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# A Study of the Impact of a School-Based, Job-Embedded Professional Development Program on Elementary and Middle School Teacher Efficacy for Technology Integration

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## ABSTRACT

### A Study of the Impact of a School-Based, Job-Embedded Professional Development Program on Elementary and Middle School Teacher Efficacy for Technology Integration

The purpose of this study was to determine the impact of a school-based, job-embedded professional development program on elementary and middle school teacher efficacy for technology integration. Teacher efficacy has been identified as a strong predictor of whether the content of professional development will transfer to classroom practice (Bandura, 1997). Using a conversion mixed methods quasi-experimental research design, qualitative data were collected from the experimental groups' journal postings. Grappling's Technology and Learning Spectrum (Porter, 2002) was used to convert this qualitative data into quantitative data to determine the change in levels of technology integration in classroom practice. The Computer Technology Integration Survey (Wang, 2004) was used to determine differences in efficacy levels for technology integration between the experimental and comparison groups.

Study findings indicated there was no statistically significant change in teachers' levels of technology integration after participation in a school-based, job-embedded professional development program. However, statistically significant differences in levels of efficacy for technology integration between teachers who participated in a school-based, job-embedded professional development program and those who had not were found. Additionally, study findings indicated statistically significant differences in the experimental group's levels of efficacy for technology integration based on whether teachers taught in an elementary or middle school and whether teachers taught multi-subjects or a single subject. Finally, there was no statistically significant relationship between efficacy for technology integration and technology integration in classroom practice for those teachers who participated in the professional development program.

DEDICATION

To my husband, Rob, who not only encouraged me to pursue my doctoral degree but provided the support to make it a reality.

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Henry Ford said, "If you think you can do it, or you think you can't do it, you are right". I wish to thank those who helped me to think that I can do it. Without the support of the following individuals, writing and defending my dissertation would not have been possible.

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# CHAPTER ONE:  INTRODUCTION

When West Virginia entered into the Partnership for 21st Century Skills (P21) in November of 2005, a commitment to provide a rigorous and relevant curriculum to equip every student with the skills necessary to secure a successful future was communicated. A basic assumption undergirding the P21 agenda is education for every child in America will be strengthened as opportunities to gain mastery of 21st century knowledge and skills are offered.  Four core learning outcomes are emphasized:  (1) to deepen content knowledge through exploring relevant 21st century interdisciplinary topics to include global awareness and financial literacy; (2) to critically examine information and media for validity and reliability, and use technology ethically as a tool for learning; (3) to enhance one's learning skills to develop as a life-long learner to include critical thinking and collaboration; and (4) to expand one's life and career skills to include self-direction, responsibility, and social skills (West Virginia Department of Education, 2008; McClure, 2009).

Kay and Honey (2006) refer to this 21st century education as a basics-plus education. Mastery of basic skills is the starting point.  Moving beyond basic skills is needed to prepare our students for the information-based, technologically-driven world in which they now live. Students must be able to apply content knowledge to a real world context if they are to improve in their ability to collaborate, solve problems, and communicate (Meisenger, 2004).  Technology tools used seamlessly for teaching and learning provide the means to master essential 21st century knowledge and skills.   The 21st century teaching model proposes student outcomes that move beyond basic skills mastery for the purpose of application to include analytic thinking, problem-solving, innovation, self-directed learning, effective communication, and information, communications, and technology (ICT) literacy.

To meet this challenge, the $21^{st}$ Century Learning Initiative was created by the West Virginia Department of Education to provide a systematic plan for implementing $21^{st}$ century teaching and learning in every classroom in the state. State sponsored professional development focuses on building capacity in understanding and implementing the elements that comprise $21^{st}$ century learning. Even though all educators would receive training, the initiative's success will be measured by the extent to which $21^{st}$ century learning skills become integrated into the fabric of the classroom (West Virginia Board of Education, 2008).

Fuhrman and Odden (2001) analyzed teaching and learning reform efforts that produce marked improvement in student achievement. Their analysis revealed that for student learning to improve substantially, the "core technology of education" (p. 60) must change. By this, they mean that instructional practice and the way that instruction is organized must change. Extensive professional development is critical to produce this change (Fuhrman & Odden, 2001). Corcoran (2007) agrees that effective professional development can produce changes in classroom practice, enhance the capacity for continued learning and growth, and ultimately lead to student achievement.

