of blogging, chats and/or e-mail (Stover, 2005).

In 2007, NAPSE outlined the guidelines for online physical education in a position statement (National Association for Sport and Physical Education, 2007). They prefer a hybrid or blended approach where online modules are combined with physical activity. One of the challenges noted in this position statement is the preparation of effective online PE teachers. In order to teach online, PE teachers should have adequate
professional pedagogical and technological knowledge in order to provide a supportive online learning environment. By modeling a mixture of computer applications in class, teachers may be open to exploring the field of online education.

**Handheld computers / PDA / Tablet PCs**

Desktop programs such as Microsoft Excel, and Web and CD-ROM software can allow for the collection of data using hand-held computers or tablet PCs, with the ability to transfer results to desktop systems quickly. Handheld technologies can assist physical educators with class management, fitness testing, and assessment and are favored for their quick and easy access to input data and calculate formulas (Dorman, 1998).

In a study involving the use of PDAs in physical education Wegis (2008) found several benefits such as: (a) keeping attendance; (b) storing and retrieving fitness test scores; (c) filing electronic lesson plans; (d) keeping inventory; (e) grading; (f) tracking student physical activity levels; (g) recording student performance in the various learning domains (e.g., psychomotor, cognitive, and affective); (h) performing assessments of various skills and behaviors associated with learning; and (i) expanding available resources via internet capabilities.

Tablet PCs have proven to benefit classroom instruction in several ways: (a) digital note-taking, (b) annotation of presentation materials, (c) mark-up of students’ assignments, and (d) improvement in students’ attention and comprehension in class (Anderson, 2004; Berque, Johnson, & Jovanovic, 2001; Wise, Toto, & Lim, 2006). In physical education tablet PCs have the capability to become mobile devices that students can use in the gym. During physical education, students can use tablet PCs to learn,
interact, and collaborate with peers on learning experiences about and around their movement (Gubacs, 2004; Nye, 2010).

**Video/Audio Media**

Digital video recorders have been found to enhance the instruction of physical education (Banville & Polifko, 2009). Several studies have shown the benefits to teaching and learning motor skills using digital video (Del Rey, 1971; Gendron, 1992; Rikli & Smith, 1980). Rikli and Smith (1980) found that video feedback correlated with higher tennis serve scores than traditional verbal feedback from the teacher. Gendron (1992) showed how the importance of slow motion video can have an impact on learning motor skills. In physical education, video cameras can be used to tape students while performing specific sport skills that later they examine and reflect on. All studies revealed that video recordings can enhance the instruction of motor skills in physical education.

Digital video and motion-analysis software can provide teacher, peer and student assessment and make performance evaluation easier. Other studies show that motion software can help students understand the biomechanical principles behind movement (Mohnsen & Thompson, 1997). A study done by Knudson and Kluka (1997) illustrated that video instruction provides teachers and coaches a way to observe by using their vision interception skills to engage in appropriate and effective feedback sessions.

**Technology to Measure Physical Activity**

The most common technology devices used in physical education today are pedometers and heart rate monitors. With the increase in obesity levels, technologies for measuring activity levels are popular. Monitoring students’ physical activity levels with
Pedometers, accelerometers, or heart rate monitors can provide valuable data concerning exercise intensity and/or duration (Mears, 2010).

Many researchers have examined the use and implications of pedometers in measuring accurate levels of physical activity in physical education (Beighle, Morgan, & Pangrazi, 2004; Cardon & De Bourdeaudhuij, 2004; Kang, Zhu, Tudor-Locke, & Ainsworth, 2005; Rowe, Mahar, Raedeke, & Lore, 2004; Scruggs, et al., 2003). Butcher, Fairclough, Stratton and Richardson (2007) state that pedometers are the best and most valid way to assess students' physical activity levels in physical education.

Pedometers provide physical education teachers with evidence of the level of physical activity of their students. Beighle, Morgan and Pangrazi (2004) and Scruggs, et al. (2003) believe that pedometers can enhance the quality of physical education programs by encouraging healthy active lifestyles. Therefore, it is important for PETE faculty to educate teacher candidates about the use, implementation, validity, and reliability to promote its use in physical education. Rowe, et al. (2004) believe that pedometers have many features that make their use in physical education appropriate such as: (a) pedometers are unobtrusive to the students and their personal values, (b) pedometers are easy to use, (c) most students, no matter the age, could be trained to use pedometers very quickly, and (d) pedometers are inexpensive. One study involving students with special needs revealed that talking pedometers helped children set goals to increase their daily activity (McCaughtry, Oliver, Rocco, Dillon, & Martin, 2008).

Another form of technology used in enhancing activity levels of students in physical education are accelerometers (Scruggs, Beveridge, & Clocksin, 2005). These are tools that do not measure the number of steps but the speed of movement a person creates.
Accelerometers are valid and useful tools as they measure the acceleration of the body in space (Sirard & Pate, 2001). Another method of assessing students’ activity level in physical education is the heart rate monitor (Grissom, Ward, Martin, & Leenders, 2005). Over time, heart rate monitors have become the standard for measuring activity levels within adults (Gavarry, Giacomoni, Bernard, Seymat, & Falgairette, 2003). Gavarry et al. (2003) found an increase in physical activity levels by using heart rate monitors. Currently schools are purchasing heart rate monitors for physical education to measure the cardiovascular fitness level and development of the students (Kirkpatrick & Birnbaum, 1997; Nichols, et al., 2009).

**Exergaming**

In a literature review on computer and video games in physical and health education written by Papastergiou (2009), there was support within the literature that computer and video games can have benefits to physical education. While exergaming is not a new concept, videogames such as DDR and the Wii have revolutionized exergames as means to enhance physical activity levels. The latest definition as defined on the Interactive Fitness and Exergaming wiki (www.exergaming.pbworks.com) states that Exergaming is the positive exertion ‘experience’ gained by combining exercise and multimedia gaming (software and hardware) (Coshott, Thin, & Young, 2009).

Positive gains to elevating the heart rate levels and increasing energy expenditure have been shown in a variety of studies using Dance Dance Revolution (DDR), a well-known dance simulation game by Konami Corporation (http://www.konami.co.jp), where the player is required to dance to a variety of songs, guided by watching scrolling
directional arrows on the screen, which correspond to arrows on the pad that he/she has to step upon in synchronization with the music (Sell, Lillie, & Taylor, 2007; Tan, Aziz, Chua, & Teh, 2002).

The use of exergaming in schools to enhance physical education and physical activity among students has been encouraged by several authors (Mohnsen, 2005; Partridge, Blair, & Leidman, 2007; Trout & Christie, 2007; Trout & Zamora, 2005; Mears & Hansen, 2009). Pilot studies done by Borja (2006) and O’Hanlon (2007) indicate the potential benefits of exergaming with students who are overweight and unmotivated. Exergames boosted their confidence levels and engaged them in cardiovascular exercises that helped them lose weight (Borja, 2006; O’Hanlon, 2007).

The research suggests exergames have the following benefits: (a) helping populations who most need them, such as overweight children and adolescents, improve their physical condition, (b) enjoyable tools for complementing traditional PE activities, (c) increasing the motivation to exercise, (d) promoting physical activity, (e) improving fitness levels, (f) favoring an understanding of physiological concepts and movement principles, (g) enhancing motor skills, (h) sport-specific training, (i) accommodating of both low- and high-ability students by offering several difficulty levels, (j) allowing self-practice in a less threatening and competitive environment than that of traditional team-based PE activities, and (k) promoting social interactions and teamwork through multiplayer modes (Papastergiou, 2009).

**Sport Video Games**

With exergames emerging and providing children with motivational and movement opportunities that produce fitness and health benefits, other video games may
assist in knowledge and motor acquisition (Papastergiou, 2009). Virtual reality games or simulation games have been used to engage students in an activity that may not be feasible in the gym or to practice an activity they are learning about in class. Research exploring sport video games demonstrate effective acquisition of the actual skills when the players can sense the execution of the skill instead of just observing it (Fery & Ponserre, 2001).

Fiorentino-Holland and Gobbone (2005) use the Virtual Gym, a software that simulates actual game play to which students must respond physically, to promote physical activity, enhance motor skill proficiency, and broaden their understanding on movement concepts and principles. Hayes and Silberman (2007) echo the potential benefits of sport video games for physical education.

**Emerging Technologies**

Wilson (2001) states that “the relentless advance in cognition, computers, and information is driving change” but many are unsure of how this change will affect us (p. 224). Gumport and Chun (2005) resonate with this statement and note that accurate predictions in the arena of technology cannot be made due to the “complex social, behavioral, and economic contexts into which new technologies are embedded” (p. 419). According to Surry, Ensminger and Jones (2005), traditional colleges and university models may not be aligned with the needs of our students today.

A study investigating the technology preparation of Physical Education preservice teachers in 2006 revealed that teacher candidates do not feel prepared to be technology proficient in order to teach in this digital age (Liang, et al., 2006). The authors stress the need for PETE programs to adopt a curriculum wide technology plan that not
only covers computer literacy content but also focuses on specific physical and health education software and hardware. By allowing pre-service teachers to interact with different technologies, old or new, they may be more open to exploring emerging technologies following graduation from the PETE program.

**Conclusion**

This literature review speaks to the need to investigate the integration of technology by PETE faculty members. Additionally, it addresses the necessity to find out what specific technologies are included and how they are integrated. This literature review provided evidence to what technology integration within teacher education means and how it can be examined. The need for a modified design of the TLC model of diffusion of technology for teacher education has been justified and is outlined in more detail in the methods section. Finally, this review of literature supports the investigation into the perceptions of PETE faculty members as to what influences their level of integration of technology within the program.
CHAPTER 3: METHODS

The purpose of this study was to identify the types of technology currently taught to Physical Education teacher candidates in PETE courses. Further, the study examined the current technological proficiency of PETE faculty (as perceived by the faculty), as well as the factors that affect technology utilization of PETE faculty within the PETE programs. Finally, this study aimed to identify how PETE educators perceive their current level of technology integration. The relationship between the level of technology integration and the influential factors was examined in order to determine the current status of technology infusion in PETE programs.

Research Design

Fraenkel and Wallen (2003) organize research studies in one or more of the following categories: descriptive, associational, or intervention. While studies often employ a combination of these research methods, this study uses a descriptive methodology of describing the characteristics of individuals and groups in relation to specific research questions. A set of basic steps that must be conscientiously executed guided the descriptive research study: (1) identify a topic or problem; (2) review the literature; (3) select an appropriate sample of participants; (4) collect valid and reliable data and (5) report conclusions (Gay, Mills, & Airasian, 2006). The first two steps have been addressed in the introduction and literature review of this dissertation. This study identified physical education teacher education faculty members as the participants in this study. However, simply asking all PETE faculty members in the USA to complete a questionnaire was unachievable within the time frame and unnecessary. It was therefore important that after identifying the accessible population, an appropriate sampling
technique was used to select the needed sample. Additionally, a data collection instrument was developed.

A research design refers to the “overall plan for collecting data in order to answer research questions” which includes the specific data analysis methods the research intends to use (Fraenkel & Wallen, 2003, p. G-7). One of the most common approaches for gathering of descriptive data is survey research. Survey research “attempts to obtain data from members of a population (or a sample) to determine the current status of that population with respect to one or more variables” (Fraenkel & Wallen, 2003, p. G-8). Descriptive research often seeks information that is not already available and researchers must therefore either modify existing data collection methods or create their own (Gay, et al., 2006). Consequently, the method for this study involved several phases: (1) development of a survey instrument; (2) pilot testing and revision of the survey; (3) data collection using the revised survey instrument; (4) data analysis and writing up the results. In addition to the major phases of the study, each phase involved sub-steps. See Figure 3 for a detailed diagram and timeline of the steps taken in this study.
Figure 6. Overview of Methods

January - April 2010

- **Phase 1: Development of Survey Instrument**
  - Modify Survey Instrument
  - Recruit experts in the field to evaluate survey instrument
  - Survey instrument revision

April - September 2010

- **Phase 2: Pilot Study**
  - IRB Approval
  - Selection and recruitment of participants
  - Pilot study data collection
  - Pilot study data analysis
  - Conduct validity study
  - Survey instrument revision

October - November 2010

- **Phase 3: Survey study**
  - A. Sampling and selection of participants
  - B. Data Collection:
    - Step 1: Pre-contact (email)
    - Step 2: First survey mailing (email)
    - Step 3: Follow-up / Thank you (email)
    - Step 4: Second survey mailing (email)
    - Step 5: Final contact (email)

November 2010 - April 2011

- **Phase 4: Data analysis and writing up the results**
  - Data analysis: descriptive statistics such as percentages, means, ranges, and confidence intervals
  - Writing up the results: Scale reliability and validity, pilot results, survey administration, demographic information, instrument reliability and validity, results of research questions, discussion, implications, conclusion.
Sampling

Selection of Sample

Sampling has been defined as “the process of selecting a number of individuals (a sample) from a population, preferably in such a way that the individuals are representative of the larger group from which they were selected” (Fraenkel & Wallen, 2003, p. G-7). In such, a good sample is a miniature version of the population. While researchers may wish to study the entire population, such a task is simply too onerous. Therefore, a sample is selected that will be representative to allow information to be drawn from the sample to which they can generalize back to the population. Fraenkel & Wallen (2003) refer to population generalizability as to “the degree a sample represents the population of interest” (p. 109).

The first step to selecting a sample is to define the target population of the study. In this study, the population was defined as PETE faculty members within American Universities. Selecting a sample is an extremely important step to insure the greatest potential for generalization of the results. For the purpose of this study, all universities listed on the NCATE website as “recognized AAHPERD/NCATE programs” were selected. From that list, the researcher reviewed the university website of each program. From each website, all PETE faculty members were included in the sample. When it was unclear from the description of the website whether the faculty worked specifically with PE majors versus exercise science or health majors, all faculty members were selected in order to provide all PETE educators a chance to participate.
Sample Size

The question of what constitutes an appropriate sample size is not an easy one. If a sample is too small, the results of the study may not be generalizable to the entire population, regardless of how the sample is selected. Many factors affect the determination of sample size. Dillman (2000) notes four: tolerance for sampling error, population size from which the sample is taken, homogeneity of the population, and the confidence level desired. This means that such factors must be examined and taken into consideration when deciding on the sample size. Sampling error refers to a non-representative, non-probabilistic sample, that is, one which is not representative of the target population, and is best controlled by random sample selection. In descriptive research, it is common to sample 10% to 20% of the population (Gay et al., 2006). This study located the most updated version of accredited PETE programs and sampled all universities to obtain the most appropriate sample and reduced sampling errors.

To prevent errors related to the selection of the sample, it was extremely important that each university had an equal chance of being selected. Dillman (2007) calls such errors coverage errors. Sampling errors refer to those as a result of collecting data from a subset, rather than all the members of the population. Dillman (2007) suggests several ways to reduce coverage errors such as: developing and maintaining accurate lists, evaluating and validating lists to determine whether all members of the survey population are on it, identify identical and/or ineligible members on the list, and using a variety of sources to develop a list if one is not provided. The latest AAHPERD/NCATE list found online was used in full to reduce coverage errors.
Instrument Development

In developing a survey instrument, a researcher typically follows five steps: 1) review the literature, 2) design the instrument, 3) have a panel of experts review and pre-test the survey instrument, 4) pilot test the instrument, and 5) final survey design and planning (Dillman, 2000; Fraenkel & Wallen, 2003). First, a review of the literature was conducted and instruments for its potential use within the study are selected. Next, the instrument was modified to suit the objectives of the research. Third, an expert panel provided vital information regarding the types of questions used in the survey and was crucial regarding the identification of potential problems with the initial survey design. This was done through a pre-test of the instrument. Fourth, a portion of the original chosen sample was selected to pilot the initial survey. A pilot study is a small scale initial study in order to check the design and feasibility of the instrument. Finally, the instrument was re-evaluated for full use. Within this study, the survey went through a second pilot study involving PETE faculty members from the previously selected expert panel. The steps of the survey design are described in detail below.

Step 1: Survey in the Literature

A review of relevant research in the area of technology integration in higher education was conducted to locate an appropriate instrument (see Chapter Two for further discussion of research on technology in education). Howland and Wedman (2004) sought to identify technologies of value in higher education by assessing faculty’s’ use of technology in their classrooms. Their instrument measured a faculty member’s 1) personal knowledge of the technology and 2) perceived value of the technology to

After reviewing the variety of instruments used to measure the perceptions of educators on the inclusion of integration, Howland and Wedman’s (2004) work most closely related to the research questions addressed in this study. As such, Howland and Wedman’s (2004) survey was examined for its potential use in this study. Employing this instrument presented several benefits. First, the instrument provided a model for collecting data regarding the types of technologies used in teaching within teacher education programs (i.e. research question one in this study). Second, the model addressed the perceived technological proficiency levels to using various technologies (i.e., research question two in this study). Third, the model incorporated a system of evaluating the current level of integration of technology within teaching (i.e., research question three in this study). However, the Howland and Wedman instrument did not address all the research needs within this research study and was therefore modified accordingly.

**Step 2: Survey Design**

**Scale Development before expert panel review**

The pilot instrument included three sections. Section one was based on the Howland and Wedman (2004) model which sought to understand how faculty members use technology. Here, faculty members were asked to identify the types of technologies used as well as their level of integration of these technologies. This section was organized according to the constructs related to the seven principles of good practices in undergraduate teaching. Depending upon the number of categories, 5 items were
identified within each category for a total of 35 or more items. Five items were chosen since a minimum of three to five items per common factor is desirable (Fraenkel & Wallen, 2003). A few examples of technology items included in this section were: Email, course management systems such as Blackboard, Angel, WebCT, pedometers, and heart rate monitors. Attitude scales such as this one attempted to determine what a person “believes, perceives, or feels about self, others, activities, institutions, or situations” (Gay, et al., 2006, p. 129). This type of survey research often measures attitudes using a scale such as a Likert scale, semantic differential scale, Thurstone scale, Guttman scale and rating scales (Gay et al., 2006). In this study, the scale used to measure the personal skill and knowledge level was based on the Technology Learning Cycle as outlined in the literature review. The scale was organized in 5 levels:

- **Non-use**: I have no knowledge/limited knowledge.
- **Awareness**: I am aware of this technology and how it can be used.
- **Exploration & Learning**: I’m in the process of learning this technology.
- **Application**: I use this technology.
- **Sharing and Reflection**: I encourage colleagues to use this technology through discussion, modeling, mentoring, collaborative planning, or other means.

Another 4-point scale was used to measure the level of integration of technology by PETE faculty members:

- **Not applicable**: I do not believe this technology has application for me or for the curriculum area(s) I teach. It is not relevant as a teaching and learning tool.
- **None**: no use in course(s)
- **Some**: some use in course(s)
• Well-integrated: natural part of course(s)

The second section examined the factors perceived by the PETE faculty members to affect their technology integration. This section gathered data on the factors identified in the literature as affecting technology adoption and usage (See Table 1). A total of 12 factors were identified affecting faculty technology integration, six factors at the individual level and six factors at the institutional level.

Table 1

Factors Affecting Faculty Use of Technology

<table>
<thead>
<tr>
<th>Individual-level Factors Influencing Faculty Technology Integration</th>
<th>Institutional-level Factors Influencing PETE Faculty Technology Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fear</td>
<td>Funding</td>
</tr>
<tr>
<td>Training</td>
<td>Accessibility</td>
</tr>
<tr>
<td>Pedagogical Beliefs</td>
<td>Institutional Culture</td>
</tr>
<tr>
<td>Motivation</td>
<td>Technical Support</td>
</tr>
<tr>
<td>Time</td>
<td>Institutional Vision</td>
</tr>
<tr>
<td>Student Needs</td>
<td>Professional Organizational Guidelines/ Standards</td>
</tr>
</tbody>
</table>

Sample items included: “Technology helps students learn”; “I have access to the training support I need to use technology”; and “I do not believe that technology enhances my course(s)”. This section used a Likert-scale to assess the extent of agreement the participants have with the statements included. Each response was assigned a point-value from 1 to 5. A score of 5 or 4 on an item indicated a strong attitude towards the statement provided. This 5-point scale includes the following values:

• Strongly Agree: 5
• Agree: 4
• Undecided: 3
• Disagree: 2
• Strongly Disagree: 1

Section three asked demographic information such as: gender, age, country, years spent teaching PE at the higher education level, number of PE courses taught each year, highest degree completed, level taught (undergraduate, graduate: Masters/Doctorate), degrees offered in institution, number of PETE faculty members part-time and full-time, number of students majoring in PE at institution, NASPE/NCATE accredited for US schools, and the approach used to integrate technology in the PETE program (i.e., research question four).

Step 3: Expert Evaluation and Field Test

Through literature reviews and conference visits, ten experts in the field of using technology in physical education were located and asked for their cooperation in the development of the instrument for this study. After the creation of the initial survey, an email including a link to the online survey and online comments form was sent to all the experts. This email included a cover letter explaining the purpose and the design of the study as well as a detailed description of their role as expert judge.

The experts were provided the purpose of the study and asked to first complete the survey and second assess the extent to which the content of the instrument measured constructs it was designed to measure. This assessment was completed within an online form created through Google Docs. The responses were coded to verify the experts’ participation in the field test.

Validity

The researcher is concerned with utilizing an instrument which is both valid and reliable. A valid instrument should measure what it is supposed to measure. Validity
refers to the “appropriateness, correctness, meaningfulness, and usefulness of the specific inferences researchers make based on the data they collect” (Fraenkel & Wallen, 2003, p. 158). Four types of validity are often discussed in the literature: content-related validity, criterion-related validity, construct-related validity, and face-validity. Face validity is a subjective measure where the items of the survey are reviewed by untrained judges. Content validity attempts to measure the degree to which a test measures the intended content area. Criterion validity is a measure of how well an instrument correlates to another instrument or predictor. Construct validity is the degree to which the test measures the intended construct. Both content validity and face validity were determined though expert judgment, pre- and pilot-testing of the instrument. The following steps were taken to ensure content validity:

1. Selected expert panel that included members that had either performed research in the area of technology in PE, had written articles or books on technology in PE, those faculty members that were highly knowledgeable in the area of instructional design and educational technology, as well as faculty with knowledge on survey research.

2. The first survey was sent to 15 experts

3. The first survey was created with the free Surveymonkey.com tool. The expert panel had to input the starting time and completion time to evaluate how much time it took to complete the survey. At the end of the survey, ten questions were asked to validate the questions and the overall esthetics of the survey in conjunction to the proposed research questions:
a. Is the survey attractive and neat? Explain any areas which could use improvement.

b. Does the survey appear too long to be completed in one sitting? Explain any ways in which the survey might be modified and still meets its research purposes.

c. Are the directions for section 1 (knowledge and skill level of technology) easy to follow? Explain any issues which need clarification.

d. Are the directions for section 2 (integration of technology) easy to follow? Explain any issues which need clarification.

e. Are the items in section one and two clear in their phrasing and terminology? Identify any changes which you believe should be made in order to achieve the purpose of this research.

f. Are there any technologies in section 1 and 2 that should be added or omitted?

g. Are the items in section 3 (factors of integration) clear in their phrasing and terminology? Identify any changes which you believe should be made in order to achieve the purpose of this research.

h. Is there any important background information that may be missing from section 4 (demographics)?

i. Please include any other comments relevant to the improvement of this survey.
Step 4: Survey Instrument Following Expert Panel Review

From the original list of technologies, the expert panel members suggested that the list was extensive and needed to be reduced or several technologies grouped together. In addition, it was requested to add more specific examples to each group of technologies. For example, provide examples of specific exergames (i.e. Dance Dance Revolution, Wii, etc.). A second look at the technologies allowed the researcher to be more specific and chose those technologies that P-12 PE teachers would use in their classrooms and gyms.

The “Personal knowledge and skill level of technology” scale was changed so that “Non-use” meant that the participant does not use the tool and that “Awareness” meant that the participant is aware the technology exists. In the “Share and Reflect” section it was noted that “colleagues” should be changed to “others”, as it is possible that respondents encourage students, colleagues, or even their own children to use the technology. The wording within the integration scale was questioned and improved for clarity.

Within the third section it appeared that some of the items asked about factors that influence the integration of technology in general rather than prompt the respondent to outline the factors that currently influence their use of technology in PETE. To help reduce confusion and focus on items that may be influential factors, the items were reworded so that respondents do not answer based on opinions of what influences their use of technology but rather be specific about what influences their current use of technology.
In the demographic section it was noted that there should be a question related to the level of education within technology. It was important to this research to find out whether or not the participants had prior training with technology as this could impact their level of technology integration.

**Step 5: Pilot Study**

Following the establishment of content and face validity via a panel of experts, the instrument was pilot tested using 7 PETE faculty members selected from the survey population. A cover letter and a paper survey instrument were provided to each faculty member. The cover letter addressed the voluntary and confidential nature of the faculty member’s participation. In addition, each participant was asked to review the instrument’s format to ensure the clarity of printing, size of type, appropriateness of language, and clarity of directions. The faculty members completed the paper survey and a comment form. The responses were coded to verify the experts’ participation in the pilot test.

**Step 6: Survey Instrument Following Pilot Study**

Following data collection and analysis of the results and comment forms it was determined that the survey questions and scales were not fully designed to measure technology integration as defined by the researcher. Faculty members perceived technology integration differently and the initial 4-point scale used to measure the level of integration of technology by PETE faculty members was deemed ambiguous. It was clear that the difference between *some integration* and *well-integrated* tools was vague and did not explain whether teacher educators use the technology in the classroom or whether they teach pre-service teachers how to use the technology.
Following an additional literature review, it appeared that the TPCK framework could be used to modify this survey so that the scales included in the survey match the research questions. Three challenges were faced and new scales were developed. The four initial sections were modified and are explained next.

Section 1: Technology Proficiency / Technology Integration.

1.1. Technology Proficiency

The first challenge this instrument displayed was the recognition of the differences in technology uses within general teacher education and physical education teacher education. Often, the uses of technology vary depending on the context. Research shows that physical education teachers employ a variety of technologies to enhance the development and physical activity levels of children. Therefore, the original framework around the “Seven Principles of Good Practice in Education” developed by Chickering and Ehrmann (1996) were be reviewed carefully. The practices were re-evaluated and modified to address the NASPE “2008 National Initial Physical Education Teacher Education Standards” as well as the “Appropriate Use of Instructional Technology in K-12 Physical Education and Physical Education Higher Education settings”. These constructs were first evaluated to include the technologies important in PETE programs. For example, pedometers or heart rate monitors were included in the framework. When modifying the instrument, constructs were added and altered. Once the list of technologies was compiled, the survey asked faculty members to rate their current level of knowledge and skill for each of the technologies listed. This survey component employed a Likert-type scale from (1) no knowledge to (5) I consider myself an expert in using this tool.
1.2. Technology Integration

The second challenge was that the TLC survey did not fully identify the level of technology integration as understood within the context of teacher education. The TPCK framework allowed examination of whether PETE faculty members understand the complex relationships between technology, content, and pedagogy when applying technology within their methods courses or whether they viewed the integration of technology as a separate entity alienated from content and pedagogy. The integration scale was consequently modified to include: (1) Non awareness: I was unaware this technology existed, (2) Awareness: I am aware of the technology but I do not use it, (3) Personal use: I use it within my personal life, (4) Professional use: I use it in the classroom, (5) Integrate: I teach my students how to teach PE with the technology, and (6) Share & Reflect: I share with others (people other than my students) how the technology can be applied to teaching PE. However, after further scrutiny of this scale, it was noted that one could use technology in their professional work even though they would not use it on their own time, resulting in an insupportable progression of technology integration. It was decided that the survey would first ask whether PETE educators used it personally and then later question their level of integration using the other five scales.

Section 2: Factors that hinder or aid technology integration.

The third challenge was the need to address the factors as perceived by the faculty members that influence the level of integration of technology within PETE programs (i.e. research question four in this study). The instrument created by Howland and Wedman (2004) did not address this question and a section was created for this study. The initial survey held 27 factors which may influence the current level of utilization and integration
of technology by the PETE faculty member in PETE courses. The participants were asked to answer on a scale from 0 to 4, to what extend the factors influence their current use of technology in the PE courses they teach (0 being the factor that does not influence their use of the technology to 4 being a factor that strongly influences the use of technology). A few examples are: (Factor 1) prior training on using the technology, (Factor 5) interest in the technology, (Factor 15) administrative support, and (Factor 23) the motivational aspects the technology brings to my students. For a complete list of the factors see appendix 1.

Section 3: Technology Integration within overall PETE program
This section investigated the different approaches to technology integration as well as allowed for more in-depth analysis of the level of technology infusion from a program perspective. It was understood that the multitude of technologies used within physical education could never be explored with one course. Consequently, technology integration was observed throughout the entire PETE program. In order to evaluate whether faculty members within PETE programs collaborated on the integration of a variety of technologies, this survey inquired about the current scope of technology integration across the program. To help with the creation of this section NCATE national standards and guidelines for PETE were examined (NCATE, 2009). Provided with the premise that the participants were selected from NCATE accredited PETE programs, this guidebook explained how such accreditation could be obtained. It shared rubrics that asses all standards including the 3.7 technology focused standard. Additionally, it provided examples of assessments that could be used to show that a program met a certain standard. Such assessments included examples such as: unit plans, teacher work
Realizing that the current experiences do not always correspond with what we believe should happen, eight of the 16 questions asked about the current events, while the other eight asked about the teacher educators perceptions towards such events.

The following YES/NO questions were included in this section:

A. Current scope

1. Does your program assess the students’ ability to use technology?
2. Do faculty in your program address technology in the course syllabi?
3. Do you meet and decide as a faculty on how you will integrate technology?
4. Do students within the program need to show evidence of technology integration within their own teaching?
5. Does your faculty have a “technology plan” that structures the integration of technology within the PETE program curriculum?
6. Do PETE majors need to complete a technology course within the program?
7. Does the level of technology integration within your program depend on each individual faculty member’s experience and knowledge of technology?
8. Is there a member within your faculty who leads in the introduction of technology within the program curriculum?

B. Perceptions

1. Do you believe that PETE students should be assessed on their ability to use technology?
2. According to you, should technology use be addressed in the syllabus?
3. Do you believe students should show evidence of teaching with technology?
4. Do you believe that faculty should meet and decide together on how you will integrate technology?
5. Do you believe that your faculty should have a “technology plan” that structures the integration of technology within the PETE program curriculum?
6. Do you believe technology integration should be taught as a separate course within the program?

7. Do you believe technology should be integrated throughout the program?

8. Do you believe PETE faculty should be trained in the integration of PE technology?

**Section 4: Demographics**

This section did not change much from the initial survey. Questions regarding the faculty members’ gender, years of teaching, PETE courses currently teaching, and educational experience with technology were included. Provided that only NCATE accredited programs were invited participants, the question that asked whether the program was accredited was replaced by when the program received its accreditation. The reason for this is that some programs are accredited with the 2004 standards while other programs are accredited with the 2008 standards in mind. This is important as the standards between 2004 and 2008 regarding technology integration changed, which was explained within the literature review.

**Reliability**

Reliability refers to the consistency, dependability, or repeatability of the scores obtained (Berg & Latin, 2003). Like validity, there are several types of reliability. Methods of testing for reliability include: test-retest method, equivalent-forms method, and internal consistency methods. This study used the internal consistency method to test for reliability. This method differs from the two other methods in that it requires only one administration of the instrument (Fraenkel & Wallen, 2003). Internal consistency can be measured by using the split-half procedure, Kuder-Richardson approaches, or computing the Cronbach alpha coefficients. To determine reliability of the instrument, Cronbach’s alphas were calculated for each of the questionnaire’s technology constructs in the
survey. Fraenkel & Wallen (2003) stated that, typically, for research purposes, the reliability of an instrument should be at least .700, but preferably higher.

Step 7: Final Review of Survey

Following the expert validation, field and pilot test, the entire instrument was re-evaluated and modified. The final survey can be reviewed in appendix 2. The cover letter and survey instrument was finalized prior to commencing the procedures for data collection. It is vital to understand that Institutional Review Board approval was received prior to beginning the pilot study.

Data Collection

Dillman (2007) outlines five elements for achieving high response rates in survey research: (1) design a respondent-friendly questionnaire, (2) up to five contacts with the questionnaire recipient, (3) inclusion of stamped return envelopes, (4) personalized correspondence, and (5) a token financial incentive that is sent with the survey request. The survey should be easily comprehensible, suggest a clear order and be visually pleasing. Multiple contacts with the participants are essential to what Dillman (2007) calls the “Tailored Design Survey Method” including: (a) a brief pre-notice letter sent a few days prior to the questionnaire that notes the importance of the survey as well as a request for participation, (b) the initial survey mailing including a cover letter explaining why the response is important, (c) a thank you postcard sent a few days after the questionnaire that expresses appreciation for responding and a request to send the survey back if they have not done so, (d) a replacement questionnaire sent 2-4 weeks after the first survey mailing, and (e) a final contact made by telephone or other mode of contact.
thanking participants for their cooperation. Another element to maximize the response rate is to personalize all correspondence and use a return envelope with a real stamp.

Due to the expected large sample size used in this study, costs were too large to mail every questionnaire. To reduce cost yet still enhance high response rate, the pre-notice was completed in the form of an email that invited PETE faculty members to participate in the study. Consequently, all participants were sent an email that included a formal invitation letter from the researcher as well as the direct link to the web-based survey. They were asked to respond to the survey within seven days and a reminder email was sent to the participants after one week to enhance the response rate. Dillman (2000) explained that most respondents who participate in research respond within that time frame. Each participant in the study received a thank you email at the completion of the survey.

Data Analysis

Once data collection had ceased, all data was entered and analyzed using the computer-based statistical program SPSS, version 16.0. First, response rate and demographic information were analyzed. Percentages and means were used to report data related to age, years of teaching, highest degree obtained, and current rank. Non responses were reported as well. Frequency tables were used to display the educational experiences with technology and courses taught in the PETE program.

In this study I asked: “What are the perceptions and experiences of Physical Education (PE) educators on the inclusion of technology in physical education teacher education programs (PETE)?” Data analysis is outlined for each of the following sub-questions:
Question 1: What types of technologies are currently included in PETE programs?

Percentages of technologies used in PETE programs were noted and analyzed according to the different technology categories. The data were analyzed within the different types of technologies which allowed analysis of what type of technologies are most often used and which are least often used within PETE programs. Patterns related to the extent certain technologies were used within PETE programs were listed.

Question 2: What do current PE educators believe to be their technological proficiency levels?

Means, ranges, and percentages were analyzed separately for each technology category. Stacked bar graphs that show the different proficiency levels were used to display the data in each category. A final table was used to display all the percentages, response number and means for each specific technology, the technology categories, and overall.

Question 3: How are PETE educators integrating technology in PETE courses?

Each level is progressive which means that it can be given a number value. NA = 0, Aware = 1, In class use = 2, Teach to Teach = 3, and Share & reflect = 4. Means, ranges and percentages were analyzed first within each specific category and later overall. The levels of integration between the different types of technologies were compared. Stacked bar graphs showing different integration levels were used to display the data in each category. A final table was used to display all the percentages, response number and means for each specific technology, the technology categories, and overall.

Question 4: What factors affect technology use of PETE faculty within the PETE programs?
Personal use was analyzed for each technology within each category. Respondents either use the technology or they do not so percentages and means of technologies used within personal life were analyzed and listed. Bar graphs were used to display the percentages of personal use within each category for each technology.

Personal use, proficiency, and integration were analyzed using a multiple regression model. This model was used to assess whether personal use and proficiency predict the level of integration. The model was explained for each technology within each category. Next, the results of the model were compared between the different categories. A table was used to display the statistic results of the regression model and included R, R squared, F-statistic, p-values and t-statistics. P-values of .001 and .05 were used to indicate statistical significance. Personal use and proficiency were looked at grouped in the model as well as separately for each technology.

Additional factors were asked about in the survey. A likert-scale was used between zero to four to express the extent to which the factors influenced the PETE faculty members’ current use of technology. Means were reported for all the factors and ordered from high to low. A bar graph was used to display the means.

**Question 5: How do PETE programs approach technology integration according to the perceptions of the PETE faculty members?**

Section three asked about the types of approaches that a faculty as a whole takes to integrate technology. These items were yes and no type questions and the frequencies were noted and explained with the help of the results from the other questions. Secondly, it was important to analyze the differences between what is currently happening in a faculty and what the PE educators believe should happen when it comes to technology.
integration. Bar graphs were used to display the percentages as they related to the beliefs and the current applications of integration. If there were similar levels, a Chi-square was used to analyze and explain such results. It is understood that the more respondents choose to answer yes, the higher the level of technology integration. Therefore, frequencies were analyzed as high integration versus medium integration, versus low integration.

Finally, an open question was asked regarding the integration of technology within the program. This qualitative question was voluntary and after reviewing all the findings, themes were noted and quotes provided evidence for the interpretations of each theme. Analyzing qualitative data refers to organizing data into categories based on patterns, themes, concepts, or similar features (Neuman, 2003). In order to complete this process, the data was reviewed and detailed notes were taken on any emerging patterns. Next, the patterns showing similar quotes were combined to form common themes that provides an answer to the research question posed. According to Patton (1990), triangulation of multiple data sources creates convergence of the data and gives credibility to the perceptions of the participants. When participants add additional information, it indicated the importance of such information within the context. All results are provided in Chapter 4 and later discussed in Chapter 5.
CHAPTER 4: RESULTS

Introduction

When interpreting the perceptions of PETE educators on the level of integration of technology it is important to chart the demographics and outline the results from each research question. The questions addressed in this section are in the following order:

- What types of technologies are currently included in PETE programs?
- What do current PE educators believe to be their technological proficiency levels?
- How are PE educators integrating technology in PETE courses?
- What factors affect technology use of PETE faculty within the PETE programs?
- How do PETE programs approach technology integration according to the perceptions of the PETE faculty members?