Student learning must be positively influenced to qualify as effective professional development. Content should focus on best practices that promote learning (Association for Supervision and Curriculum Development, 2009). Context should focus on a school-based, job-embedded, collaborative effort (Association for Supervision and Curriculum Development, 2009; West Virginia Center for Professional Development, 2009). In addition, teachers' needs must be addressed. Teachers who reflect on their practices to assign meaning to their experience are more likely to transfer this new knowledge to their classrooms (Mouza, 2002).

Efficacy levels serve as a strong predictor of whether a teacher will transfer 21$^{st}$ century knowledge and skills to the classroom. Efficacy is defined as the belief in one's capability to "organize and execute the course of action required to produce given attainments" (Bandura, 1997, p. 3). Bandura (1993) argues that a teacher's sense of efficacy will impact an individual's behaviors, attitudes, and ultimately, student outcomes. Belief systems strongly impact actions. If there is a belief that an action will not have an impact, it is unlikely that time, effort and resources will be invested (Bandura, 2002). Pajares (1992) agrees that beliefs can strongly predict behavior. He contends that, whereas knowledge influences how a task or problem is organized and defined, belief has a greater influence on how that task will be carried out or how that problem will be solved. Individuals with low efficacy for a task are likely to avoid engaging in that task altogether to avoid experiencing failure (McCabe, 2006). Teacher beliefs are positively correlated to the instructional practices implemented in the classroom and the subsequent academic progress of their students (Tschannen-Moran, Woolfolk-Hoy, & Hoy, 1998).

A teacher's sense of efficacy is both content and context-specific (Bandura, 1997). High levels of teacher efficacy in content knowledge, teaching that content, and using technology do not necessarily translate into high levels of efficacy regarding technology integration. Mishra and Kohler (2006) suggest that to effectively integrate technology into the curriculum in meaningful ways, one must interweave knowledge of content (subject matter), pedagogy (how to teach), and technology (using technological applications), a highly complex and dynamic process. Technology integration, the point where these three elements intersect, is where new strategies for teaching and learning will emerge that will positively impact 21$^{st}$ century learning. Unless professional development focuses on efforts to strengthen teachers' efficacy levels in technology integration, it is unlikely that teachers' practice will change (Bandura, 1997).

Because teachers operate in complex social environments, the collective efficacy of teachers within that school must be considered as it will influence individual teacher efficacy and beliefs. Collective teacher efficacy is defined as "the perceptions of teachers in a school that the efforts of the faculty as a whole will have positive effects on students" (Goddard, 2002, p. 100). Collective teacher efficacy, as is the case with individual teacher efficacy, positively influences student achievement and acts as a predictor of the group's behaviors (Goddard, 2002). Collectively, a group's motivation is fostered while persisting toward attaining a goal. The group ultimately enhances their ability to achieve performance accomplishments as resiliency in facing adversity is strengthened (Bandura, 2000).

The relationship between a group's collective efficacy and subsequent goal attainment lends insight into the importance of collective efficacy. An individual teacher will measure perceived competency based on other teachers in the environment and make changes and adjustments in behavior based on this assessment (Goddard, Hoy, & Hoy, 2004). In addition, all teachers, regardless of positive beliefs toward using computers in teaching and learning, will at one time or another, encounter barriers related to technology integration. Having support while persisting toward goal attainment is essential (Ball, 2006). Regardless of efficacy levels, if organizational resources are lacking, teachers will not have the needed support to translate their learning into practice (Bandura, 1997). Because collective teacher efficacy is an important determinant of individual teacher efficacy, addressing both 21st century content and context in professional development training is needed.

## Background

A commitment to provide a quality, rigorous education to prepare students for a successful future was communicated when West Virginia joined in the Partnership for 21st Century Skills in 2005. Since that time, expectations for curriculum and instruction have increased according to the standards set forth by the Partnership for 21st Century Skills and the International Society for Technology in Education (ISTE). The Partnership for 21st Century Skills' mission is to facilitate students' acquisition of essential critical thinking and problem solving skills through the integration of technology into the curriculum (Partnership for 21st Century Skills, 2009). The International Society for Technology in Education's (ISTE) National Educational Technology Standards for Students (NET-S) emphasize using technology as a tool to learn rather than learning how to use the technology (International Society for Technology in Education, 2009). Effective July, 2008, 21st century knowledge and skills have been integrated into West Virginia's professional teaching standards and West Virginia Content Standards and Objectives for students.

According to West Virginia Department Education's Policy 2520.14, "quality, engaging instruction must be built on a curriculum that triangulates rigorous 21st century content, 21st century learning skills and the use of 21st century technology tools" (Paine, 2006, p. 3). Because 21st century content and context differ from the content and context that many teachers learned in 20th century teacher preparation programs, teachers will need tools, support and training as they attempt to make this transformation (Sparks & Hirsch, 1999).