Participant Characteristics

As identified by the NCATE website, 145 programs were recognized NASPE/AAHPERD PETE programs in October 2010 (Figure 7, Table 2). The websites of each program was searched for email addresses of the PETE faculty members. No email addresses were found in 3 university programs. The total number of participants was 762. However, due to the fact that some programs did not provide specific information regarding the type of courses each faculty member teaches within a program, 495 of those selected were known PETE faculty members. In total, 255 PETE faculty members completed the survey and complete data were provided by 198 faculty members providing a response rate of 40% (198/495).
Figure 7. Number of nationally recognized (NAPSE/AAHPERD) PETE programs in the USA.
Table 2

*Distribution of NASPE/AAHPERD Recognized PETE Programs in USA*

<table>
<thead>
<tr>
<th>State</th>
<th># of recognized PETE programs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arkansas</td>
<td>5</td>
</tr>
<tr>
<td>Arizona</td>
<td>1</td>
</tr>
<tr>
<td>Colorado</td>
<td>2</td>
</tr>
<tr>
<td>Connecticut</td>
<td>3</td>
</tr>
<tr>
<td>District of Columbia</td>
<td>1</td>
</tr>
<tr>
<td>Delaware</td>
<td>3</td>
</tr>
<tr>
<td>Florida</td>
<td>1</td>
</tr>
<tr>
<td>Georgia</td>
<td>3</td>
</tr>
<tr>
<td>Guam</td>
<td>1</td>
</tr>
<tr>
<td>Illinois</td>
<td>14</td>
</tr>
<tr>
<td>New Hampshire</td>
<td>2</td>
</tr>
<tr>
<td>New Jersey</td>
<td>4</td>
</tr>
<tr>
<td>New York</td>
<td>11</td>
</tr>
<tr>
<td>Ohio</td>
<td>19</td>
</tr>
<tr>
<td>Oklahoma</td>
<td>12</td>
</tr>
<tr>
<td>Pennsylvania</td>
<td>8</td>
</tr>
<tr>
<td>Puerto Rico</td>
<td>2</td>
</tr>
<tr>
<td>Rhode Island</td>
<td>2</td>
</tr>
<tr>
<td>South Carolina</td>
<td>13</td>
</tr>
<tr>
<td>South Dakota</td>
<td>1</td>
</tr>
<tr>
<td>Texas</td>
<td>6</td>
</tr>
<tr>
<td>Virginia</td>
<td>9</td>
</tr>
<tr>
<td>Vermont</td>
<td>1</td>
</tr>
<tr>
<td>West Virginia</td>
<td>4</td>
</tr>
<tr>
<td>Wyoming</td>
<td>1</td>
</tr>
</tbody>
</table>

PETE faculty members were asked demographic information in an effort to provide the characteristics of the participants. Participants reported demographic information related to age, years of teaching, highest degree obtained, and current academic rank. Demographic data shows an evenly distributed participation from both genders (Table 3). Most teachers had taught for over 16 years (44%, 80) while the rest of
the participants were evenly spread among the years of preparing teachers. Most
respondents have a doctorate. The data showed an even distribution among the academic
ranks of assistant, associate and full professor.

Table 3

PETE Faculty Demographics

<table>
<thead>
<tr>
<th>Gender</th>
<th>Response Percent</th>
<th>Response Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>51%</td>
<td>85</td>
</tr>
<tr>
<td>Female</td>
<td>49%</td>
<td>82</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Years of preparing teachers</th>
<th>Response Percent</th>
<th>Response Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-3 years</td>
<td>12%</td>
<td>22</td>
</tr>
<tr>
<td>4-6 years</td>
<td>12%</td>
<td>21</td>
</tr>
<tr>
<td>7-10 years</td>
<td>15%</td>
<td>28</td>
</tr>
<tr>
<td>11-15 years</td>
<td>17%</td>
<td>30</td>
</tr>
<tr>
<td>+16 years</td>
<td>44%</td>
<td>80</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Highest Degree</th>
<th>Response Percent</th>
<th>Response Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelor</td>
<td>0%</td>
<td>0</td>
</tr>
<tr>
<td>Master</td>
<td>16%</td>
<td>28</td>
</tr>
<tr>
<td>Doctorate</td>
<td>84%</td>
<td>152</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Academic Rank</th>
<th>Response Percent</th>
<th>Response Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructor</td>
<td>9%</td>
<td>16</td>
</tr>
<tr>
<td>Assistant Professor</td>
<td>30%</td>
<td>54</td>
</tr>
<tr>
<td>Associate Professor</td>
<td>35%</td>
<td>63</td>
</tr>
<tr>
<td>Full Professor</td>
<td>26%</td>
<td>46</td>
</tr>
</tbody>
</table>

Further, the participants were asked to describe their educational experiences with
technology (Table 4). For this question they could check more than one option. More
than 100 participants either teach themselves how to use technology or learn it from
others at work or by going through workshops. While most respondents had experience
with some use of technology, 4% (8) conveyed to have little to no prior knowledge on the
use of technology.
Table 4

*Frequency Table of PETE Faculty's Educational Experiences with Technology*

<table>
<thead>
<tr>
<th>Educational experiences</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>I teach myself on how to use technology (through reading, online tutorials)</td>
<td>147</td>
</tr>
<tr>
<td>I learn about technology from my colleagues at work.</td>
<td>129</td>
</tr>
<tr>
<td>I attend seminars / workshops on technology (on or off campus)</td>
<td>128</td>
</tr>
<tr>
<td>I have family members/ students /mentor teachers that help me understand technology.</td>
<td>44</td>
</tr>
<tr>
<td>I attended postgraduate course work related to technology</td>
<td>21</td>
</tr>
<tr>
<td>I obtained a degree in a technology related field</td>
<td>10</td>
</tr>
<tr>
<td>None to little prior knowledge of technology</td>
<td>8</td>
</tr>
<tr>
<td>Other: trial and error, undergraduate work, I enjoy it, I teach online</td>
<td>5</td>
</tr>
</tbody>
</table>

A final demographic question asked about the type of coursework PETE faculty were currently teaching. For this question, most faculty members appear to teach more than one type of course. Following their description of the specific course, all were put in categories ranging from courses in K-12 Methods in PE, motor development/learning, physical activity, adapted PE, assessment and measurement, philosophy/history and sociology of PE and sport, technology, foundations in PE, internship, research methods, health education, coaching, exercise science, recreation, and graduate courses in PE. Most faculty members conveyed teaching methods courses (112). Other courses taught often by the respondents were assessment and measurement courses (50), activity based courses (45), and motor development courses (38). The break-down of these courses as well as the additional courses are shown in Table 5.
Table 5

Frequency Table of Coursework Taught by Participants

<table>
<thead>
<tr>
<th>Courses</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>K-12 Methods in PE</td>
<td>112</td>
</tr>
<tr>
<td>Assessment &amp; Measurement</td>
<td>50</td>
</tr>
<tr>
<td>Activity/Skill/Dance Courses</td>
<td>45</td>
</tr>
<tr>
<td>Internship/Supervision</td>
<td>39</td>
</tr>
<tr>
<td>Motor development/learning</td>
<td>38</td>
</tr>
<tr>
<td>Foundations in PE/Kinesiology</td>
<td>28</td>
</tr>
<tr>
<td>Adapted PE</td>
<td>25</td>
</tr>
<tr>
<td>Health/Fitness Education</td>
<td>18</td>
</tr>
<tr>
<td>History, sociology, philosophy &amp; psychology</td>
<td>17</td>
</tr>
<tr>
<td>Exercise science courses</td>
<td>15</td>
</tr>
<tr>
<td>Research methods</td>
<td>13</td>
</tr>
<tr>
<td>Technology</td>
<td>11</td>
</tr>
<tr>
<td>Recreation</td>
<td>5</td>
</tr>
<tr>
<td>Coaching</td>
<td>4</td>
</tr>
</tbody>
</table>

Research Question #1: What types of technologies are currently included in PETE programs?

Within the first section of the survey, respondents were asked to share which technologies they used in the classroom. Responses were based on a Likert scale and consisted of: 1) Not aware of the technology, 2) Aware of the technology, 3) I use it in the classroom, 4) I use it in the classroom and I teach the students how to teach with the technology (Teach to Teach), and 5) I use it in the classroom, I teach to teach and I share and reflect on the use of the tool with others in my field (Share & Reflect). In order to find out what tools are currently included within PETE programs, means of “in classes use” (level 3), “teach to teach” (level 4), and “share & reflect” (level 5) were included.

Table 6 indicates that 75% or more of PETE faculty members reported the use of projectors, digital cameras, office tools, presentation software, course management tools, electronic distribution of grades, and email. Fitness assessment tools, web-based survey
or tests, electronic portfolio, online research databases, YouTube, pedometers, heart rate monitors, and online discussion forums were used by 50 to 75% of respondents. Less the 50% of PETE programs included handheld and smart board technology, educational games, cell phone applications, PE software programs, Web 2.0 tools, exergames, sport simulator, and chat rooms. Respondents reported least used technologies to be accelerometers, webquests, GPS systems, podcasting/vodcasting, bookmarking tools, and virtual networks (≤ 20%).
Table 6

Percentages of Technologies Used in PETE Programs

<table>
<thead>
<tr>
<th>Technology</th>
<th>Percentage</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office Tools</td>
<td>97%</td>
<td>Computer Technologies</td>
</tr>
<tr>
<td>Presentation Tools</td>
<td>96%</td>
<td>Computer Technologies</td>
</tr>
<tr>
<td>Projector</td>
<td>94%</td>
<td>Teaching Technologies</td>
</tr>
<tr>
<td>Email</td>
<td>93%</td>
<td>Communication Technologies</td>
</tr>
<tr>
<td>Course Management Tools</td>
<td>86%</td>
<td>Web-Based Technologies</td>
</tr>
<tr>
<td>Electronic Distribution of Grades</td>
<td>84%</td>
<td>Web-Based Technologies</td>
</tr>
<tr>
<td>Digital Camera</td>
<td>79%</td>
<td>Teaching Technologies</td>
</tr>
<tr>
<td>Online Research Databases</td>
<td>74%</td>
<td>Web-Based Technologies</td>
</tr>
<tr>
<td>Pedometers</td>
<td>72%</td>
<td>Physical Activity Technologies</td>
</tr>
<tr>
<td>YouTube/TeacherTube</td>
<td>70%</td>
<td>Web-Based Technologies</td>
</tr>
<tr>
<td>Web-based assignments</td>
<td>67%</td>
<td>Web-Based Technologies</td>
</tr>
<tr>
<td>Fitness Assessment Tools</td>
<td>65%</td>
<td>Computer Technologies</td>
</tr>
<tr>
<td>Heart Rate Monitor</td>
<td>63%</td>
<td>Physical Activity Technologies</td>
</tr>
<tr>
<td>Electronic Portfolios</td>
<td>61%</td>
<td>Web-Based Technologies</td>
</tr>
<tr>
<td>Online Discussion Forum</td>
<td>56%</td>
<td>Communication Technologies</td>
</tr>
<tr>
<td>Handheld</td>
<td>45%</td>
<td>Teaching Technologies</td>
</tr>
<tr>
<td>Smart Board</td>
<td>44%</td>
<td>Teaching Technologies</td>
</tr>
<tr>
<td>Educational Games</td>
<td>39%</td>
<td>Computer Technologies</td>
</tr>
<tr>
<td>Cell phone applications</td>
<td>36%</td>
<td>Teaching Technologies</td>
</tr>
<tr>
<td>PE Software Programs</td>
<td>35%</td>
<td>Computer Technologies</td>
</tr>
<tr>
<td>Social Networks</td>
<td>27%</td>
<td>Communication Technologies</td>
</tr>
<tr>
<td>Web 2.0 Tools</td>
<td>27%</td>
<td>Web-Based Technologies</td>
</tr>
<tr>
<td>Sport Based Simulators</td>
<td>24%</td>
<td>Physical Activity Technologies</td>
</tr>
<tr>
<td>Exergames</td>
<td>24%</td>
<td>Physical Activity Technologies</td>
</tr>
<tr>
<td>Chat Rooms</td>
<td>22%</td>
<td>Communication Technologies</td>
</tr>
<tr>
<td>Accelerometer</td>
<td>20%</td>
<td>Physical Activity Technologies</td>
</tr>
<tr>
<td>Webquests</td>
<td>20%</td>
<td>Web-Based Technologies</td>
</tr>
<tr>
<td>GPS Systems</td>
<td>19%</td>
<td>Physical Activity Technologies</td>
</tr>
<tr>
<td>Podcasting/Vodcasting</td>
<td>19%</td>
<td>Web-Based Technologies</td>
</tr>
<tr>
<td>Bookmarking Tools</td>
<td>5%</td>
<td>Web-Based Technologies</td>
</tr>
<tr>
<td>Virtual Networks</td>
<td>1%</td>
<td>Communication Technologies</td>
</tr>
</tbody>
</table>
Research Question #2: What do current PE educators believe to be their technological proficiency levels?

The PETE Technology survey asked the respondents about their perceived level of proficiency in all the listed technologies. The Likert scale used included: 1) No knowledge of the tool, 2) Some knowledge of the tool but no usage, 3) Basic usage of the tool, 4) Confident in my abilities to use this tool, and 5) I perceive myself to be an expert in using this tool. There were five categories of technologies within the survey including 1) teaching technologies, 2) physical activity technologies, 3) computer technologies, 4) communication technologies, and 5) web-based technologies. Each category of technology is reported separately, once pictured in the appropriate figure and once reported as percentages within Table 7.

Teaching Technologies

Respondents reported the highest proficiency levels in this category with projectors and digital cameras while smart boards, handheld devices and cell phone applications were technologies they reported lower proficiency levels (Figure 8). The proficiency level of the respondents was the highest with projectors as 51% of respondents perceived to be experts in using projectors. The mean proficiency use of the teaching technologies ranged from 2.95 to 4.36, with an overall mean of 3.7. This shows that on average, PETE professors reported basic usage or confident use of the teaching technologies, with smartboards being the only teaching technology not reaching the “basic use” level.
Physical Activity Technologies

Pedometers and heart rate monitors received the highest rating in proficiency levels (Figure 9). The highest percentage of respondents giving expert levels in proficiency is in the use of pedometers (54%). GPS Systems, exergames, accelerometers and sport based simulators received the lowest proficiency levels ratings. No knowledge and no use of accelerometers and GPS systems were reported by 50% of the respondents. On average, the proficiency means ranged from 2.64 to 4.35 with an overall mean of 3.31.

Figure 8. Perceived level of proficiency of teaching technologies.
Figure 9. Perceived level of proficiency of physical activity technologies.

**Computer Technologies**

Office tools and presentation software received the highest perceived levels of proficiency of the computer technologies (Figure 10). PE software and educational games were reported to have the lowest proficiency levels, not quite reaching the “basic use” level. The perceived level of proficiency of fitness assessment technologies was evenly divided between the upper three levels. On average, proficiency means of computer technologies ranged between 2.79 and 4.39 with an overall mean of 3.63.
Communication Technologies

Email had the highest level of perceived proficiency among the communication technologies; 97% reported confident use and expert use of email (Figure 11). The respondents used virtual networks the least with 83% of respondents not knowing anything about it or not using it. Respondents reported evenly spread proficiency levels of social networks and online discussion forums, with slightly lower proficiency with chat rooms. On average, proficiency means of communication technologies ranged between 1.77 and 4.61 with an overall mean of 3.21.

Figure 10. Perceived level of proficiency of computer technologies.
Web-Based Technologies

The respondents reported the highest levels of proficiency in course management tools, web-based assignments, electronic distribution of grades, online databases, and electronic portfolios with 50% or more feeling confident or experts in its use (Figure 12). They reported the lowest levels of proficiency in bookmarking, web 2.0 tools, webquests, and podcasting (Figure 13). On average, proficiency levels of web-based technologies ranged between 1.68 and 4.01 with an overall mean of 3.09.

The reported percentages and means are displayed in Table 7. Overall, proficiency levels among the different technology categories ranged from 3.09 to 3.7. Higher means of proficiency levels were reported in the use of teaching technologies (3.7) and computer technologies (3.63). Respondents reported a slightly lower proficiency mean in the use of physical activity technologies (3.31) and communication technologies (3.21). The lowest average proficiency levels were web-based technologies (3.09).
In summary, PETE faculty reported to be mostly proficiently in the use of email, presentation tools, office tools, projector, pedometer, and digital cameras, and least proficiently in the use of web 2.0 tools, podcasting/vodcasting, webquests, virtual networks, and bookmarking tools.

*Figure 12.* Perceived level of proficiency of web-based technologies part 1.

*Figure 13.* Perceived level of proficiency of web-based technologies part 2.
Table 7

Levels of Proficiency in PETE Technologies

<table>
<thead>
<tr>
<th>Technology</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Responses</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Teaching Technologies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.70</td>
</tr>
<tr>
<td>Projector</td>
<td>2%</td>
<td>1%</td>
<td>9%</td>
<td>37%</td>
<td>51%</td>
<td>182</td>
<td>4.36</td>
</tr>
<tr>
<td>Smart Board</td>
<td>7%</td>
<td>30%</td>
<td>32%</td>
<td>22%</td>
<td>9%</td>
<td>176</td>
<td>2.95</td>
</tr>
<tr>
<td>Handheld</td>
<td>7%</td>
<td>15%</td>
<td>28%</td>
<td>34%</td>
<td>16%</td>
<td>178</td>
<td>3.37</td>
</tr>
<tr>
<td>Digital Camera</td>
<td>1%</td>
<td>3%</td>
<td>16%</td>
<td>43%</td>
<td>37%</td>
<td>179</td>
<td>4.13</td>
</tr>
<tr>
<td>Cell Phone Applications</td>
<td>3%</td>
<td>11%</td>
<td>24%</td>
<td>37%</td>
<td>25%</td>
<td>177</td>
<td>3.70</td>
</tr>
<tr>
<td><strong>Physical Activity Technologies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.31</td>
</tr>
<tr>
<td>Pedometer</td>
<td>1%</td>
<td>4%</td>
<td>8%</td>
<td>32%</td>
<td>54%</td>
<td>179</td>
<td>4.35</td>
</tr>
<tr>
<td>Accelerometer</td>
<td>23%</td>
<td>27%</td>
<td>27%</td>
<td>10%</td>
<td>13%</td>
<td>175</td>
<td>2.64</td>
</tr>
<tr>
<td>Heart Rate Monitor</td>
<td>2%</td>
<td>6%</td>
<td>20%</td>
<td>34%</td>
<td>38%</td>
<td>177</td>
<td>4.01</td>
</tr>
<tr>
<td>Sport Based Simulators</td>
<td>6%</td>
<td>27%</td>
<td>28%</td>
<td>22%</td>
<td>16%</td>
<td>176</td>
<td>3.15</td>
</tr>
<tr>
<td>Exergames</td>
<td>6%</td>
<td>29%</td>
<td>30%</td>
<td>18%</td>
<td>17%</td>
<td>174</td>
<td>3.09</td>
</tr>
<tr>
<td>GPS Systems</td>
<td>14%</td>
<td>37%</td>
<td>27%</td>
<td>11%</td>
<td>10%</td>
<td>173</td>
<td>2.66</td>
</tr>
<tr>
<td><strong>Computer Technologies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.63</td>
</tr>
<tr>
<td>Fitness Assessments</td>
<td>2%</td>
<td>12%</td>
<td>28%</td>
<td>31%</td>
<td>27%</td>
<td>179</td>
<td>3.68</td>
</tr>
<tr>
<td>PE Software</td>
<td>16%</td>
<td>31%</td>
<td>25%</td>
<td>15%</td>
<td>13%</td>
<td>177</td>
<td>2.79</td>
</tr>
<tr>
<td>Educational Games</td>
<td>13%</td>
<td>28%</td>
<td>26%</td>
<td>19%</td>
<td>13%</td>
<td>172</td>
<td>2.92</td>
</tr>
<tr>
<td>Office Tools</td>
<td>2%</td>
<td>1%</td>
<td>10%</td>
<td>34%</td>
<td>54%</td>
<td>181</td>
<td>4.38</td>
</tr>
<tr>
<td>Presentation Tools</td>
<td>2%</td>
<td>1%</td>
<td>8%</td>
<td>36%</td>
<td>54%</td>
<td>179</td>
<td>4.39</td>
</tr>
<tr>
<td><strong>Communication Technologies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.21</td>
</tr>
<tr>
<td>Online Discussion Forum</td>
<td>4%</td>
<td>20%</td>
<td>32%</td>
<td>26%</td>
<td>18%</td>
<td>178</td>
<td>3.33</td>
</tr>
<tr>
<td>Chat Rooms</td>
<td>9%</td>
<td>34%</td>
<td>26%</td>
<td>18%</td>
<td>13%</td>
<td>175</td>
<td>2.93</td>
</tr>
<tr>
<td>Email</td>
<td>1%</td>
<td>0%</td>
<td>5%</td>
<td>27%</td>
<td>68%</td>
<td>180</td>
<td>4.61</td>
</tr>
<tr>
<td>Social Networks</td>
<td>3%</td>
<td>22%</td>
<td>29%</td>
<td>24%</td>
<td>23%</td>
<td>171</td>
<td>3.42</td>
</tr>
<tr>
<td>Virtual Networks</td>
<td>47%</td>
<td>36%</td>
<td>12%</td>
<td>3%</td>
<td>2%</td>
<td>171</td>
<td>1.77</td>
</tr>
<tr>
<td><strong>Web-Based Technologies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.09</td>
</tr>
<tr>
<td>Course Management Tools</td>
<td>2%</td>
<td>6%</td>
<td>21%</td>
<td>37%</td>
<td>34%</td>
<td>179</td>
<td>3.97</td>
</tr>
<tr>
<td>Electronic Grading</td>
<td>1%</td>
<td>10%</td>
<td>18%</td>
<td>30%</td>
<td>41%</td>
<td>176</td>
<td>4.01</td>
</tr>
<tr>
<td>Web-Based Assignments</td>
<td>2%</td>
<td>14%</td>
<td>32%</td>
<td>24%</td>
<td>28%</td>
<td>176</td>
<td>3.61</td>
</tr>
<tr>
<td>Electronic Portfolios</td>
<td>6%</td>
<td>20%</td>
<td>25%</td>
<td>26%</td>
<td>24%</td>
<td>178</td>
<td>3.42</td>
</tr>
<tr>
<td>Bookmarking Tools</td>
<td>57%</td>
<td>26%</td>
<td>12%</td>
<td>4%</td>
<td>2%</td>
<td>171</td>
<td>1.68</td>
</tr>
<tr>
<td>Online Research Tools</td>
<td>5%</td>
<td>8%</td>
<td>21%</td>
<td>33%</td>
<td>34%</td>
<td>179</td>
<td>3.82</td>
</tr>
<tr>
<td>Web 2.0 Tools</td>
<td>18%</td>
<td>41%</td>
<td>24%</td>
<td>8%</td>
<td>9%</td>
<td>173</td>
<td>2.49</td>
</tr>
<tr>
<td>Webquests</td>
<td>35%</td>
<td>29%</td>
<td>19%</td>
<td>11%</td>
<td>6%</td>
<td>170</td>
<td>2.23</td>
</tr>
<tr>
<td>Podcasting/Vodcasting</td>
<td>17%</td>
<td>46%</td>
<td>21%</td>
<td>8%</td>
<td>8%</td>
<td>170</td>
<td>2.42</td>
</tr>
<tr>
<td>YouTube</td>
<td>6%</td>
<td>20%</td>
<td>33%</td>
<td>27%</td>
<td>15%</td>
<td>173</td>
<td>3.25</td>
</tr>
</tbody>
</table>

1=No Knowledge, 2=Knowledge, 3=Basic Use, 4=Confident Use, 5=Expert
Research Question #3: How are PE educators integrating technology in PETE courses?

The level of integration of technology in PETE courses were addressed by allowing respondents to evaluate the extent of using each technology in the PETE courses they teach. The Likert-type scale included the following criteria: 1) Not aware of the technology, 2) Aware of the technology, 3) I use the technology in class, 4) I use the technology in class and I teach my students how to teach with the technology, and 5) I use the technology in class, I teach my students how to teach with the technology, and I share and reflect on the use of the technology. The level of technology integration of each of the five technology categories is displayed in figures, while the percentages and means are reported in Table 8.

Teaching Technologies

The respondents reported highest levels of the integration of digital cameras and projectors (Figure 14). The teaching technology most frequently used in class was the projector while cell phone applications, smart boards, and handheld technologies were used the least even though many faculty were aware of these technologies. On average, a mean integration score of 3.05 and a range of 2.62 to 3.61 was reported for the integration of teaching technologies.

Physical Activity Technologies

Pedometers and heart rate monitors are the most integrated activity technologies within PETE courses (Figure 15). While 22% of faculty members use pedometers in class, 23% teach the teacher candidates how to teach with pedometers. Similarly, 22% of faculty use heart rate monitors in their courses and 24% teach teacher candidates how to
teach with heart rate monitors. PETE faculty members were aware of other physical activity technologies such as accelerometers, sport based simulators, exergames, and GPS systems but did not use them much in class or teach the students how to teach with such tools. On average, the mean integration score of physical activity technologies was 2.71 with a range of 2.24 to 3.59.

Figure 14. Perceived levels of integration of teaching technologies in PETE courses.
Figure 15. Perceived levels of integration of physical activity technologies in PETE courses.

Computer Technologies

Office tools and presentation tools were the most integrated in PETE courses while PE software and educational games were the least integrated technologies (Figure 16). Both office tools and presentation tools are used in the classroom, taught to the students with regards to using it in teaching and were reflected on its use and shared with others. The respondents reported that they were aware of educational games and PE software but these tools were not integrated as much with a mean integration score around 2.5. With a mean score of 3.34, fitness assessment tools are used in PETE courses and its integration is evenly spread between those respondents who use it in the classroom, teach to teach with it, and share and reflect on it. On average, the mean integration score of computer technologies was 3.24 with a range of 2.47 to 3.93.
Communication Technologies

Email was the communication technology that was most integrated into the PETE program while virtual networks was the least integrated tool (Figure 17). Online discussion forums were often used in class while chat rooms and social networks were not often used even though most PETE professors were aware of such tools. On average, the mean score of integration of communication technologies among the respondents was 2.59 with a range of 1.6 to 3.77. Only email had a mean integration score of above 3.0 while other tools’ mean integration score ranged from 1.6 to 2.81.
Web-Based Technologies

Figure 18 displays the web-based technologies that have a mean integration score higher than 3.0. The integration scores are evenly distributed with most of the emphasis on in class use. The integration scores range from 3.09 to 3.43. The respondents reported highest integration scores on course management tools. Figure 19 displays the web-based technologies that have a mean integration score less than 3.0. Bookmarking and webquests were the two technologies reported least integrated in PETE courses. Of these five technologies, most respondents are aware of the tools but do not often integrate them into the classroom. The integration scores of these tools range from 1.51 to 2.97. On average, the mean integration score of all web-based technologies is 2.72 with a range between 1.51 and 3.43.

Figure 18. Perceived levels of integration of web-based technologies in PETE courses part 1.
Table 8 reports the percentages of the integration scores reported by PETE professors. On average, the mean integration score of the different technology categories is 2.86 with a range between 2.59 and 3.05. Teaching technologies are the only group of technologies where the integration score is higher than 3.0. The top five technologies reported to be mostly integrated into the PETE program are office tools, presentation tools, email, pedometers, and projectors. The five lowest integrated technologies in PETE programs are bookmarking tools, virtual networks, web quests, podcasting, and chat rooms.

When analyzing the overall average percentages at each level of integration the data reveal that respondents were mostly aware of the technologies. The mean integration score of all the technologies combined was 2.83. This indicates that most PETE faculty members are either aware of the technologies or use the technologies in class.
Table 8  
*Levels of Perceived Technology Integration of PETE Faculty in PETE Courses*

<table>
<thead>
<tr>
<th>Technology</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Responses</th>
<th>Mean</th>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Projector</td>
<td>1%</td>
<td>6%</td>
<td>53%</td>
<td>19%</td>
<td>22%</td>
<td>178</td>
<td>3.57</td>
</tr>
<tr>
<td>Smart Board</td>
<td>6%</td>
<td>50%</td>
<td>25%</td>
<td>10%</td>
<td>9%</td>
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<tr>
<td>Handheld</td>
<td>5%</td>
<td>50%</td>
<td>21%</td>
<td>10%</td>
<td>14%</td>
<td>175</td>
<td>2.78</td>
</tr>
<tr>
<td>Digital Camera</td>
<td>2%</td>
<td>19%</td>
<td>26%</td>
<td>22%</td>
<td>31%</td>
<td>178</td>
<td>3.61</td>
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<tr>
<td>Cell Phone Applications</td>
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<td>16%</td>
<td>9%</td>
<td>11%</td>
<td>175</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pedometer</td>
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<td>27%</td>
<td>17%</td>
<td>22%</td>
<td>33%</td>
<td>181</td>
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<tr>
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<td>7%</td>
<td>5%</td>
<td>8%</td>
<td>176</td>
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<tr>
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<td>17%</td>
<td>22%</td>
<td>24%</td>
<td>179</td>
<td>3.31</td>
</tr>
<tr>
<td>Sport Based Simulators</td>
<td>6%</td>
<td>70%</td>
<td>7%</td>
<td>6%</td>
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<td>Exergames</td>
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<tr>
<td>GPS Systems</td>
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<td>8%</td>
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<td>Fitness Assessments</td>
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<td>3.93</td>
</tr>
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<td>32%</td>
<td>31%</td>
<td>34%</td>
<td>180</td>
<td>3.93</td>
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<tr>
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</tr>
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<td>8%</td>
<td>11%</td>
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<td>180</td>
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<td>1%</td>
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<td></td>
</tr>
<tr>
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<td>22%</td>
<td>18%</td>
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<td>51%</td>
<td>20%</td>
<td>13%</td>
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<td>3.28</td>
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<td>15%</td>
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<td>19%</td>
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<td>175</td>
<td>3.24</td>
</tr>
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<td>3%</td>
<td>168</td>
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</tr>
<tr>
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<td>2.97</td>
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<td><strong>36%</strong></td>
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<td><strong>11%</strong></td>
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<td>23%</td>
<td>13%</td>
<td>14%</td>
<td>176</td>
<td>2.83</td>
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</tbody>
</table>

1=Not Aware, 2=Aware, 3=In Class Use, 4=Teach to Teach, 5=Share & Reflect
The data revealed that proficiency scores averaged at a basic use level
(proficiency level 3-3.39) and integration scores average at the awareness level
(integration level 2-2.82). The means of all technologies for the level of proficiency and
integration are compared in Table 9. Results indicated that all integration scores are lower
than proficiency scores between the technologies respectively.

Table 9

Comparison of Proficiency and Integration Means between all Technologies

<table>
<thead>
<tr>
<th>Technology</th>
<th>Proficiency Mean</th>
<th>Integration Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Teaching Technologies</strong></td>
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<tr>
<td>Projector</td>
<td>4.36</td>
<td>3.57</td>
</tr>
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<td>Smart Board</td>
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<td>2.65</td>
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<td>Handheld</td>
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<td>2.78</td>
</tr>
<tr>
<td>Digital Camera</td>
<td>4.13</td>
<td>3.61</td>
</tr>
<tr>
<td>Cell Phone Applications</td>
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<td>2.62</td>
</tr>
<tr>
<td><strong>Physical Activity Technologies</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pedometer</td>
<td>4.35</td>
<td>3.59</td>
</tr>
<tr>
<td>Accelerometer</td>
<td>2.64</td>
<td>2.21</td>
</tr>
<tr>
<td>Heart Rate Monitor</td>
<td>4.01</td>
<td>3.31</td>
</tr>
<tr>
<td>Sport Based Simulator</td>
<td>3.15</td>
<td>2.44</td>
</tr>
<tr>
<td>Exergames</td>
<td>3.09</td>
<td>2.47</td>
</tr>
<tr>
<td>GPS Systems</td>
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<td>2.24</td>
</tr>
<tr>
<td><strong>Computer Technologies</strong></td>
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<tr>
<td>Fitness Assessments</td>
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<td>3.34</td>
</tr>
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<td>PE Software</td>
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<td>2.47</td>
</tr>
<tr>
<td>Educational Games</td>
<td>2.92</td>
<td>2.51</td>
</tr>
<tr>
<td>Office Tools</td>
<td>4.38</td>
<td>3.93</td>
</tr>
<tr>
<td>Presentation Tools</td>
<td>4.39</td>
<td>3.93</td>
</tr>
<tr>
<td><strong>Communication Technologies</strong></td>
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</tr>
<tr>
<td>Online Discussion Forum</td>
<td>3.33</td>
<td>2.81</td>
</tr>
<tr>
<td>Chat Rooms</td>
<td>2.93</td>
<td>2.28</td>
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<tr>
<td>Email</td>
<td>4.61</td>
<td>3.77</td>
</tr>
<tr>
<td>Social Networks</td>
<td>3.42</td>
<td>2.47</td>
</tr>
<tr>
<td>Virtual Networks</td>
<td>1.77</td>
<td>1.6</td>
</tr>
<tr>
<td><strong>Web-Based Technologies</strong></td>
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<td></td>
</tr>
<tr>
<td>Course Management Tools</td>
<td>3.97</td>
<td>3.43</td>
</tr>
<tr>
<td>Electronic Grading</td>
<td>4.01</td>
<td>3.28</td>
</tr>
<tr>
<td>Web-Based Assignments</td>
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</tr>
<tr>
<td>Electronic Portfolios</td>
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<td>3.15</td>
</tr>
<tr>
<td>Bookmarking Tools</td>
<td>1.68</td>
<td>1.51</td>
</tr>
</tbody>
</table>
Online Research Tools 3.82 3.24
Web 2.0 Tools 2.49 2.31
Webquests 2.23 1.99
Podcasting/Vodcasting 2.42 2.21
YouTube 3.25 2.97

3.39 2.82

Research Question #4: What factors affect technology use of PETE faculty within the PETE programs?

The factors that can affect technology integration were found in the literature. This section provides the results to the question of whether personal use and proficiency predict the technology integration levels of PETE faculty. In addition, other factors that may aid or discourage the process of integration are explored.

Personal Use

One of the factors often reported in the literature in relation to the integration of technology is the use of the technology in an individual’s personal life. The survey asked respondents to report whether they used the technology in their personal life (yes) or whether they did not (no).

Teaching Technologies

The respondents reported that they most often used digital cameras and cell phones in their personal life in comparison to other teaching technologies (Figure 20). Smart Board technology was used the least (29%). Over 50% of the participants also used projectors and handheld technologies within their personal life.
Physical Activity Technologies

Pedometers and heart rate monitors are the only two physical activity technologies used over 50% in the personal lives of PETE faculty (Figure 21). Personal use of accelerometers had the lowest scores (15%).

Figure 20. Percentages of personal use of teaching technologies.
Figure 21. Percentages of personal use of physical activity technologies.

**Computer Technologies**

Respondents reported most of their personal use of computer technologies to be office tools (99%) and presentation software (95%) (Figure 22). Fitness assessment programs, educational games and PE software were the least used in personal life of PETE faculty.
Communication Technologies

Almost all PETE faculty members indicated use of email in their personal life (99%) (Figure 23). Over 50% of PETE faculty members use social network sites to communicate in their personal life. The least used communication tool was virtual network sites (5%).
Figure 23. Percentages of personal use of communication technologies.

**Web-based technologies**

Figure 24 shows the web-based technologies most often used in the personal lives of PETE faculty members while figure 25 shows the least used web-based technologies. Online databases are most often used (86%). The least used web-based technologies were bookmarking tools, webquests, and podcasting technologies. Web-based assignments, YouTube, electronic portfolios and distribution of grades as well as course management tools are used by more than 50% of the respondents.
Figure 24. Percentages of personal use of first group of web-based technologies.

Figure 25. Percentages of personal use of second group of web-based technologies.
Multiple Regression

Literature shows that personal use and proficiency may influence the level of a person’s integration of technology. A multiple regression analysis was used to test if personal use and proficiency significantly predicted the level of technology integration of PETE faculty members. The results are organized according to the different technology categories. Overall, the results of the regression indicated that proficiency significantly predicted the level of integration of technology among PETE faculty while personal use only significantly predictor integration levels with certain technologies.

Teaching Technologies

Teaching technologies outlined in Table 10 showed that personal use and proficiency predictors combined explained between 32% and 61% of the variance (p<.001). It was found that proficiency significantly predicted the integration of teaching technologies (p<.001). Personal use of projectors and smart board technology significantly predicted the integration of these technologies (p<.001). However, personal use of handheld technologies, digital cameras and cell phone applications did not significantly predict integration (p>.05).
Table 10

Summary of Standardized Regression Analysis of Variables Predicting Technology Integration of Teaching Technologies

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Predictor</th>
<th>R</th>
<th>R-squared</th>
<th>F-statistic</th>
<th>p-value</th>
<th>t-statistic</th>
<th>p-value</th>
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<td>.57</td>
<td>.32</td>
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<td>&lt;.001</td>
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<td>Personal Use</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Proficiency</td>
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<td></td>
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<td>Smart Board</td>
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<td>.61</td>
<td>135.70</td>
<td>&lt;.001</td>
<td>4.52</td>
<td>&lt;.001</td>
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<td>Personal Use</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
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<td>Proficiency</td>
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<td>1.94</td>
<td>.05</td>
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<td>Digital Camera</td>
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<td>.39</td>
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Physical Activity Technologies

All physical activity technologies outlined in Table 11 showed that the two predictors combined explained between 37% and 52% of the variance (p<.001). It was found that proficiency significantly predicted the integration of all physical activity technologies (p<.001). Personal use of pedometers and heart rate monitors significantly predicted the integration of these technologies (p<.001). However, personal use of accelerometers, sport based simulators, exergames, GPS technologies did not significantly predict integration (p>.01).
Table 11

*Summary of Standardized Regression Analysis of Variables Predicting Technology Integration of Physical Activity Technologies*

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Predictor</th>
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<th>p-value</th>
<th>t-statistic</th>
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<td>3.82</td>
<td>&lt;.001</td>
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<td>&lt;.001</td>
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<tr>
<td>Sport Based Simulators</td>
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<td>.38</td>
<td>52.93</td>
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<td>.09</td>
<td>.93</td>
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<td>&lt;.001</td>
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<tr>
<td>Exergames</td>
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<td>.41</td>
<td>46.93</td>
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<td>.11</td>
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<td></td>
<td>Proficiency</td>
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<td>&lt;.001</td>
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<tr>
<td>GPS</td>
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<td>.44</td>
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<td></td>
<td></td>
<td>8.08</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

**Computer Technologies**

All computer technologies outlined in Table 12 showed that the two predictors combined explained between 22% and 70% of the variance (p<.001). It was found that proficiency significantly predicted the integration of all physical activity technologies (p<.01). Personal use of fitness assessment tools, PE Software, and educational computer games significantly predicted the integration of these technologies (p<.01). However, personal use of office tools, and presentation tools did not significantly predict integration (p>.01).
### Table 12

**Summary of Standardized Regression Analysis of Variables Predicting Technology Integration of Computer Technologies**

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Predictor</th>
<th>R</th>
<th>R-squared</th>
<th>F-statistic</th>
<th>p-value</th>
<th>t-statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fitness Assessment</td>
<td>Personal Use</td>
<td>.80</td>
<td>.65</td>
<td>159.58</td>
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<td>4.07</td>
<td>&lt;.001</td>
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<tr>
<td></td>
<td>Proficiency</td>
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<td></td>
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<td></td>
<td>14.26</td>
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<tr>
<td>PE Software</td>
<td>Personal Use</td>
<td>.84</td>
<td>.70</td>
<td>206.75</td>
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<td>4.87</td>
<td>&lt;.001</td>
</tr>
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<td></td>
<td>Proficiency</td>
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<td></td>
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<td>13.90</td>
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<tr>
<td>Educational Computer Games</td>
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<td>.83</td>
<td>.69</td>
<td>196.03</td>
<td>&lt;.001</td>
<td>6.01</td>
<td>&lt;.001</td>
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<td>Office Tools</td>
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<td>-.74</td>
<td>.46</td>
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<td></td>
<td>6.87</td>
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</tr>
<tr>
<td>Presentation Software</td>
<td>Personal Use</td>
<td>.56</td>
<td>.31</td>
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<td>.02</td>
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<td>Proficiency</td>
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<td></td>
<td></td>
<td></td>
<td>7.01</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