Whereas issues of access to technology tools and training were the greatest concern at one time, this is no longer the case. The Enhancing Education Through Technology Act of 2001 has allocated over 700 million dollars toward improving student learning through the use of technology. Twenty-five percent of that budget has been reserved for professional development focused on technology integration (U.S. Department of Education, 2004). With funding provided for initiatives to support ongoing, sustained, high quality professional development, teachers receive training in how to use technology tools to increase student achievement.

The greatest challenge is to facilitate teachers' use of technology in meaningful ways to support new ways of learning (Becker, 2000; Plair, 2008). The Partnership for 21st Century Skills (n.d.) identifies information, communication, and technology (ICT) literacy, which is represented as a combination of technology skills and learning skills, as critical to a 21st century education. Three main categories comprise ICT literacy: thinking and problem-solving skills, information and communication skills, and interpersonal and self-directional skills. Even though learning skills are not new to education, using technology to promote learning skills is new. Described as a critical enabler of learning skills, technology promotes new learning in a way that is not possible without it. Technology integration requires the use of technology in all phases of learning. This includes using technology to acquire information, synthesize information with current knowledge and to represent that new understanding (U.S. Department of Education, 2002).

West Virginia's 21st Century Learning Initiative's mission is to equip teachers with the knowledge and skills to effectively and seamlessly integrate technology into all facets of the school day. A measure of its success will depend on the extent to which 21st century knowledge and skills are integrated into every classroom (West Virginia Department of Education, 2008). If 21st century skills are to remain viable, research must center on best practices and professional development in implementing those best practices into the classroom (Kay & Honey, 2006).

Translating knowledge into action remains the greatest challenge. Teachers become aware of new practices in professional development. Without the willingness to accept and adapt these new practices, change will not occur (Wiske, Perkins, & Spicer, 2006). The difficulty does not lie in teachers gaining knowledge of what is considered best practice in 21st century teaching and learning but rather committing to adapting these new ideas and strategies into their daily practice.

In summary, teacher efficacy is a strong predictor of whether teachers will translate the knowledge gained from professional development into instructional practice. Teacher efficacy is the self-judgment of the capability to create a learning environment that will positively impact students' learning. With a belief that results are unattainable, there will be little motivation to act (Tschannen-Moran & Woolfolk Hoy, 2001). Likewise, with a belief that results are attainable, motivation to act will be greater. Student achievement and teacher efficacy are positively related. A strong predictor of group behavior and subsequent student achievement is collective teacher efficacy.

Because collective teacher efficacy influences individual teacher efficacy and vice versa, both individual and organizational factors involved in enhancing efficacy should be considered in professional development (Goddard, 2002).

## Problem Statement

Despite increased access to technology and teacher training, meaningful use of technology for learning is not being fully realized in our classrooms (Becker, 2000; Plair, 2008). Wiske, Perkins, and Spicer (2006) suggest the reason may be that even with extensive professional development, the challenge is not with teachers gaining knowledge but rather committing to adapting those new ideas and strategies into their daily practice. A strong predictor of whether teachers will translate the knowledge gained from professional development into instructional practice is teacher efficacy. Teachers will choose to engage in or avoid an activity based on whether they believe they will be successful. Time, effort, and resources will be invested in proportion to this judgment (Bandura, 1997). Pajares (1992) contends that, even though knowledge influences how a task or problem is organized or defined, belief exerts more of an influence on how that task will be carried out or how that problem will be solved. Even with West Virginia's commitment to extensive professional development on technology integration to support 21$^{st}$ century knowledge and skills, if efficacy is low, it is unlikely that classroom practice will change to reflect this new knowledge. Because efficacy is task and context-specific (Bandura, 1997), it is, therefore, imperative to investigate the impact of a school-based, job-embedded professional development on teacher efficacy for technology integration.

Dependent variables in this study are teachers' level of technology integration and efficacy for technology integration as operationalized with scores on the Grappling's Technology and Learning Spectrum (Porter, 2002) and the Computer Technology Integration Survey (Wang, 2004). The independent variables are the school-based, job-embedded professional development program, years of full-time teaching experience, grade level and subject area taught in 2009-2010.

## Research Questions

The following research questions will be investigated:

1. What is the change, if any, in teachers' level of technology integration in classroom practice after participation in a school-based, job-embedded professional development program?
2. What is the change, if any, in teachers' level of technology integration in classroom practice after participation in a school-based, job-embedded professional development program based on a selected list of attribute variables (e.g., teaching experience, grade level, and subject area)?
3. What is the difference, if any, in efficacy levels for technology integration between teachers who have participated in a school-based, job-embedded professional development program and those who have not?
4. What is the difference, if any, based on a selected list of attribute variables (e.g., teaching experience, grade level, and subject area), in efficacy levels for technology integration between teachers who have participated in a school based, job-embedded professional development program and those who have not?

5. What is the relationship, if any, between teachers' efficacy levels for technology integration and technology integration in the classroom for teachers who have participated in a school-based, job-embedded professional development program?
6. What are the differences in the relationship, if any, between teachers' levels of efficacy for technology integration and technology integration in the classroom, based on a selected list of attribute variables (e.g., teaching experience, grade level, and subject area), for teachers who participated in a school-based, job-embedded professional development program?

## Operational Definitions

**Efficacy for Technology Integration** – The belief in one's capability to integrate technology effectively in teaching and learning. In this study, efficacy for technology integration was operationalized with the score on the Computer Technology Integration Survey (Wang, 2004).

**Professional Development** – "Those processes and activities designed to enhance the professional knowledge, skills, and attitudes of educators so that they might, in turn, improve the learning of students" (Guskey, 2000, p.16).

**Technology Integration** – The use of technology as a tool to support students as they engage in learning activities that support 21st century knowledge and skill acquisition (International Society for Technology in Education, 2007). This study operationalized technology integration with the score from Grappling's Technology and Learning Spectrum (Porter, 2002).

**School-based, job-embedded professional development** – Professional development occurring daily within the context of the teacher's work day to support teachers' learning (National Staff Development Council, 2010)

**Collective teacher efficacy** – The judgment formed by a collective group of teachers that their efforts will have a positive impact on student learning (Goddard, 2002).

**21st century knowledge and skills** – The knowledge and skills outlined by the Partnership for 21st Century Skills that are needed to prepare students for success in the 21st century (West Virginia Department of Education, 2008).

**Teaching experience –** The number of years a teacher has been employed as a teacher.

**Grade level –** The grade level of students identified in present teaching assignment in 2009-2010.

**Content area –** The subject area in which content is presented as identified in present teaching assignment (i.e., reading, math) in 2009-2010.

## Significance of the Study

Several studies have produced findings supporting the positive impact of professional development on teachers' beliefs toward technology and on teacher efficacy for using computers. Yet few studies have investigated the impact of professional development on teacher efficacy for technology integration specifically for in-service teachers. Additionally, few studies have investigated the change in elementary and middle school teachers' technology integration in classroom practice after participation in a school-based, job-embedded professional development program. Finally, few studies have investigated the relationship between teacher efficacy for technology integration and technology integration in classroom practice after participation in a school-based, job-embedded professional development program.

The results of this study will inform future professional development efforts about best practices that may contribute to teachers translating what is learned in professional development program into classroom practice. Administrators may also use the results of this study to provide the context to support teachers as they work toward increasing levels of efficacy for technology integration. Finally, the results of this study may inform teacher educators about best practices that enhance efficacy for technology integration.

## Delimitations of the Study

Because this study is limited to teachers in West Virginia, the results may not be generalizable to populations outside of West Virginia. In addition, because elementary and middle school teachers participated in the study, the results may not be generalizable to high school teachers. Finally, this study is limited to teachers who participated in Phase I (2009-2010) of the Infusing Technology Professional Development Program, sponsored by the West Virginia Center for Professional Development. Although teachers make a two year commitment to participate in the professional development training and to sustain school-wide engagement, this study is limited to the time period specified.

## Organization of the Study

Chapter One presents an introduction to the research. Chapter Two provides a review of literature relevant to the research. Chapter Three describes the methods and procedures used to collect data. Chapter Four presents the findings of the study. Chapter Five provides a discussion of the findings, conclusions and recommendations for future research.

# CHAPTER TWO: LITERATURE REVIEW

The purpose of this chapter is to provide a review of relevant literature. The literature review is divided into three sections. Section one explores the literature on technology integration in promoting 21st century teaching and learning skills. Section two documents the elements of effective professional development that produce change in teacher practice to affect student learning. Section three explores the literature on efficacy and the elements of professional development that enhance its development. A summary concludes chapter two.