#### Communication Technologies

All communication technologies outlined in Table 13 showed that the two predictors combined explained between 12% and 44% of the variance (p<.001). It was found that proficiency significantly predicted the integration of all communication technologies (p<.001). Personal use of online discussion forums, and chat rooms significantly predicted the integration of these technologies (p<.001). However, personal use of email, social networks, and virtual networks did not significantly predict integration (p>.01).
Summary of Standardized Regression Analysis of Variables Predicting Technology Integration of Communication Technologies

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Predictor</th>
<th>R</th>
<th>R-squared</th>
<th>F-statistic</th>
<th>p-value</th>
<th>t-statistic</th>
<th>p-value</th>
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<td>.001</td>
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<tr>
<td></td>
<td>Proficiency</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chat Rooms</td>
<td>.67</td>
<td>.45</td>
<td>71.55</td>
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<td>5.61</td>
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<td>Proficiency</td>
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<td>Email</td>
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<td>.04</td>
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<td></td>
<td>Proficiency</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social Networks</td>
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<td>.73</td>
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<td></td>
<td>Proficiency</td>
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<td></td>
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<tr>
<td>Virtual Networks</td>
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<td>Proficiency</td>
<td></td>
<td></td>
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</table>

Web-Based Technologies

All web-based technologies outlined in Table 14 showed that the two predictors combined explained between 36% and 73% of the variance (p<.001). It was found that proficiency significantly predicted the integration of all web-based technologies (p<.001). Personal use of e-portfolios and course management tools significantly predicted the integration of these technologies (p<.001). Personal use of Web 2.0 tools, webquests, web-based assignments, electronic grading, and podcasting significantly predicted the integration of these technologies at the <.05 level. However, personal use of bookmarking and online databases did not significantly predict integration (p>.01).
Table 14

*Summary of Standardized Regression Analysis of Variables Predicting Technology Integration of Web-Based Technologies*

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Predictor</th>
<th>R</th>
<th>R-squared</th>
<th>F-statistic</th>
<th>p-value</th>
<th>t-statistic</th>
<th>p-value</th>
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<tr>
<td>e-Portfolios</td>
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<td>8.93</td>
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<td>Bookmarking</td>
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<td>Web 2.0 Tools</td>
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<td>Webquests</td>
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<td>&lt;.001</td>
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<td>Podcasting</td>
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<td>.05</td>
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<td>Course Management Tools</td>
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<td>1.51</td>
<td>.134</td>
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<td></td>
<td></td>
<td></td>
<td>7.63</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

**Additional Factors**

PETE faculty members were provided with 14 different factors, as described in the literature that could influence their level of integration of technology in PETE courses (Figure 26). A zero to four scale was used for respondents to explain the extent the
additional 14 factors influenced their current use of technology in PE courses, zero being the factor that does not influence their use of technology to 4 being a factor that strongly influences the use of technology.

The respondents reported that knowledge of how to use the technology had the most influence on the choice to use or integrate a technology ($\alpha = 3.62$). Knowledge on how to integrate the technology, financial support, and the motivational aspects technology brings to the students were also strong factors that influenced the integration of technology in PE courses ($\alpha = 3.46 - 3.54$). Fear of failure when using the technology in class ($\alpha = 1.91$) and unsupportive colleagues ($\alpha = 1.75$) were reported to be factors that influenced the integration of technology the least.

As an extra measure to explore any additional factors influencing integration of technology in PETE courses, the respondents were allowed to add other factors that were not mentioned in figure 26. The two most prominent factors PETE faculty mentioned were the availability and access to the technologies and the time it takes to learn a technology. Other factors mentioned were: “mandates from the administration for more online delivery of course materials, availability of a technology lab space, the organization and management of the faculty, availability of training, personal interest and motivation, the impact technology has on learning, and the inability to keep up with the current development of technology.”
Research Question #5: How do PETE programs approach technology integration according to the perceptions of the PETE faculty members?

The final question asked in the survey consisted of three parts. First, PETE faculty members reflected on what was currently happening in the program in relation to the integration of technology. Second, Pete faculty members reflected on what they believed should be happening in regards to the integration of technology. Finally, PETE faculty provided additional information related to the integration of technology within their program. The first and second part provided quantitative results while the final part required qualitative interpretation.

Current Integration of Technology at the Program Level

In figure 27, the reflections of PETE faculty members are portrayed in relation to what they believed was currently happening (yes), or not currently happening (no) as far
as the integration of technology within their program. The option “I don’t know” was also provided. Over 80% of the respondents reported that technology use must be shown within student teaching experiences and technology is mentioned in the syllabus. More than 70% reported that the program does assess the use of technology. On average, PETE programs often provide a separate course in technology in PE; they collaborate on technology use and often have someone in the faculty that is considered a technology guru. Less than 40% of the respondents reported that technology is integrated throughout the program and they use a technology plan to integrate technologies across PETE courses.

![Figure 27. Current technology integration practices in PETE programs.](chart)

<table>
<thead>
<tr>
<th>Practice</th>
<th>Yes (%)</th>
<th>No (%)</th>
<th>I Don't Know (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student teaching evidence</td>
<td>85</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Technology in syllabus</td>
<td>82</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Assessment of technology applications</td>
<td>76</td>
<td>20</td>
<td>14</td>
</tr>
<tr>
<td>Separate PETE technology course</td>
<td>52</td>
<td>41</td>
<td>41</td>
</tr>
<tr>
<td>Collaboration on technology integration</td>
<td>49</td>
<td>49</td>
<td>41</td>
</tr>
<tr>
<td>Technology guru in faculty</td>
<td>46</td>
<td>49</td>
<td>41</td>
</tr>
<tr>
<td>Technology plan</td>
<td>39</td>
<td>51</td>
<td>41</td>
</tr>
<tr>
<td>Technology integrated throughout program</td>
<td>19</td>
<td>78</td>
<td>41</td>
</tr>
</tbody>
</table>
**Beliefs of Integration of Technology at the Program Level**

PETE faculty members reflected on what they believed should happen in the PETE program in regards to the integration of technology (Figure 28). Over 80% of PETE faculty members believed that technology should be included in student teaching, faculty should be required to attend technology training sessions, technology expectations should be mentioned in the syllabus, and PETE students should be assessed on their use of technology. A major difference in current events and beliefs is that while currently less than 50% of programs have a technology plan to guide the technology integration process, more than 80% believe that there should be one implemented in the program. Additionally, while less than 20% of PETE programs currently collaborate on the integration of technology, more than 80% of faculty members believe that should happen.

![Figure 28. PETE faculty’s beliefs on technology integration within a PETE program.](chart.png)
Results indicate that 52% of PETE faculty members reported to work in a program that offers a separate technology course while 52% of PETE faculty believes there should be separate technology course. To further analyze the relationship between those faculty who stated they have a PE technology course and those who believed that there should be one, a Chi-square test was completed (Table 15). PETE Faculty members who currently have a PETE technology course are significantly more likely to believe that there should be a course (65.7%) than those who believe there shouldn’t be a course (35.8%).

Table 15

Chi-Square Results of Technology Course in PETE Programs

<table>
<thead>
<tr>
<th></th>
<th>Believes there should be a PE technology course</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Currently has a PE technology</td>
<td></td>
</tr>
<tr>
<td>course in the program.</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>67</td>
</tr>
<tr>
<td>No</td>
<td>29</td>
</tr>
<tr>
<td>Total</td>
<td>96</td>
</tr>
</tbody>
</table>

X² (1, N=183) = 16.17, p <.01

Perceptions of the Integration of Technology in PETE: Qualitative Data

The respondents were able to discuss anything related to the integration of technology within their own program. Given the breath of these findings, quotes were analyzed and organized into themes. The three major themes can be described as: (1) Current applications of technology in PETE, (2) Technology integration concerns, and (3) The purpose of technology integration in PETE.
Current applications of technology in PETE

Respondents shared information on what types of technologies are currently used, and how they used such technologies within their programs. The following quotes are examples of what type of technologies are currently used within PETE programs:

We use pedometers, HR monitors, You-Tube, Electronic folios, Electronic grading, Power Point, D2L (formerly used WebCT and Blackboard), TK20, Smart Boards, Computer lab in building, projection and multi-media linked smart classrooms, Tri-Fit; FITNESSGRAM, Facebook, Web pages, Dartfish movement analysis software, PE Metrix.

We have an exergame motor lab that consists of an Izone, Wiis, Xavix and Treadwall equipment. We also have ordered a Trazer and a 3 kick. Flip cam as well as regular camcorders are used in various method classes.

I use Blackboard, with blogs, collaboration (chat discussion), electronic grade distribution, electronic assignment submission, video streaming, and discussion boards. I teach hybrid courses where students meet in person and do some work online.

Next to outlining the types of technologies, respondents also reported on specific ways of using such tools.

Electronic portfolios are required starting with last year's freshman--started in Intro class and will work on it each year via my classes. Require purchase of pedometer and heart rate monitors for Teaching Health related fitness class and require a technology-related lesson.

We have recently implemented an instructionally technology (IT) course for undergraduates in the semester prior to student teaching. In that class students are taught to use various instructional technologies in PE. They are then assigned a specific technology that they need to use during student teaching. They develop an action research project in student teaching that they then present in poster format.

A final reflection on the application of technology within PETE programs addressed the different ways PETE faculty teach with and about technology. One respondent explained the need to add a pedagogy focus when teaching technologies: “I think we do a good job with basic stuff--power point, digital cameras, blackboard, etc.
But probably not enough on how to do/use technology in the school physical education setting.”

**Technology integration concerns**

Many respondents reported various concerns in relation to the integration of technology including: the lack of technology access in K-12 schools, issues with collaboration at the program level, difficulties of keeping up with the abundance of technology, training concerns, and issues with support.

**Technology access in K-12 schools**

Various respondents discussed the disconnect that exist in technology availability across K-12 schools.

During student internship, very few placements are exposed to or are able to use much technology in current school systems. Therefore, students experience little need for much technology in "PE". Not stressed or available ($) in most schools in our area.

We have to do our tech use assessments in their methods courses, as student teaching placements vary widely in terms of on-site available technology. Grappling with gap between a few local schools having great access to and innovative uses of tech (e.g., smart boards, activ slates) and what we have access to and want to integrate in future. Also, some local schools have zero tech resources.

One respondent expressed that the “The biggest problem is people in the schools do not have the technology nor are they willing to learn it.” According to responses, a large gap in the technology access and openness to learning technology within K-12 schools appears within and across districts, which makes technology integration during student teaching extremely difficult. Some PETE faculty members reported including technology access as one of the factors they evaluate when locating various practica sites and considering placements.
Collaborating on technology integration

A variety of responses addressed the need to collaborate on technology used within a program in order not to overload specific courses with too much technology.

One respondent specifically mentions “training and department collaboration on how we can best offer our students a stronger knowledge base for using technology in the PE setting for planning and instruction.” Another respondent explained the collaborative process that he or she is currently involved in:

Faculty, (there are 11 of us) decide what technology needed, what level of proficiency, and then what course should take the lead to teach it. Additional courses use the technology, but one takes the lead to teach its use. Typically, a GA is available for individual student tutoring or to do group instructional sessions outside class on a particular technology. For example, the assessment class devotes one meeting to electronic grade books, and the GA helps teach that, and provides additional help to individual students. But the next semester, electronic grade are expected to be used as part of the course in clinical teaching.

Some programs have experimented with separate technology courses and are seeing the benefits of collaboration: “We are currently restructuring the technology integration in our PETE program. Within the past several semesters we have integrated a stand-alone technology integration course in our PETE program, while simultaneously enhancing the technology stranded throughout our other required PETE courses.”

Several mention their disappointment in the lack of collaboration:

Several colleagues are working on this, but it is not an integrated, program-wide effort, unfortunately.

There is a college technology course all PETE majors now must take. I don't think it is sufficient for us.

We have a required technology course, but that is the basic extent of the connection our program makes with technology and teaching with it. We are very much limited by faculty who choose not to learn technology or feel it's not important to educate our students on it or how to teach with it.

How do you keep up?
Several respondents explained their frustrations with the abundance of technology and the struggle to keep up with it all while teaching quality PETE courses. Some examples of those frustrations are shown in the following quotes:

- Hard to keep up with tech - we are using heart rate monitors in different courses and I go to conferences and hear about new physical activity equipment. Want to add/do more and more with technology but finding I need to be realistic in terms of baby steps moving forward, timing of integration, and seeking admin/financial support.

- I am always trying to stay as current as possible with the amount of time available. It is challenging to stay up with all the changes in technology, but very important to try as hard as you can.

**Support**

The findings show that administrative support and funding has an influence on the level of technology integration at the PETE program level. More specifically, examples of both positive effects of support and negative results of limited support are provided in these findings. Positive gains from accessing adequate support appears when grants are accessible and achieved as in the following examples:

- We are very much supported by our administration and by Technology Grants that are available to those with the gumption to write the grant.

- We are in a brand new facility with upgraded technology. In addition, the university has a technology plan so we do not have to beg for software or use of the technology. We also have Dartfish on 25 computers in our technology lab in the PE complex.

- We use technology a lot in our program. Most of the technology is purchased through grants, and used in a variety of courses.

- When the grant process is unsuccessful or when there is a lack of support from administration, the integration of technology suffers as described in the following examples:
We have done some unsuccessful grant writing with Polar in an effort to fund equipment to upgrade technology for physical activity assessment. The cost of technology equipment has been a limiting factor in us using it more.
We do not have administrative support or the resources needed to update our classroom with the current technology.
We are weak and it is based on the lack of funding and support we are provided by the college. Technology is necessary for PETE programs.
Need more time/money for the purchase of technology and its integration.
Difficult request during these current economic times

**Training**
Even though support may be provided, the findings show that training is often not included in the type of support allocated to integrate technology in the program. Various faculty members expressed their frustrations with the lack of training in the area of technology integration in PETE, mainly due to the inaccessibility to training and the time it takes to learn how to teach with a technology. Some examples of these frustrations are:

I taught in a local high school for 30 years prior to retirement and being hired as an instructor in our PETE program. I had more access to technology and training in my public school career.

[Technology is] important for self and my students to experience and use but time consuming in terms of planning and quality integration.

We have secured a large grant to integrate technology into our PETE program. However, I feel a bit frustrated about the lack of training that faculty are receiving.

Some faculty members believe in the importance of technology training within the program and their responses are related to the quality of the training PETE faculty should be exposed to. On the question of whether or not PETE faculty should receive training, one respondent answered: “… to me is it depends on what we need our candidates to learn. Of course we need technology training, but I don't want to use technology because it's there. The technology must be used for learning outcomes.” One
PETE faculty member reported that having someone on staff with a strong background in the use of technology can enhance the program:

Faculty struggling to get enough tutoring to use it effectively and fully integrated into course management. - we have an exceptional Polar scholar working in our program and he is key to the success of technology in our program at this point.

Overall, PETE faculty expressed that they would integrate technology if the above concerns were addressed. To put it in the voice of a respondent: “I would be more likely to utilize technology if our institution provided easy access to training, educational workshops, and one-on-one instruction in the tools available on campus.”

**Perceptions on the purpose of integrating technology in physical education**

A final theme within the qualitative findings was associated with the perceptions of PETE faculty members about the purpose of integration of technology and how technology stands in relation to other priorities in PETE. One respondent expressed an opinion in support to the integration of technology: “We continue to work toward the use of technology that will enhance my students’ background and be used with future learners.” While a few other PETE faculty members expressed their disapproval in the integration of technology in PETE:

The push toward integrating technology into a movement field such as Physical Education is counterproductive. Forcing students to learn to use technologies in a PETE program that don't exist in public schools wastes time and energy.

I am not interested in technology as much as the younger professors. I was not brought up nor educated in the technology era and really don't plan to use very much tech.

Other faculty members conveyed to have mixed feelings about the integration of technology in PETE. One faculty member commented that technology may negatively affect the promotion of maximum physical activity levels in physical education:
The other piece is that philosophically many of us believe forcing the use of technology takes from maximum PA time in a quality PE class. There are times technology can be a great learning tool, but it does not always enhance the learning. With 1 year in high school, one semester a year in middle school, and 2 days a week in elementary, there are other priorities. Technology in a PE class is the new "band wagon" as opposed to investigating it as a tool to aid in learning. For a profession that is encouraging a decrease in "screen time" we do not need to contradict ourselves.

Other mixed feelings were expressed related to the quality of instruction in relation to technology integration:

I am conflicted with technology in PE in general though. If you have a teacher that embraces it and incorporates it well, wonderful. However, I do not feel that technology integration is necessary for quality instruction in PE, and resent the standards that state that PE must incorporate technology. Such standards seem to fit an overall agenda to make sure our students are competent in the use of technology. That's great in general, but to suggest that it must happen in movement based discipline is unnecessary for promoting quality PE.

Finally, the findings indicated mixed feelings that arose from the idea that pedagogy should inform technology and not the other way around. The following quotes express this notion:

Technology is a great thing to use and incorporate. However, the ability to teach should be supported by the use of technology not the other way around.

I have mixed feelings about integration of technology as a key aspect of PETE- I use it when it makes sense and you ways for my students to show me what they know and can do.

Technology is a tool to make teaching easier and sometimes more effective. However, it is not a tool that is more important that pedagogical knowledge and skill.

We believe it is a useful tool and should in no way minimize critical thinking and particularly activity. We do not want candidates to become technology dependent - activity must be accessible without technology, rather with fresh air and friends.
CHAPTER 5: DISCUSSION, RECOMMENDATIONS AND CONCLUSION

Introduction

The integration of technology in physical education teacher education has the potential to impact the learning of physical education teacher candidates as well as their future K-12 students. Past studies revealed that computer technologies have been integrated at the PETE level, yet the benefits of many other types of technologies have been exposed through mainly K-12 practitioners’ experiences. With the ever changing nature of technologies that expose their potential within PE, a new study focusing on technology in PETE was necessary. More specifically, this study considered the perceptions of teacher educators on the integration of current technologies at the PETE program level. The purpose of this survey research was to analyze the current scope of technology infusion in accredited PETE programs within the USA. In addition, this study examined the factors that aid and hinder the process of technology integration. Finally, the study aimed to reveal what technologies are being integrated and how integration is approached within PETE programs.

This chapter is organized into three sections: (a) discussion, (b) recommendations, and (c) conclusion. Each research questions was outlined and discussed according to the interpretations of the results found in Chapter 4 and in respect to the relevant literature as outlined in Chapter 2. Recommendations for further research as well as suggestions for the integration of technology within PETE programs were also shared in this chapter.
Discussion

Technologies within PETE

A list of technologies was provided and the participants were asked to share if they used the tools in the classroom. The results indicated that PETE programs are using a variety of technologies within PETE courses, yet, the majority of tools currently used are those related to traditional computer technologies. Technologies such as projectors, office tools, presentation software, email, electronic grading and course management tools are very common in higher education in general. Provided that many courses are taught within a classroom setting at the higher education level, such tools would benefit learning and teaching of any subject. These results correspond with an earlier study on the use of technology in PETE programs done by DelTufo (2000). The results of his study indicated that PETE students are exposed to computer technology within the methods courses. Evidence indicated that many teacher candidates were exposed to a variety of computer technologies such as the Internet, word-processing, spreadsheets, databases, digital imaging, assessment software, and distance learning (DelTufo, 2000).