## Technology Integration

Technology integration is the use of a technology tool to support student learning. Plair (2008) defines technology as any tool that contains a microchip. Some common examples include computers, document cameras, multimedia, voice recorders, video cameras, and handheld devices. Integrating technology meaningfully into a curriculum is a highly complex, dynamic process and continues to pose challenges for teachers (Mishra & Koehler, 2006). First, teachers must gain a basic level of proficiency in how to use the technology tool and understand its uses. Second, and most importantly, teachers must know when, why, and how different technology tools can be used to support students' learning in different contexts. This requires that teachers take their understanding of their content, their knowledge of how best to teach that content, and explore how technology best supports students in learning that content.

The acronym, TPCK, which stands for technology, pedagogy, and content knowledge, is a framework developed by Mishra and Koehler (2006). This framework provides an explanation of why technology integration is so complex. Additionally, the

TPCK framework lends insight into why technology integration involves much more than just learning how to use technology and adding technology-related activities to an existing curriculum. To effectively integrate technology into the curriculum, a teacher must not only have knowledge of technology, pedagogy and content but have knowledge of how these three elements are interconnected.

The TPCK framework is based on Shulman's (1987) work in which he discusses how knowledge of content and knowledge of pedagogy must not be considered as two separate entities but must be approached simultaneously to effectively translate knowledge of subject matter to another. He termed this concept Pedagogical Content Knowledge (PCK). He asserts that it is at the point where knowledge of pedagogy and knowledge of content overlap, that a new knowledge, pedagogical content knowledge, exists.

Mishra and Koehler (2006) theorize that with the introduction of a third element, technology, this relationship becomes even more complex. Analogous to Shulman's argument, technology, content and pedagogical knowledge must be approached simultaneously. It is at the point where these three elements intersect that support new strategies for 21st century teaching and learning. Conversely, if technology is viewed as a separate entity outside of the pedagogical content knowledge, such as adding technology to an existing curriculum, technology integration will not occur.

If teachers are to change their practice and integrate technology in meaningful ways, then they must become actively involved in solving real problems with technology (Mishra & Koehler, 2006). As Wiske, Perkins, and Spicer (2006) postulate, the difficulty is not in teachers gaining knowledge of technology integration but rather committing to adapting that knowledge into their classroom practice. Mishra and Koehler (2006) believe that merging theory and practice can occur when teachers create design-based activities that promote learning by doing, dialogue, and reflection. Individuals take ownership of their learning as they collaborate and explore new ways to represent that learning through the creation of artifacts.

The International Society for Technology in Education (ISTE) (2008) has outlined five National Educational Technology Standards and Performance Indicators for Teachers (NETS-T). These standards are designed to serve as benchmarks for the meaningful use of technology in the planning, delivery, and assessment of learning experiences. These standards and performance indicators also delineate how technology must be used to enrich professional practice. The standards are:

1. Facilitate and Inspire Student Learning and Creativity.

Teachers use their knowledge of subject matter, teaching and learning, and technology to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments.

2. Design and Develop Digital-Age Learning Experiences and Assessments.

Teachers design, develop, and evaluate authentic learning experiences and assessments incorporating contemporary tools and resources to maximize content learning in context and to develop the knowledge, skills, and attitudes identified in the NETS-S.

3. Model Digital-Age Work and Learning.

Teachers exhibit knowledge, skills, and work processes representative of an innovative professional in a global and digital society.

4. Promote and Model Digital Citizenship and Responsibility.

Teachers understand local and global societal issues and responsibilities in an evolving digital culture and exhibit legal and ethical behavior in their professional practices.

5. Engage in Professional Growth and Leadership.

Teachers continuously improve their professional practice, model lifelong learning, and exhibit leadership in their school and professional community by promoting and demonstrating the effective use of digital tools and resources. (p.1)

Each of these standards calls for teachers to use technology in ways that promote critical thinking, reasoning and problem-solving skills. Teachers must not only gain an understanding of the interrelatedness of technology, pedagogy and content knowledge but apply this understanding within their classroom practice to effectively integrate technology in meaningful ways to influence student learning (Mishra & Koehler, 2006).

The Partnership for 21st Century Skills has outlined four core learning goals and objectives that must be emphasized in the instruction students receive in the classroom. These include (1) deepen content knowledge through exploring relevant 21st century interdisciplinary topics to include global awareness and financial literacy; (2) critically examine information and media for validity and reliability, and use technology ethically as a tool for learning; (3) enhance learning skills to develop as a life-long learner to include critical thinking and collaboration; (4) expand life and career skills to include self-direction, responsibility, and social skills (McClure, 2009; West Virginia Department of Education, 2008).