Next to computer technologies, the results of this study indicated that quite a few teacher educators are using some technologies related specifically to the instruction of physical education, such as pedometers, heart rate monitors, and digital cameras. In 2000, Lindauer found that students within NCATE PETE programs were better prepared to use digital video, heart rate monitors, and pedometers in relation to PETE programs from non-NCATE accredited schools. Similarly, DelTufo (2000) found that digital cameras, fitness assessment tools and heart rate monitors were often included within the PETE curriculum.
Portfolio’s, while included within DelTufo’s research, did not show that it was significantly used at that time (2000). However, this study indicated that in relation to DelTufo’s research, PETE programs are observing the benefits of incorporating digital portfolios in physical education. While this study only asked about electronic portfolios, it is important to know that there may be some programs within this study that use paper based portfolios. The popularity of using portfolios in higher education, especially electronic portfolios have been growing since the mid 90’s (Batson, 2002). Portfolios allow for a more authentic assessment of student learning both at the higher education level and within K-12 schools. Batson stated that due to the accessibility of the web, students and faculty are freed from paper and e-portfolios may just be the biggest technology innovation on campus. E-portfolio developers are creating a variety of platforms that allows students to incorporate teaching videos, audio, graphics, and other animations that may allow for a more authentic evaluation of student performance (Batson, 2002). As a result, teacher education programs are using digital or e-portfolios to document and demonstrate the teacher candidates’ growth and development within the program as well as their achievement of the standards of content knowledge (Horton, 2004).

While computer technology, digital cameras, fitness assessment, heart rate monitors and pedometers have been embraced by most PETE programs, other technologies that have shown benefits in enhancing student learning have not. This study revealed that web 2.0 tools, bookmarking tools, podcasting, vodcasting, GPS, webquests, accelerometers, virtual/social networks, handheld technologies, and exergames were used the least in PETE programs. While the investigator could vindicate for all these tools (as
illustrated in Chapter 2), the results illustrated that researchers and practitioners using such tools must find a way to share the positive benefits of such tools with PETE faculty members.

With an abundance of new technologies and the possibilities of the web, it is important for PE professionals to share their expertise through workshops, webinars (online workshops), research articles, and conference sessions. Additionally, there is a need to connect PETE programs with what tools are currently being used in K-12 physical education. Roby and Dehler (2010) mention the importance of identification of educational technologies and technology skills that are needed for current and future teachers. Murphy, Richards, Lewis, and Carman (2005) echo this assertion and advocate for a restructuring of both teacher preparation programs and current K-12 schools as it relates to the integration of technology. A study was done to investigate the collaboration between higher education and K-12 schools and it was found that an ongoing discussion about the current practical applications of teaching and learning enhances the level of integration of technology for practitioner and faculty and transformed the practice of all involved (Murphy, Richards, Lewis, and Carman, 2005).

**Technology Proficiency**

Research confirmed that in order to infuse technology effectively in teacher education programs, K-12 teachers and teacher educators must be skilled in a variety of technology applications (Carlson & Gooden, 1999; Vannatta and O’Bannon, 2002). Within the survey, participants were asked to rate their level of proficiency on the list of provided technologies. A 5-point Likert-scale was provided to guide this process. PETE faculty found themselves most skilled in using teaching technologies and computer
technologies followed by physical activity technologies, communication technologies and web-based technologies.

However, on average, PETE faculty members did not feel confident in using any technologies. Rather, they perceived their skill level to be limited to basic use. For the majority of web based tools PETE faculty perceived to have knowledge of such tools, yet do not use them. The results showed that technology proficiency does vary across and within technologies categories. The highest proficiency levels within this study were in general computer tools, course management tools, email, projectors, digital cameras, pedometers and heart rate monitors. Moderate proficiency levels were reported with fitness assessment software, social networks, online discussion forums, electronic portfolios, web based assignments, and online databases. PETE faculty reported low proficiency levels in relation to the use of smartboards, handheld technologies, accelerometers, exergames, sport based simulators, GPS, PE software, educational games, chatrooms, virtual networks, bookmarking, podcasting, vodcasting, webquests, Youtube, and Web 2.0 tools.

This study revealed similar results as earlier work on the integration of technology in teacher education completed by Vannatta (1999). Vannatta reports moderate to high proficiency levels in the area of general computer use, word processing, and email. However, Vannatta’s study was completed within general education programs and not physical education. Provided that no other studies within PETE programs have specifically investigated the proficiency levels of PETE educators on physical education specific technologies, no data can be used to compare these results. Later in this chapter
the results relating proficiency to the levels of technology integration are discussed and specific recommendations are presented.

**Technology Integration**

Teachers often teach by example (Bennett, 1991; Adamy & Heineche, 2005). The use of technology by pre-service or beginning teachers is often influenced by how they have been taught in their teacher preparation program. Even further, those new teachers will be impacting students for the next 30 years (Handler, 1993). It is therefore crucial to investigate the teaching practices of current PETE educators in relation to the use of technology. Within this study, the perceived level of integration was examined using a 5-point scale that ranged from (1) no integration, (2) aware but no use, (3) to using technology in the classroom, (4) to teaching the teacher candidates how to teach with the technology, to (5) sharing and reflecting on the appropriate use of the technology. This study used a combination of the Howland and Wedman (2004) five phase cycle and the Technological Pedagogical Content Knowledge Framework by Mishra and Koehler (2006) to analyze the level of technology integration of PETE professors.

When examining the technology categories, PETE professors used teaching technologies and computer technologies in class and were aware of physical activity technologies, communication technologies, and web based technologies. More specifically, office tools and presentation software, digital camera, pedometers, fitness assessment, and heart rate monitors were the few tools that obtained the highest scores in integration. On average, PETE educators perceived that they teach the pre-service PE teacher how to teach with these tools. These results reflected that the most common tools
used in K-12 physical education are being integrated within the teacher preparation programs, yet not by all, and not at high levels.

In-class use (level 3) was reported with the following tools: projector, online discussion forum, course management tools, web based assignments, electronic grading, online databases, YouTube, email, and electronic portfolio. Some of these tools are more specific to higher education teaching (e.g. course management tools such as Blackboard), yet some have shown applications within K-12 physical education (e.g. e-portfolios, YouTube, web based assignments). The lowest integration scores were recorded for technologies such as smart board, handhelds, cell phones, accelerometers, exergames, sport based simulators, GPS, educational games, PE software, chatrooms, social & virtual networks, bookmarking, web 2.0, webquests, and podcasting.

Overall, the results indicated that PETE professors on average are not integrating technology at such a level in which the students can learn how to effectively integrate technology to enhance learning in PE. In order for PE students to learn how to integrate technology, integration levels should be much higher within their teacher education experience. When evaluating the corresponding proficiency levels, professors do not perceive themselves to be confident in the use of technology. The results showed that while some professors do feel confident and do integrate some technologies, on average, both the level of proficiency and integration is too low. Consequently, the current level of technology integration may have an impact on the ability of PE students to create effective PE lessons infused with technology. Within the final chapter, a number of recommendations are made to improve the quality of integration of technology within PETE. In order to understand why certain technologies are included within the PETE
program while some are not, it is important to look at the factors that affect technology integration.

Factors Affecting Technology Integration

Personal Use

Personal use of technology is often related to how much people integrate the tool within their work life. When teachers use technology within their personal life, they may become more confident in their use of technology (Bitner & Bitner, 2002). Consequently, when teachers gain more confidence in their technology abilities, they are likely to enhance their level of technology integration in their own teaching (Nisan-Nelson, 2001). Sprague, Kopfman, and Dorsey (1998) included personal application of the technology within the process-oriented cycle of technology learning. While research shows that personal use can be an attributing factor within the technology integration process, this study used personal use as a separate factor with the intention to assess whether personal use can indeed impact integration.

This study found that most PETE professors used the following tools personally: digital camera, cellphone applications, office tools, presentation software, email, online databases, and course management tools. Moderate personal use was reported for projectors, handheld, pedometers, heart rate monitors, social networks, electronic distribution of grades, YouTube, web-based assignments, and electronic portfolios. The lowest level of personal use was found with technologies such as smartboards, sport based simulators, exergames, GPS, accelerometers, fitness assessment, educational computer games, PE software, online discussion forum, chat rooms, virtual networks, web 2.0, podcasting, webquests, and bookmarking.
A multiple regression analysis indicated that when combined, personal use and proficiency significantly predicted the level of integration. However, when looking specifically at personal use, results depicted that not all predictions are significant. For certain technologies, personal use can predict technology integration (i.e. projectors, smartboards, course management tools, e-portfolios, online discussion forums, chat rooms, fitness assessments, PE software, educational games, pedometers, and heart rate monitors), but it was not the case for other technologies. Personal use of digital cameras, cell phone applications, accelerometer, sport-based simulators, exergames, GPS, office tools, presentation software, social networks, virtual networks, bookmarking, online databases, and YouTube did not show significant predictions of their integration in the classroom. Results indicated that a few of the technologies had higher proficiency and integration scores, yet, their personal use did not predict integration. For example, PETE faculty felt confident in the use of digital cameras and integrated them in the classroom. In this case, their level of proficiency was a predictor of integration. As compared to some of the other tools such as sport based simulators, exergames, and GPS systems that similarly indicated personal use was not a predictor, these tools were not well integrated in PETE programs.

These results indicated that for some technologies, the multiple regression model does not fully explain the factors affecting integration. Other, additional factors must be reviewed. For example, tools such as exergames, GPS, and sport-based simulators may not be as widely accessible for faculty to use in their personal life which would affect the prediction model. Alternatively, technologies such as office tools, digital cameras, cell phones, and online databases, are so commonly used these days within everyday life that
their use may not predict integration much. Cost of certain technologies that would allow people to purchase a tool for personal use could be a contributing factor as well. Several digital cameras can be bought for the cost of a single exergame unit. Also, even if the cost of a sport simulator, GPS system or exergames is fairly low, in order to purchase a class set, PETE professors must often go through grant programs to receive such funds. While many technologies have shown benefits in PE, certain factors must be addressed before purchasing the required technologies. Additional factors that may contribute to technology integration of these technologies are explained in the section below followed by recommendations that provide different ways to enhance the integration of technologies benefiting PETE programs.

**Proficiency**

Results from the multiple regression analysis predicting the effect of personal use and proficiency on the integration of technology indicated that proficiency significantly predicted the level of integration for all technologies included within this study. These results are consistent with previous conducted research. Moursund and Bielefeldt (1999) found that the best predictor of technology integration is the level of technology proficiency. According to DelTufo (2000) and Vannatta & Fordham (2004), teachers’ willingness to devote time to learning and implementing technologies can play a role in the integration of technology. Kerr (2005) affirmed that technology integration is enhanced when teachers are well prepared and confident in their own ability to work using technology in a technology-rich environment. These lucid results validate the need for quality and adequate training and professional development in the area of technology proficiency within PETE.
The survey asked participants to address the factors that aid or hinder their integration of technology within PETE courses. Listed were 14 different factors and an option to add additional factors. Some of these factors were found within earlier research while others were added to aim specifically at addressing those factors that may influence PETE programs in specific. Similarly to and in support of the results from the multiple regression analysis, proficiency and knowledge of how to use and integrate technology within teaching of PETE courses appeared to be leading factors affecting successful technology infusion. These results affirmed Shulman’s (2004) argument that the most inhibiting factor for successful integration of technology by teachers is the lack of technology skills and understanding on how technologies can impact learning.

The seven components of Surry, Ensminger, and Haab’s (2005) model of reducing implementation barriers included similar factors. To explain the factors mentioned as being important in affecting integration of technology within PETE, the RIPPLES model was used to organize these affectively:

1. Resources: financial support
2. Infrastructure: availability and access to technology and labs
3. People: skill level, personal interest, beliefs and motivation in the use of technology in PE, students desire to use technology, motivational benefits to students
4. Policies: national standards in technology integration, organization and management of faculty, mandates from administration
5. Learning: time to learn, impact of technology on learning
(6) Evaluation: how to deal with the abundance of technologies, current level of technology inclusion in K-12, research in support of the technology

(7) Support: administrative support, supportive colleagues, training availability

The need for evaluation of an overall implementation plan, the use of the technologies itself and the role of technology in relation to the learning objectives was not mentioned specifically by the respondents. However, such aspects were indirectly mentioned in the final open question that allowed participants to speak freely about what is currently happening with technology within their own practice. PETE professors expressed concerns related to the abundance of technologies and the possibility to learn and understand the technologies used currently in K-12 schools. Surry, Ensminger, and Haab (2005) suggested the inclusion of continual assessment of technology uses within education to enhance the process of technology integration. As PETE professors were asked to question and assess their own proficiency and integration levels, a common concern revealed that technology integration within PE should not fall on the shoulders of a single individual within a faculty.

According to Rogers (2003), diffusion occurs within a social system and in order to understand the diffusion process within PETE faculties, questions related to the program mechanisms and the way the faculty addresses technology integration were asked within this study. In conjunction with the National Initial Physical Education Teacher Education Standards (NASPE, NCATE, 2008), technology integration must be discussed within the scope of the entire PETE program, or as Rogers (2003) calls it, the social system engaged in accomplishing a common goal, in this case, that of preparing new PE teachers.
Integration of Technology at the Program Level

Within higher education, supplementing teaching with technology benefits learning (Davis, Preston, & Sahin, 2009; DelTufo, 2000; Handler, 1993). In physical education teacher education, additional technologies, more specifically related to PE are incorporated to facilitate this learning process (i.e. heart rate monitors, pedometers, and others). K-12 PE teachers are encouraged to integrate technologies to improve the quality of physical education classes (Mohnson, 1995). A common question related to the integration of technology at the higher education level is how this process is facilitated within a faculty or program.

Quantitative Analysis

Within the quantitative analysis, questions compared the current integration process with the processes PETE educators believe should happen. Most programs included technology within their student teaching experiences and most believed that students should show evidence of technology use in student teaching experiences. This was important information as the standard 3.7 specifically states that PE teacher candidates must “demonstrate knowledge of current technology by planning and implementing learning experiences that require students to appropriately use technology to meet lesson objectives” (NASPE/NCATE, 2008). Most PETE educators addressed technology in the syllabus and assessed the use of technology within the PETE methods courses.

The results indicated that some programs have a faculty member that is often looked upon as the technology guru. According to Rogers (2003), early adopters and innovators are people who can move technology integration forward within a social
system. Early adopters often are highly respected and looked at before adopting a new tool or innovation while innovators are those who try out new ideas and become advocates for the integration of new tools. While every person within a social system adopts new tools at different rates, early adopters and innovators can be extremely important to the integration process. Even though technology gurus are looked upon as advantageous, the majority of respondents expressed that all faculty should go through mandatory technology training to assist in the integration process. This affirms the belief that most PETE educators felt the need to learn more about technology and believed in its usefulness within teaching and learning, yet felt the need for more training to assist them in the process.

Evenly divided results were found in relation to having a separate technology course within the PETE program. While 50% of programs currently have a technology course, 50% of faculty members believed that there should be a PETE technology course. In order to assess in more detail the differences between what is currently happening and what faculty members believe should happen, a Chi-square analysis was completed. It was found that those who currently have a separate PETE technology course are significantly more likely to believe that there should be course. These results showed that faculty may not be aware of the benefits of having technology fully integrated in a PETE program, or it could be that teacher educators believed that technology should be integrated and there should be a separate PETE technology course as well.

According to previous research in teacher education programs, the single course approach had a low correlation with technology competency to the integration of technology into methods courses and teaching (Moursund & Bielefeldt, 1999; Stetson &
Bagwell, 1999). Benno (2000) explained that a basic technology course can be useful to provide a foundation for integrated activities within their entire curriculum. Furthermore, Hill and Somers (1996), Benno (2000), and Doering et al. (2003) substantiated that while pre-service teachers need practice and instruction in the integration of technology within their methods courses, they also need to experience learning tasks where effective technology integration practices are modeled by teacher educators as well as the supervising teachers during student teaching placements. In order for teacher candidates to implement quality lessons infused with technology, there is a need to restructure the teacher education program to keep the entire curriculum in mind and focus our attention away from using technology for technology sake and towards finding ways technology can enhance learning of all students (DeCoker, 2000).

Not surprising yet important to highlight are the results in relation to the level of collaboration on technology integration within the PETE program. While the above research has illustrated that technology integration should be program wide, the results of this study indicated that currently less than half of faculty members collaborate on the use of technology. In addition, even less faculty members stated that their current programs do not use a technology plan to facility the integration process. However, more than 80% of participants confirmed the need to collaborate on technology integration and 84% supported the creation of a technology plan.

These findings indicated that only a very small percentage of programs currently integrate technology throughout the program while most faculty members believed that technology should be more fully integrated within the program. Consequently, PETE program administrators, who, when evaluating the entire program or preparing for
NCATE review, must take a closer look at the integration of technology within the entire PETE curriculum. In 1997, the NCATE Task Force on Technology in Teacher Education recommended that teacher preparation programs have a technology infusion plan (NCATE, 1997). Technology plans are conducive to helping programs structure the integration process within the program.

**Qualitative Analysis**

In addition to the quantitative analysis of what faculty members believed and perceived technology integration should be within PETE programs, the participants were asked to share any information related to technology integration in PETE. A qualitative interpretation of how PETE faculty members felt about using technology was necessary to allow for a multifaceted understanding of the current scope of technology integration within PETE. Through this qualitative interpretation, three themes appeared: the current applications of technology in PETE, technology integration concerns, and the perceptions on the pedagogical applications of technology in PE.

Many faculty members shared their current applications with technology and included specific ways to help teacher candidates learn about technology in PE. Some PETE programs have a technology teaching lab while many expressed their concern on not having a specific technology lab for PETE students. Technology teaching labs can provide teacher candidates a place to develop technology-enhanced lesson (Bucci, 2002). When in 2002, Bucci created a technology teaching lab for the teacher candidates in elementary education, the intention was to provide a space that would allow time, assistance, training, and equipment as it related to infusing technology within the student teaching lessons they were creating. Bucci found that having a technology teaching lab in
conjunction with the teaching internship allowed teacher candidates to integrate the lessons they created. Another important factor in the success of a technology teaching lab is that it would allow teacher candidates to check out certain technologies they needed within their internship experience but that were not accessible at the internship site (Bucci, 2002). This is a very common issue as this current study indicated.

Many faculty members expressed their concerns related to the integration of technology such as the access to technology in K-12 schools and practicum or internship placements, the need to enhance the level of collaboration on technology integration, the abundance of technology and how to deal with that in PETE, and the support and training for technology integration. While some placement schools may have obtained a good amount of technologies through grants, some schools do not have any technologies in the gymnasium. Swain (2005) found that the disconnect between the use of technology in schools and the way that technology is presented in some pedagogy courses can create organizational barriers in the integration process. If teacher education programs want to address the requirement for teacher candidates to plan and implement technology-enhanced lessons in PE, there must be a connection between higher education and K-12 schools as well as access to technology. Consequently, when there is no access to adequate PE technologies at the internship site, teacher preparation programs must find a way to provide teacher candidates with the appropriate technologies and training.

A valid concern the respondents brought up was the inability to deal with the abundance of technologies that currently exists. New technologies are constantly emerging and when looking at this trend, teacher candidates starting their teaching programs right now may not be using the same technologies when they start their
teaching careers four years from now (Robyler, 2003). While it is important to stay informed on the current trends in technology in education, it is more important to focus on the integration process rather than on the use of the variety technologies. The standards for technology in teacher education can assist in this process. The 2008 National Educational Technology Standards for Teachers provides a framework for educators to use as they prepare teachers to teach in a digital classroom (ISTE.NETS.T, 2008). According to the International Society for Technology in Education (ISTE), effective teachers model and apply five standards as they design, implement, and assess student learning experiences:

1. Facilitate and inspire student learning and creativity
2. Design and develop digital-age learning experiences and assessments
3. Model digital-age work and learning
4. Promote and model digital citizenship and responsibility
5. Engage in professional growth and leadership

Javeri and Persichitte (2010) stressed that “only in the digital age, one can be considered illiterate if you cannot learn, unlearn, and relearn” (p. 608). When teacher educators use the above standards to learn and teach about and with technology, it becomes clear that teachers don’t teach technology but promote technology literacy by ensuring that digital-age students are empowered to learn, move, live, and work successfully today and tomorrow (ISTE, 2008).

The respondents often exclaimed that it is impossible to keep up with the abundance of technologies, especially when no training is provided. It is important to
realize that most current teacher educators do not come with a technology background. In fact, within this study, most teacher educators attend seminars or teach themselves how to use technology. Only 5% of respondents reported to have a specific degree in a technology related field and only 11% received technology training when they were undergraduate or graduate students. In addition, Swain (2005) explained that many universities and teacher education programs have a greater concern for research than for excellence in teaching. Consequently, next to developing a technology plan and digitally aligned curriculum, teacher preparation programs must include a faculty development program that promotes effective integration of technology within teaching physical education. Research-based recommendations for such a program follows in the next section.

As teacher educators reflected more on their experiences with technology in PETE, conflicting perceptions of the purpose of technology within physical education were expressed. While the results of this study reported that most respondents valued the inclusion of technology within PETE and PE, some are not convinced and question the pedagogical implications of technologies within their own philosophies of teaching and learning of PE. The beliefs and attitudes of teacher educators in relation to technology integration can be a major barrier in the integration process and often claimed negative attitudes toward technology is the reason why technology is not integrated in a curriculum (Swain, 2005). Similarly to the study Swain conducted, respondents in this study weighed their own beliefs with the content and context of their own courses and what they believed teacher candidates should experience.
One respondent felt that technology integration was not necessary for quality instruction in PE and that priorities for teacher candidates should be about learning. She believes that technology is just a new “bandwagon” and for a “profession that is encouraging a decrease in screen time, we do not need to contradict ourselves.” Clearly this PETE educator valued quality instruction of PE; however, a clear vision of why technology can aid in the learning process is not observed. Another PETE educator echoes this belief and stated that “the ability to teach should be supported by the use of technology and not the other way around”. It is important for PETE programs to understand and develop a clear vision of technology integration in PE and PETE. Faculty must understand and experience the pedagogical fit between their own teaching and learning philosophy and technology infusion (Shaunessy, 2005). Javeri & Persichitte (2010) add that if faculty do not see that fit, integration will not occur.

Within this study related to the integration of technology within PE teacher preparation programs, the data showed and PETE educators revealed common needs and desires which programs can learn from. The following section outlines distinct recommendations for PETE programs and PETE educators as they prepare to teach new PE teachers in the digital age.

**Recommendations**

Within this study, PETE educators have shared their perceptions, fears, and successes related to the integration of technology within PETE courses. The quantitative and qualitative interpretations of results allowed the researcher to compile a set of recommendations that can help PETE program administrators and educators with the
development of effective technology integration processes. It is important to understand
that these recommendations are founded within the results and supported by previous
research.

1. **Clear Vision of technology integration.** Within the discussion section of this
chapter it was noted that not all PETE faculty members have a clear
understanding of why technology can assist in providing quality instruction in PE.
It is vital that an entire PETE faculty, including the administration, to work
together to gain an appreciation of what technology can do for learning in
physical education. Ertmer (1999) suggested three tactics for developing a
common vision: modeling, reflection, and collaboration.

   a. **Modeling:** Just as with student teachers, faculty must have an opportunity
to observe models of effective technology integration in physical
education and PETE. As part of a professional development model, it can
be useful to locate faculty and professional members within the
community that PETE faculty can observe whether it is in person, by
video, or through web based case studies. With technologies such as
Skype, faculty can look through the window of today’s technology infused
gymnasiums. In addition, observing other faculty members that model
effective technology use, even though they may be in a different field can
be very advantageous.

   b. **Reflection:** Reflection comes from the Latin term “reflectere” meaning “to
Professionals Think in Action”, encourages practitioners that thinking about our actions will help us understand our actions:

The practitioner allows himself to experience surprise, puzzlement, or confusion in a situation which he finds uncertain or unique. He reflects on the phenomenon before him, and on the prior understandings which have been implicit in his behaviour. He carries out an experiment which serves to generate both a new understanding of the phenomenon and a change in the situation. (Schön, 1983, p.68)

Following meaningful observations of effective technology models, PETE faculty must draw upon this experience and reflect on how it can be framed within their teaching experience.

c. **Collaboration:** Vygotsky’s (1978) work emphasizes that knowledge is constructed within a social context. Social constructivists view knowledge as socially constructed and learning happens within a social and active process of sharing which they call collaboration. The idea behind collaboration is that when different individuals share their own experiences, learners can come to new ideas or a new understanding. Vygotsky calls the process of gaining new understanding beyond the limitations of individual thinking, “scaffolding” and found that it extended the learning process. When modeling, reflecting, and collaboration is part of the professional development program, PETE faculty members may begin to understand how technology fits in within their own pedagogical philosophy of teaching and learning in PE.

2. **Creating a technology plan.** Once a clear vision is created of why technology is used within PE and PETE, the PETE program administrator and faculty members
should discuss how technology can be incorporated within the PETE curriculum. A technology plan acts as a means to communicate the inclusion of technology between all members of the PETE faculty. “The purpose of a technology plan is not just to produce a document, but to produce continuous action that creates and maintains a technology-rich educational environment” (Anderson, 1996, pg. 9). For this to happen, a good understanding of technology related standards and how these fit in with the overall PETE curriculum is needed. Both the ITSE technology standards for teachers and administrators (ITSE, 2008, 2009) as well as the NCATE/AAHPERD standards for using technology in PE can be used to assist in this process. The NASPE position statement on the appropriate use of instructional technology in PE can be an added resource (NASPE, 2009). See (1992) suggested that a technology plan can be created by including the following six parts:

a. Technology mission statement connected to the common vision. Effective technology plans will focus on pedagogy, not technology. See (1992) mentions that a technology plan is output based, not input based.

b. A detailed needs assessment of current uses of technology. Effective technology plans focus the assessment on how technology enhances learning.

c. Goals and objectives for using technology in PETE. Effective technology plans focus on the integration of technology into the overall curriculum.

d. A professional development strategy and action plans for implementation. Technology planning is about people (Anderson, 1999). Effective
technology plans should be developed by those members who will implement the plan.

e. An ongoing assessment process of what is happening within PETE and within K-12 PE. Effective technology plans are short and should be reviewed every year as part of the yearly staff development planning sessions. (See, 1992)

3. **PETE Technology course.** Research confirmed that a PE technology course can provide valuable foundational information regarding the use of technology within PE (Benno, 2000). However, results within this study acknowledged that it is difficult for one person to provide all instruction related to technology. In addition pre-service teachers need more practice with technology within other courses in order to transfer that knowledge into their own teaching experiences (Doering et al., 2003). Therefore, while a PE technology course can provide the foundation, it should not be the teacher candidates’ only exposure to technology.

4. **Technology Integration throughout the PETE program.** Previous research (Moursund & Beilefeldt, 1999; Stetson & Bagwell, 1999; DeCoker, 2000) as well as the results within this study indicated that teacher candidates can become more proficient in providing technology infused lessons if technology was integrated throughout the entire curriculum. Teacher educators within this study wanted more collaboration when it comes to technology infusion into the program. The results asserted that while many teacher educators used a variety of technologies within the classroom, they often do not teach teacher candidates how to teach with these technologies. It is crucial to provide opportunities that explain the pedagogy
around using a certain technology, that it is modeled and that teacher candidates get the chance to teach with the tools.

5. **Professional Development.** When technology becomes an integrated part of the PETE curriculum, PETE educators are encouraged to model certain technologies within their teaching. Before this happens, administration must provide specific professional development workshops that focus on effective teaching with technology in PE. The results of this study confirmed that if teacher educators do not feel proficient in the use of technology, they are less likely to integrate those technologies. Professional development sessions on technology integration should be part of the strategic change within the technology plan. Yilmazel-Sahin and Oxford (2010) discussed three models of professional development and found that mentoring models and university-school collaboration models are the most effective as compared to workshop models for the following reasons:

   a. Teacher educators are actively involved in the planning and implementation aspects of the professional development sessions

   b. Faculty members increased their comfort levels as they incorporated technologies within their courses

   c. It allowed the faculty members to develop their skills at their own pace using their own learning styles

   d. It offered individualized follow-up support

   e. It allowed for more flexibility in scheduling
Working with other faculty members who are more experienced with technology or with practitioners in the field has been observed as positive professional development experiences. The most important focus of professional development sessions should be on teaching with technology and not just on using the tools. The research and voices from the trenches speak for itself: “Pedagogy comes first”.

6. Providing PETE teacher candidates with opportunities to integrate technologies. Transferring knowledge from isolated learning experiences into practice when teaching children is not an easy task. Pre-service teachers have difficulties transferring this knowledge (Eifler et al., 2001; Kay, 2006). The results of this study indicated that insufficient access to technologies within the schools is a major hurdle to overcome. Students need access to the technologies and must be allowed to use them within their practical teaching experiences. Creating authentic teaching experiences using a variety of technologies is a way to combat such issues. Close collaboration with the practitioners in the internship placement schools can enhance the faculty-practitioner partnership and authentic learning opportunities can be presented. It is therefore equally important to extent professional development sessions as described above to practitioners in the field as many PE teachers who are mentors for pre-service teachers may not have much experience with technology either.

7. Technology teaching lab developments. Not much research is written on having technology teaching labs in PETE programs. However, such labs can provide teacher candidates with a place to create technology-enhanced lessons, practice
using a variety of technologies, as well as allow opportunities to check technologies out and use them during their practicum or internships (Bucci, 2002). In order to find out what types of technologies such technology teaching labs should hold, one appropriate resource is the “Using technology in physical education” book, written by Bonnie S. Mohrson, and currently in its seventh edition. When developing such a lab, it is important to put pedagogy first and allow for technology support availability during lab hours. As part of the technology lab, Bucci (2002) encouraged having demonstrations, time to play with the technologies, specific lesson plan assignments, assessments and a technology teaching lab teacher that helps the students apply educationally sound ideas of technology within their PE lessons.

8. Abundance of technologies. We all see it, new technologies emerge each day. In fact, by the time this dissertation is completed several new tools applicable within physical education will appear. How do you keep up? That was a very common question that appeared within the results of this study. Once again, it is important to focus on teaching teacher candidates about integration versus specific tools. If teacher candidates see effective modeling of technology integration within PE and they get to try it out on their own, they may be more likely to learn on their own how to integrate a new technology when they become a PE teacher. The NETS standards (ISTE, 2008) can help to PETE faculty focus on pedagogy surrounding technology integration and how to address the needs of the digital gymnasium.

An opportunity the National Association for Sport and Physical Education (NASPE) can look at is to allow for experts in the field to extend their expertise
more freely. Open education or free sharing of educational materials has become more popular as people use the World Wide Web to learn and share knowledge openly online. In his book, “The World is Open: How Web Technology is Revolutionizing Education”, Bonk (2009) outlined ten key learning and technology trends that demonstrate how the Web has revolutionized education. The dissemination of knowledge can now be shared by an entire world at the touch of a button. An example of such an open source for educational purposes was the developed by Siemens and Tittenberger (2009) of the Learning Technologies Center at the University of Manitoba, “Handbook of Emerging Technologies for Learning”, an online “living” resource for educators planning to incorporate technologies in their teaching and learning activities. This technique can therefore be used to assist in the professional development of PETE faculty. The NASPE website already has online free tools for teachers to use (NASPE Teacher Toolbox); however, these focus on K-12 PE teachers, while an open source such as this one for PETE faculty members can also be useful. Imagine a place where experts in technology are invited to write up specific professional development sections on how to use and integrate a technology within PETE. This online open source network can contain step-by-step guides on how to implement certain technologies within PE where both PETE educators and students alike can learn and experiment on their own time and from where ever they are.

9. *On-going research on effective integration of technology in PETE.* The study presented within this dissertation is of descriptive nature. It is important to further
this study with case studies of PETE programs that indicated effective integration of technologies and study the effect of such integration on PETE administrators, educators, and teacher candidates. Closer examination of technology plans and professional development models in PETE programs can help drive the infusion of technology in PETE forward. Equally, if not more important is to complete research that investigates the integration of technology processes within K-12 gymnasiums and how this affects learning in physical education and informs teaching with PETE.

Conclusion

This research study was designed with learning in mind. Teacher education matters and quality physical education teacher preparation programs have a major impact on the active and healthy lives and futures of young children. While technology often receives a bad reputation for increasing obesity levels, it also has become a common medium through which youth can express their active selves. Research in the use of technology showed many benefits to enhance teaching and learning; yet the abundance of new technologies and the speed of which such tools are introduced in society makes one wonder about how technology is integrated within education in a way that it preserves the quality of effective instruction. This dissertation examined technology integration from the perspectives of PETE faculty members. Physical education preparation programs are looked upon as leaders in the field of instruction of physical education and have the duty to, among others, prepare new teachers how to integrate technology to enhance learning and teaching in physical education.
The purpose of this dissertation was to examine the current scope of technology integration within physical education teacher education programs as perceived by the faculty of such programs. This study aimed to 1) identify the types of technology currently taught to physical education teacher candidates in PETE courses within undergraduate and graduate programs, 2) analyze the current technological proficiency of PETE faculty (as perceived by the faculty), and 3) its relationship to the level of integration within the PETE courses, 4) examine the factors that affect technology utilization of PETE faculty within the PETE programs, and lastly, 5) explore the approaches PETE faculty use to encourage technology infusion within the overall PETE curriculum.

The study surveyed faculty members from nationally recognized NASPE/NCATE PETE programs across the United States. It included questions related to proficiency, integration, factors influencing integration, and program involvement. The results indicated that computer technologies, pedometers and heart rate monitor are tools most often used within PETE programs. The level of proficiency predicted integration levels significantly. More specifically, PETE educators expressed their overall “basic use/knowledge” on most tools which reflected their integration level as it was often limited to in-class use. Based on the “Technological Pedagogical Content Knowledge” Framework, technology infusion in teacher educators programs should help PETE students understand the connections between technology, teaching, and physical education in a practical way. Since the implementation of the 2008 Initial Standards in Physical Education Teacher Education, the National Association for Sport and Physical Education (NASPE) requires data collection of evidence that shows that teacher
candidates are adequately prepared to integrate technology when teaching physical education (NASPE, 2009). Consequently, creating authentic learning experiences for pre-service teachers to demonstrate effective integration of technology within physical education lessons should be an objective within quality PETE programs. However, the results indicated that most PETE faculty members do not collaborate on the infusion of technology. Furthermore, only 51% of PETE faculty members reflected that there was a specific PE technology course and 19% shared that technology was infused within the overall program.

To effectively integrate technology within PETE preparation programs, a clear vision on the integration of technology in PE should be developed, technology plans can be used, professional development models can be explored, effective modeling of technology can be learned, and faculty-practitioner collaboration can be encouraged. PETE teacher educators expressed concerns related to the abundance of technologies as well as the limited availability and accessibility of technologies both at the PETE level and within K-12 schools. Such concerns can be addressed by fostering faculty-practitioner collaboration, developing teaching technology labs, and by creating opportunities to share best practices around technology infusion.

Finally, the most important aspect of integrating technology within PETE is to focus all efforts on the enhancement of learning. Technology should only be used to inform and improve the quality of physical education instruction and learning. Additional research is encouraged to investigate the effects of technology on learning in PE as well as examining and sharing best practices of technology integration within PETE in relation to the development of quality teacher educators and candidates.
REFERENCES


National Association for Sport and Physical Education. (2008). 2008 National Initial Physical Education Teacher Education Standards (pp. 34): NASPE, NCATE.


Williams, B. (1998). The Internet: we are wired, now what? In I. S. Zimmerman & M. F. Hayes (Eds.), *Beyond technology...Learning with the wired curriculum.* Wellesley, MA: MASCD.


APPENDIX A: IRB APPROVAL

May 19, 2010

MEMORANDUM

TO: Helena Baert
    Dean Gorman

FROM: Ro Windwalker
    IRB Coordinator

RE: New Protocol Approval

IRB Protocol #: 10-05-644

Protocol Title: The Inclusion of Technology in Physical Education Teacher Education Programs in the USA

Review Type: X EXEMPT 0 EXPEDITED 0 FULL IRB
Approved Project Period: Start Date: 05/18/2010 Expiration Date: 05/17/2011

Your protocol has been approved by the IRB. Protocols are approved for a maximum period of one year. If you wish to continue the project past the approved project period (see above), you must submit a request, using the form Continuing Review for IRB Approved Projects, prior to the expiration date. This form is available from the IRB Coordinator or on the Compliance website (http://www.uark.edu/admin/rsspinfo/compliance/index.html). As a courtesy, you will be sent a reminder two months in advance of that date. However, failure to receive a reminder does not negate your obligation to make the request in sufficient time for review and approval. Federal regulations prohibit retroactive approval of continuation. Failure to receive approval to continue the project prior to the expiration date will result in Termination of the protocol approval. The IRB Coordinator can give you guidance on submission times.

If you wish to make any modifications in the approved protocol, you must seek approval prior to implementing those changes. All modifications should be requested in writing (email is acceptable) and must provide sufficient detail to assess the impact of the change.

If you have questions or need any assistance from the IRB, please contact me at 120 Ozark Hall, 5-2208, or irb@uark.edu.
APPENDIX B: ORIGINAL SURVEY

Introduction
You have been identified by the researcher as experts in the field of technology and physical education. A doctoral research study will be conducted this next Fall (2010) to investigate the use of technologies within physical education teacher education programs (PETE). You are asked respectfully to share with me your professional opinions regarding a new survey on the inclusion of technology in Physical Education teacher Education. You will be asked to complete the survey and add your comments to each section on how the researcher can improve the survey. In addition, you will be asked to add additional final comments at the end of this survey. Your input in this process is vital information and I appreciate your cooperation. If you have any questions, please do not hesitate to email me at helenabaert@gmail.com or call me at 479-287-9521

The purpose of this study is to identify the types of technology currently taught to Physical Education teacher candidates in PETE courses within undergraduate and graduate programs. Further, the study will evaluate the current technological proficiency of PETE faculty as well as their beliefs on the technologies that should be taught in PETE programs (as perceived by the faculty). In addition, the factors that affect technology utilization of PETE faculty within the PETE programs will be examined. Finally, this study aims to identify and highlight programs where faculty believe effective integration of technology is used in order to determine the current status of PETE programs with respect to the integration of technology.