To meet these learning goals and objectives, teachers must become proficient in integrating technology in classroom practice. Information, communications, and technology (ICT) literacy have been identified as essential to a 21st century education because they enable students to develop their learning skills so that they may be effective learners. Three categories of skills are included in ICT literacy: thinking and problem-solving skills; information and communication skills; and interpersonal and self-directional skills. Using technology tools in meaningful ways promotes learning skills that will lead learners to gaining essential 21st century knowledge and skills (Partnership for 21st Century Skills, n.d.).

With the implementation date of July, 2008, the West Virginia Content Standards and Objectives (WVCSOs) have been revised to reflect the competencies outlined by ISTE and the Partnership for 21st Century Skills. According to West Virginia's State Educational Technology Plan, teachers must be prepared to integrate technology into instruction to promote students' learning skills if they are to prepare their students for lifelong learning and self-sufficiency. These learning skills are included within the standards outlined in the WVCSOs (West Virginia Department of Education, 2007-2010).

Based on a literature review, Brinkerhoff (2006) categorized the barriers that teachers encountered as they attempted to integrate technology into their classroom. The first barrier was resources. Resources included the technology tools, such as computers, software, and Internet connections. The second barrier was institutional and administrative support with scheduling of time being identified as a major obstacle. With an already imposing schedule, insufficient time was available for exploring how to use the technology, planning technology-infused lessons, collaborating with other teachers in how they are using technology in their classroom, and scheduling time to meet with the technology coordinator. The third barrier was training and experience. Teachers reported a lack of training and experience in how to integrate technology into a specific content area. A lack of follow-up support after the professional development program ended was also cited. The fourth barrier was attitudinal or personality factors. Many participants reported feeling anxious prior to integrating technology in their teaching. Brinkerhoff cites Piper's (2003) research in which teacher efficacy was identified as a significant indicator of whether a teacher would integrate technology into lessons. Low levels of efficacy can be identified as a barrier in teachers' technology integration practices.

Keengwe and Onchwari (2009) identified similar barriers to technology integration practices for early childhood teachers: lack of familiarity with technology applications, lack of administrative and technical support and difficulties with integrating the technology within the curriculum. According to the authors, the teachers who participated in the professional development viewed instruction and technology integration as two mutually exclusive events. The teachers reported feeling overburdened with the additional responsibilities of having to add technology into a curriculum that was already filled with curriculum objectives and goals. The teachers also reported feeling uncomfortable with managing a technology-infused classroom. The authors suggest that in order for technology integration to occur, teachers must become more comfortable in the idea that they do not have to be an expert in technology to use it effectively in supporting student learning. When a teacher is learning how to use the technology along with the students, and uses the technology as a tool to support learning of content, students can benefit from the teacher's modeling of problem-solving and critical thinking skills and strategies.

According to Cowan (2008), many teachers feel that they do not have the freedom to deviate from the curriculum to integrate technology into their classroom curriculum. With pressure to integrate technology into their teaching, a choice must be made to either follow the strict guidelines outlined in pacing guides where a certain lesson needs to be taught on a specific day or teach a technology-infused lesson. With increased pressures to prepare students for benchmark testing, the lesson outlined in the pacing guide usually wins out. Professional development in technology integration holds promise in that teachers may begin to see the benefits for students' learning as technology becomes more integrated with classroom practice.

To address these barriers, the West Virginia State Educational Technology Plan was developed to facilitate students' attainment of the West Virginia content standards and objectives. The plan outlines four major goals. One, a standards-based curriculum integrated with 21st century technology resources will be used to raise student achievement. Teachers will not have to choose between teaching the content standards and teaching a technology-infused lesson. Two, technology infrastructure will remain a priority. With the goal of a 1:5 computer to student ratio, 76% of all elementary and middle schools in West Virginia are meeting that standard in 2008-2009 as compared to 54% in 2005-2006. Increased Internet access is also being realized in many schools. Teachers will have the resources to integrate technology. Three, online and onsite professional development will be provided to support teachers in learning new strategies for technology integration to transform instructional practice. Teachers will have the training and experience needed for successful technology integration. Four, instruction will be driven by data based on sound assessment and evaluation practices (West Virginia Department of Education, 2007-2010). Teachers will plan instruction based on the needs of their students.

Integrating technology appropriately into classroom practice has many benefits. Technology integration promotes student achievement in core subject areas such as reading, writing, math, and science (ISTE, 2008). Integrating technology also helps build 21$^{st}$ century skills (ISTE, 2008). Roblyer and Edwards (2000) agree that when technology is used in teaching and learning, critical thinking improves as students are given opportunities that focus on solving authentic real world problems. As students use technology to locate information and apply it in a meaningful way, 21$^{st}$ century skills are enhanced (Dockstader, 1999). Technology-infused lessons also offer versatility. Differentiation can be accomplished through making accommodations for students, depending on their ability levels, learning styles, and interest levels (Cowan, 2008).

Integrating technology increases student engagement in learning. Because technology affords new ways to communicate with others beyond the classroom space, students are able to share their new understandings with an audience (ISTE, 2008). When content is presented with the aid of technology, students' interest levels were greater when compared to students' interest levels when the content was presented through more traditional means (Booth, 2009). As a result, student behavior and learning increased as students became more engaged and interested in the content (Dockstader, 1999).

While computers and other technology tools are a prerequisite for technology integration, their presence in a classroom will not guarantee its use (The National Foundation for the Improvement of Education, 2000). In fact, Cuban's (2001) national survey of 4,100 teachers found that computers are frequently underused in the classroom. In addition, he found that when computers are being used, they are being used for low level drill and practice activities or games. Lawless and Pellegrino (2007) reported word processing as one of the most common uses of computers in the classroom. If the computers were removed from the classroom, the effect on student learning would be minimal. Although meant to transform instructional practices and subsequent student learning, computers were being used in ways that maintained current teaching practices (Cuban, 2001).

Porter (2002) states that all technology uses are not equal. For many teachers, the focus has been on using technology for the sake of using technology with little regard to its influence on learning. In Grappling's Technology and Learning Spectrum, Porter identifies three broad categories of technology use and corresponding instructional and learning focus. The categories include technology literacy use, adapting use, and transforming use. Technology literacy use includes teacher-centered instruction with a focus on acquiring technical skills. Examples include learning how to use the keyboard or create a PowerPoint presentation. Technology adapting use includes teacher-centered instruction with a focus on adapting lessons to include technology as an optional way to teach the content standards and objectives. Examples include drill-and-practice activities and instructional games. Technology transforming use includes student-centered instruction in which technology is seamlessly embedded within the learning. It is at this level that students use technology to construct new knowledge and to represent that knowledge to share with others. Examples include creating a video to represent learning or engaging in collaborative writing on a wiki. Porter presents the spectrum as an instructional framework useful for evaluating progress of how technology is being used to influence student learning (Porter, 2002).

Another tool that can provide important feedback to improve instruction and student learning is a rubric. Although traditional assessments have focused on assessment of basic skills, twenty-first century skills, such as critical thinking, innovation, problem-solving and teamwork, cannot easily be assessed with these traditional assessments. A rubric is an alternative assessment tool that can assess both basic skills and twenty-first century skills (Cowan, 2008).

A rubric is a tool that communicates performance-based expectations so that participants will know what they need to do to achieve a certain level of proficiency. Tierney and Marielle (2004) define a rubric as a "descriptive graphic rating scale" (p. 1). A well constructed rubric contains three elements: criteria, performance levels, and performance descriptors. The criteria are the specific dimensions in which a performance will be evaluated. The criteria are listed in the rows of a matrix. The performance levels are the different levels of performance identified. These may be identified by numbers (1 to 5) or words (novice to distinguished). The performance levels are listed in the columns of a matrix. The performance descriptors provide a qualitative description of each criterion at each varying level of performance. The performance descriptors are located in the cells of the matrix (Allen & Tanner, 2006). With three criteria and five levels of performance, 15 performance descriptors would be identified.

Tierney and Marielle (2004) believe the most difficult task associated with constructing a valid and reliable rubric is the identification of performance criteria levels that are consistent across the scaled levels. The rubric should be a reflection of a positive, continuous learning continuum. The authors stress that each performance level must contain a reference to each specific criterion at varying gradations of quality. The attributes of each criterion need to be explicitly stated and described fully enough for the rubric to be useful. The language used must be precise. In addition, the language must have a positive tone, meaning that a descriptor of a lower level on the rubric should not reflect negativity as opposed to a descriptor of a higher level being expressed in positive terms.

Some of the benefits of using a well constructed rubric are that it provides both a quantitative and qualitative analysis of an individual's level of performance. With qualitative expectations clearly communicated and quantitative point values associated with descriptors for each performance level, consistency is provided in monitoring levels of proficiency and in charting progress (Allen & Tanner, 2006). A well designed rubric encourages reflection. As individuals use the rubric for self-assessment, self-directed learning can be enhanced as individuals rate their performance along a graduated learning continuum. Performance descriptors provide valuable information about what needs to be done to progress to the next level. This feedback is needed before one will revise their performance so that improvements can be made to lead to attainment of higher levels of proficiency (Reddy, 2007). This is important in building capacity for continued growth and learning (Allen & Tanner, 2006). Finally, rubrics can provide evaluative feedback that can be useful in planning for needed instruction or improving a course design (Reddy, 2007).