When reviewing this survey, keep in mind the following four main objectives:
1) To assess the opinions of PETE faculty members regarding their knowledge and skill level on using certain technologies.
2) To assess the opinions of the PETE faculty members regarding the level of integration of a variety of technologies in the PETE program.
3) To assess the factors influencing the level of integration of technology into the PETE program.
4) To assess whether or not the integration of technology is pursued in a collaborative matter throughout a faculty/department. (This final question will be assessed by sampling entire faculties within small/medium/large universities across the US)

Thank you for your assistance.
Helena

Start Time
Please enter the time you started the survey: ____________

Section 1: Personal Knowledge and Skill Level of Technology
In the first section, for each technology, indicate the extent to which you believe you demonstrate proficiency in each technology practice using the following codes for Personal Knowledge and Skill Level:
- Non-use: I have no knowledge/limited knowledge.
- Awareness: I am aware of this technology and how it can be used.
- Exploration & Learning I’m in the process of learning this technology.
- Application: I use this technology.
- Sharing and Reflection: I encourage colleagues to use this technology through discussion, modeling, mentoring, collaborative planning, or other means.

**Identify your level of knowledge and skill for the following technologies:**

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<tr>
<th>Technology</th>
<th>Non-use</th>
<th>Awareness &amp; Learning</th>
<th>Application</th>
<th>Sharing and Reflection</th>
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<td>Projectors</td>
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<td>Handheld Devices (palm pilot, iTouch, etc.)</td>
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<td>Digital video camera</td>
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<td>Fitness Assessment Programs (Fitnessgram, Microfit, etc.)</td>
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<td>PE software</td>
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<td>Exergames (DDR, Wii, Sportwall,...)</td>
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<td>Educational Computer games</td>
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<td>Sport Simulators</td>
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<td>Audio/video conferencing (e.g. Skype, Elluminate, Virtual Realities)</td>
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<td>Cell Phone Applications (text messaging, polling, etc.)</td>
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<td>Tablet PC's</td>
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<td>Tools to measure body composition</td>
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<td>Heart Rate monitors</td>
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<td>Pedometers</td>
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<td>Accelerometers</td>
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<td>Office tools (Word, Excel, PowerPoint, Publisher)</td>
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<td>Data analysis and display</td>
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<td>Educational PowerPoint Games (e.g. jeopardy)</td>
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<td>Listservs</td>
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<td>Presentation software</td>
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<td>Multimedia authoring packages (HyperStudio, Hypercard, Director, Toolbook, Authorware)</td>
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<td>Graphics packages (Photoshop, Canvas, Pagemaker, Corel Draw)</td>
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<td>Use course management tools (WebCT, BlackBoard, Moodle)</td>
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<td>Online Discussion Forums</td>
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<td>Electronic distribution of grades</td>
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<td>Web-based surveys/ quizzes</td>
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<td>Electronic portfolios</td>
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<td>Blogging</td>
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<td>Educational Social Network Sites (NING, Edmodo for examples)</td>
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<td>Google Applications (Google Sites, Google Docs for example)</td>
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<td>Bookmarking sites such as Diigo, Delicious, Digg</td>
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<td>Computer based advanced organizers (e.g., favorites, bookmarks)</td>
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<td>Online research databases (e.g. Google Scholar, library: EBSCO)</td>
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<td>WebQuests</td>
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<td>Podcasting or Vodcasting</td>
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<td>YouTube</td>
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**Section 2: Integrating Technology in PE courses**

In the second section, for each technology, indicate the extent to which you utilize that technology in your teaching using the following codes:

- Not applicable: I do not believe this technology has application for me or for the curriculum area(s) I teach, and it is not relevant as a teaching and learning tool.
- None: no use in course(s)
- Some: some use in course(s)
- Well-integrated—natural part of course(s)

For each technology, indicate the extent to which you utilize that technology in your teaching.

<table>
<thead>
<tr>
<th>Technology</th>
<th>NA</th>
<th>None</th>
<th>Some</th>
<th>Well-integrated</th>
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<tr>
<td>Exergames (DDR, Wii, Sportwall,...)</td>
<td></td>
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<tr>
<td>Educational Computer games</td>
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<tr>
<td>Sport Simulators</td>
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<tr>
<td>Audio/video conferencing (e.g. Skype, Elluminate, Virtual Realities)</td>
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<tr>
<td>Cell Phone Applications (text messaging, polling, etc.)</td>
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<tr>
<td>Tablet PC's</td>
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<tr>
<td>Tools to measure body composition</td>
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<tr>
<td>Heart Rate monitors</td>
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<tr>
<td>Pedometers</td>
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<tr>
<td>Accelerometers</td>
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<tr>
<td>Office tools (Word, Excel, PowerPoint, Publisher)</td>
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<tr>
<td>Data analysis and display</td>
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<tr>
<td>Educational PowerPoint Games (e.g. jeopardy)</td>
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<tr>
<td>Listservs</td>
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</tr>
</tbody>
</table>
Online reference tools  
Presentation software (PowerPoint, Persuasion, Astound)  
Multimedia authoring packages (HyperStudio, Hypercard, Director, Toolbook, Authorware)  
Graphics packages (Photoshop, Canvas, Pagemaker, Corel Draw)  
Use course management tools (WebCt, BlackBoard, Moodle)  
Online Discussion Forums  
Electronic distribution of grades  
Web-based surveys/ quizzes  
Electronic portfolios  
Chat Rooms  
Email  
Personal Web Site  
Course Web Site  
Blogging  
Wikis  
Social Networking (Twitter, Facebook, MySpace, etc.)  
Educational Social Network Sites (NING, Edmodo for examples)  
Google Applications (Google Sites, Google Docs for example)  
Bookmarking sites such as Diigo, Delicious, Digg  
Computer based advanced organizers (e.g., favorites, bookmarks)  
Online research databases (e.g. Google Scholar, library: EBSCO)  
WebQuests  
Virtual Reality (E.g Second Life)  
Podcasting or Vodcasting  
YouTube

**Section 3: Factors contributing to the integration of technology**
This section is about factors which hinder or aid in the utilization of technology in the classroom. Read each statement and indicate the extent to which you agree or disagree with the statement.

**To what extent do the following factors influence your use of technology?**

<table>
<thead>
<tr>
<th>1 - Strongly disagree</th>
<th>2 - Disagree</th>
<th>3 - Neither agree nor disagree</th>
<th>4 - Agree</th>
<th>5 - Strongly agree</th>
</tr>
</thead>
</table>

I do not believe that technology enhances my teaching methods.
I do not believe that technology enhances my course(s).
Technology helps students learn.
I have had sufficient training to utilize technology in my course(s).
I have access to the training support I need to use technology.
I have time to use technology in my course(s).
I have time to experiment with technology.
I have time to learn new technologies.
I am interested in using technology in my teaching.
I am interested in learning ways in which to incorporate more technologies into my course(s).
I am interested in learning more technologies.
A fear of failure keeps me from using technology in my course(s)
I fear my students will understand the technology better than I.
I worry about making mistakes with technology in front of my students.
Our professional organization, the National Association for Sport and Physical Education (NASPE) encourages technological usage by physical educators.
Physical Education students need to see technology modeled in the classroom.
My physical education students want to learn more technology.
Use of technology alienates some of my students.
My institution provides financial support to use technology.
My institution will purchase the technology that I want to experiment with in my courses.
My institution will pay to send me to conferences to be trained on the technology(ies) in which I am interested.
Faculty members at my institution place importance on technology.
Very few faculty members at my institution have implemented technology in their teaching.
Administrators at my institution do not value technology’s role in the classroom.
I have access to various technologies at my institution, such that I can experiment with them.
I have access to computers to hold class wherein students can experiment.
I have access to technologies from home such that I can experiment with them without having to be on campus.

I have access to high-quality technology mentors on my campus.

I have access to individuals on my campus who can train me to use technology.

My institution has reward structures in place to encourage usage of technology.

My institution provides monetary incentives for using technology in the classroom (e.g., extra course pay, additional expense account funds to faculty implementing technology, etc.).

My institution provides non-monetary incentives for using technology in the classroom (e.g., release time to faculty, etc.)

My institution has a vision for enhancing technology utilization on our campus.

My institution has a vision for enhancing faculty members’ use of technology in their courses.

My institution values producing graduates with high technological competence.

---

**Section 4: Demographics**

1. **Type of technology integration in your department:**
   - [ ] No or limited use of technology
   - [ ] Students all take a specific technology course within the program
   - [ ] Technology is integrated within the entire program

2. **Type of technology integration that you believe if more fitting for PE majors:**
   - [ ] Within a specific course dealing with technology
   - [ ] Integrated throughout the required courses
   - Other (please specify):

3. **Are you male or female?**
   - [ ] Male
   - [ ] Female

4. **How many years have you been preparing teachers?**
   - [ ] 1-3 years
5. What is your age?

- 4-6 years
- 7-10 years
- 11-15 years
- 16+ years

6. What courses do you currently teach?

7. How would you prefer to learn more about integrating technology in PETE? You may choose more than one answer.

- Presentations at conferences
- Journal
- Textbook
- Online Resources - websites, blogs, forums, etc.
- Workshops at your school/university
- I have no interest in learning more

**Completion Time:**
What time is it now? _______
Dear PETE educators,

You have been invited to participate in a survey as part of a dissertation research study that examines the use and integration of technology within the PETE program you currently work in. I am interested in learning about your personal experiences as to the inclusion of technology within the courses you teach.

The purpose of this survey is to answer the following research questions:

1. What types of technologies are currently included in PETE programs?
2. What do current PE educators believe to be their technological proficiency levels?
3. How are PE educators integrating technology into PETE courses?
4. What factors affect technology use of in PETE programs?
5. How do PETE programs approach technology integration according to the perceptions of the PETE faculty members?

There are no known risks if you decide to participate in this research study, nor are there any costs for participating in the study. The information you provide will help me understand how best to assist PETE educators when it comes to the integration of technology in PETE programs. The information collected may provide general benefits to PETE educators, students and researchers.

This survey will take approximately 10 minutes to complete. Your participation is voluntary and when you participate, your consent is implied. The information you provide will remain confidential. The data of this research will be analyzed and compiled in a dissertation publication and/or future articles. At the end of this process, a summary of the results from this study will be emailed to you.

If you have any questions or concerns about completing the questionnaire or about being in this study, you may contact me at (XXX) XXX-XXXX or at XXXXXX@uark.edu.

The University of Arkansas Institutional Review Board has accepted my request to conduct this project. If you have any concerns about your rights in this study, please contact Rosemary Ruff, Director of the University of Arkansas Research Compliance at 479-575-3845 or email rruff@uark.edu.

I thank you in advance for participating in this survey,

Helena Baert

Section 1:
For this first section you will be presented with a variety of technologies. This section asks you about your personal use of different technologies, the extent to which you believe you demonstrate proficiency in each technology and the extent to which you utilize that technology within your teaching.

1. Teaching Technologies

A. Personal Use
Please tell me whether you use the tool in your personal life.

B. Technology Proficiency
(1) no knowledge of the tool
(2) I know this tool exists but I do not know how to use it.
(3) I know how to use this tool at a basic level
(4) I feel confident in my abilities to use this tool.
(5) I consider myself an expert in using this tool and am able to explain its use to others.

C. Technology Integration
Non awareness: I was unaware this technology existed
Awareness: I am aware of the technology but I do not use it
In Class Use: I use it in the classroom/gym
Teach to Teach: I use it in the classroom and I teach my students how to teach PE with the technology.
Share & Reflect: I use it in the classroom, I teach my students how to teach PE with the technology and I share with others how the technology can be applied to teaching.

<table>
<thead>
<tr>
<th>A. Personal Use</th>
<th>B. Technology Proficiency</th>
<th>C. Technology Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Projector</td>
<td></td>
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<tr>
<td>Smart Board</td>
<td></td>
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<tr>
<td>Handheld</td>
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<tr>
<td>Technologies (Tablet PC, iPad, Palm pilot, iTouch, etc.)</td>
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<tr>
<td>Digital camera, flip camera</td>
<td></td>
<td></td>
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<tr>
<td>Cell phone applications (text messaging, polling, etc.)</td>
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<td></td>
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</tbody>
</table>

2. Technologies that promote physical activity

A. Personal Use
B. Technology Proficiency
(1) no knowledge of the tool
(2) I know this tool exists but I do not know how to use it.
(3) I know how to use this tool at a basic level
(4) I feel confident in my abilities to use this tool.
(5) I consider myself an expert in using this tool and am able to explain its use to others.

C. Technology Integration
Non awareness: I was unaware this technology existed
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<table>
<thead>
<tr>
<th>A. Personal Use</th>
<th>B. Technology Proficiency</th>
<th>C. Technology Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedometers</td>
<td></td>
<td></td>
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<tr>
<td>Accelerometers</td>
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<tr>
<td>Heart Rate Monitors</td>
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<tr>
<td>Sport Based Simulators (Virtual golf, Wii Sports, Xavix Bowling, etc.)</td>
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<tr>
<td>Exergames (DDR, Wii Fit, Sportwall, etc.)</td>
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<tr>
<td>GPS Systems (Geocaching)</td>
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</tbody>
</table>

3. Computer Technologies
A. Personal Use
Please tell me whether you use the tool in your personal life.

B. Technology Proficiency
(1) no knowledge of the tool
(2) I know this tool exists but I do not know how to use it.
(3) I know how to use this tool at a basic level
(4) I feel confident in my abilities to use this tool.
(5) I consider myself an expert in using this tool and am able to explain its use to others.

**C. Technology Integration**

*Non awareness:* I was unaware this technology existed  
*Awareness:* I am aware of the technology but I do not use it  

**In Class Use:** I use it in the classroom/gym  
**Teach to Teach:** I use it in the classroom and I teach my students how to teach PE with the technology.  
**Share & Reflect:** I use it in the classroom, I teach my students how to teach PE with the technology and I share with others how the technology can be applied to teaching.

<table>
<thead>
<tr>
<th>Fitness Assessment Programs (Fitnessgram, Microfit, etc.)</th>
<th>PE Software (Anatomy program, PE record book, etc.)</th>
<th>Educational computer games (Jeopardy, review games, etc.)</th>
<th>Office Tools (Word, Excel, Publisher, etc.)</th>
<th>Presentation Software (PowerPoint, Persuasion, Prezi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
<td>1</td>
<td>2</td>
<td>3</td>
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</table>

### 4. Communication Technologies

**A. Personal Use**  
Please tell me whether you use the tool in your personal life.

**B. Technology Proficiency**  
(1) no knowledge of the tool  
(2) I know this tool exists but I do not know how to use it.  
(3) I know how to use this tool at a basic level  
(4) I feel confident in my abilities to use this tool.  
(5) I consider myself an expert in using this tool and am able to explain its use to others.

**C. Technology Integration**  
*Non awareness:* I was unaware this technology existed
Awareness: I am aware of the technology but I do not use it
In Class Use: I use it in the classroom/gym
Teach to Teach: I use it in the classroom and I teach my students how to teach PE with the technology.
Share & Reflect: I use it in the classroom, I teach my students how to teach PE with the technology and I share with others how the technology can be applied to teaching.

<table>
<thead>
<tr>
<th>A. Personal Use</th>
<th>B. Technology Proficiency</th>
<th>C. Technology Integration</th>
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<tbody>
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</table>

### Online Discussion
- Forums
- Chat Rooms
- Email

### Social Networks
- (Facebook, Twitter, Ning, etc)

### Virtual Networks
- (Second Life, IMVU, etc.)

### 5. Web-Based Technologies

**A. Personal Use**
Please tell me whether you use the tool in your personal life.

**B. Technology Proficiency**
1. (1) no knowledge of the tool
2. (2) I know this tool exists but I do not know how to use it.
3. (3) I know how to use this tool at a basic level
4. (4) I feel confident in my abilities to use this tool.
5. (5) I consider myself an expert in using this tool and am able to explain its use to others.

**C. Technology Integration**

**Non awareness:** I was unaware this technology existed

**Awareness:** I am aware of the technology but I do not use it

**In Class Use:** I use it in the classroom/gym

**Teach to Teach:** I use it in the classroom and I teach my students how to teach PE with the technology.

**Share & Reflect:** I use it in the classroom, I teach my students how to teach PE with the technology and I share with others how the technology can be applied to teaching.
Section 2:
This section is about the factors which influence your utilization of technology in the classroom. Read each factor and indicate the extent to which that factor currently influences your use of technology.

On a scale from 0 to 4, to what extent do the following factors influence your current use of technology in the PE courses you teach? (0 being the factor does not influence the use of technology to 4 being a factor that strongly influences the use of technology)

<table>
<thead>
<tr>
<th>Factors that influence technology use</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Fear of failure when using the technology in the classroom</td>
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<tr>
<td>2. Knowledge of how to use the technology</td>
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<tr>
<td>3. Knowledge of how to implement the technology within my teaching</td>
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<td>4. National standards/ Guidelines for technology integration</td>
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<td>5. Research support in using the technology in education</td>
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<tr>
<td>6. Financial support</td>
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</table>
Factors that influence technology use

<table>
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<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Administrative support</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2. The encouragement of others</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>3. Colleagues that believe in incorporating technology</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>4. Colleagues that are not in support of integrating technology</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>5. The current level of technology inclusion in P-12 PE</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>6. The students' desire to use technology</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>7. The motivational aspects the technology brings to my students</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>8. The knowledge level of my students related to using technology</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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</table>

Are there any other factors that influence your current use of technology that may not be listed in above? Please list these below.

**Section 3:**
This section aims to investigate the different approaches to technology integration from a program perspective.

A. The following questions will ask you about the current policies within your program in regards to the integration of technology.

<table>
<thead>
<tr>
<th></th>
<th>This is currently happening</th>
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<tbody>
<tr>
<td></td>
<td>Yes</td>
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</tbody>
</table>

1. Does your program assess the students' ability to use technology?
2. Do faculty in your program address technology use in the course syllabi?
3. Do you meet and decide as a faculty on how you will integrate technology?
4. Do students within the program need to show evidence of technology integration within their own teaching?
5. Does your faculty have a “technology plan” that structures the integration of technology within the PETE program curriculum?
6. Do PETE majors need to complete a technology course within the program?
7. Does the level of technology integration within your program depend on each individual faculty member’s experience and knowledge of technology?
8. Is there a member within your faculty who leads in the
This is currently happening
Yes  No  I don't know

introduction of technology within the program curriculum?

B. The following questions will ask you for **your perceptions towards current policies** related to technology integration in your program.

1. Do you believe that PETE students should be assessed on their ability to use technology?
2. According to you, should technology use be addressed in the syllabus?
3. Do you believe students should show evidence of teaching with technology?
4. Do you believe that faculty should meet and decide together on how you will integrate technology?
5. Do you believe that your faculty should have a “technology plan” that structures the integration of technology within the PETE program curriculum?
6. Do you believe technology integration should be taught as a separate course within the program?
7. Do you believe technology should be integrated throughout the program?
8. Do you believe all PETE faculty members should be trained in the integration of PE technology?

Section 4: Demographics

1. Are you male or female?
   - Male
   - Female

2. What is your age?

3. How many years have you been preparing teachers?
hahahahahaha
   - 1-3 years
   - 4-6 years
   - 7-10 years
4. What is your highest Degree?
- Bachelor
- Masters
- Doctorate

5. What is your current academic rank?
- Graduate Assistant
- Lecturer/Instructor
- Assistant Professor
- Associate Professor
- Professor

6. Describe your educational experience with technology (Check all that apply).
- None to little prior knowledge of technology
- I teach myself on how to use technology (through reading, online tutorials, etc.)
- I learn about technology from my colleagues at work.
- I have children that help me understand technology.
- I attend seminars / workshops on technology (on or off campus)
- I attended postgraduate course work related to technology
- I obtained a degree in a technology related field
- Other [ ]

7. What courses do you currently teach in the PETE program?

8. If you wish, please share with me any feedback you would like regarding the integration of technology within the PETE program you currently work at.