## Professional Development

Professional development is defined as "those processes and activities designed to enhance the professional knowledge, skills and attitudes of educators so that they might, in turn, improve the learning of students" (Guskey, 2000, p. 16). When students are placed in classrooms with highly qualified teachers who implement effective instructional strategies, student achievement increases (Walker, Downey, & Sornensen, 2008). Effective professional development produces changes in classroom practice, enhances the capacity for continued learning and growth and ultimately leads to student achievement (Corcoran, 2007).

Professional development provides the link between teachers learning new skills and changes in instructional practices. These changes in instructional practices can produce marked improvement in student achievement (Darling-Hammond, Chung, Andree, Richardson, & Orphanos, 2009). According to Guskey (2000), one central factor present in all educational reform efforts that produced marked improvements in student achievement is professional development.

In Becoming a Nation of Readers, a call to improve teacher quality through improved professional development was issued (National Institute of Education, 1984). When the Elementary and Secondary Education Act of 1965 (ESEA) was reauthorized under The No Child Left Behind Act of 2001, professional development was identified as a primary strategy for attracting and retaining quality teachers. Funds have been allocated for improving teacher knowledge in one or more content area(s) in an effort to provide every student in every classroom with a highly qualified teacher.

**Effective Professional Development**

The American Board for Certification of Teacher Excellence outlined guidelines for effective professional developed in accordance with the No Child Left Behind Act of 2001. When planning professional development, the following criteria should be met. The planned activities should reference student learning, include research-based practices, match the content being instructed, align with state standards and make mastery of content a priority. All decisions should be based on school data and on-going evaluation of the professional development is required. Finally, a long-term plan for sustained and focused professional development should be created. One-day workshops are not acceptable (Madigan, n.d.). Workshop professional development sessions taking place outside of teachers' classrooms have been criticized as being ineffective in producing any lasting change in teachers' classroom practice (Loucks-Horsley, Hewson, Love, & Stiles, 1998).

The American Educational Research Association (2005) refines this list to include four elements. One, the content should include the subject matter that the teachers who are in attendance will be teaching. Two, activities should involve the use of the actual teaching and assessment materials that teachers would use in their own classrooms. Three, extended time should be devoted to the professional development so that teachers can improve their learning as well as observe the impact on student learning. Four, an evaluation system should be in place to document changes in teachers' practices and student learning.

The Partnership for 21st Century Skills (2009) identifies the specific content and the context in which 21st century professional development should occur in order to facilitate teachers' capacity for equipping their students with essential 21st century knowledge and skills. Twenty-first century professional development should meet the following goals:

- Highlight ways teachers can seize opportunities for integrating 21st century skills, tools and teaching strategies into their classroom practice — and help them identify what activities they can replace/de-emphasize
- Balance direct instruction with project-oriented teaching methods
- Illustrate how a deeper understanding of subject matter can actually enhance problem-solving, critical thinking, and other 21st century skills
- Enable 21st century professional learning communities for teachers that model the kinds of classroom learning that best promotes 21st century skills for students
- Cultivate teachers' ability to identify students' particular learning styles, intelligences, strengths and weaknesses
- Help teachers develop their abilities to use various strategies (such as formative assessments) to reach diverse students and create environments that support differentiated teaching and learning
- Support the continuous evaluation of students' 21st century skills development
- Encourage knowledge sharing among communities of practitioners, using face-to-face, virtual and blended communications
- Use a scaleable and sustainable model of professional development (p. 8-9)

The focus of 21st century professional development is to improve student learning by enhancing teachers' capacity for infusing 21st century knowledge and skills into the classroom. Because information, communication, and technology (ICT) literacy are integral components of acquiring 21st century knowledge and skills, teachers are required to enhance their ability to use technology to promote students' learning skills (U.S. Department of Education, 2002). With 21st century technological advances, new opportunities for collaboration extend learning beyond a classroom, for both the teacher and the student. The challenge will be in using technology in meaningful ways to support new ways of learning that may not already be included in teachers' repertoire of instructional strategies (Becker, 2000; Plair, 2008).

**Professional Development in Technology Integration**

If teachers are to be prepared to infuse essential 21st century knowledge and skills into the curriculum, professional development in technology integration is critical (Kay & Honey, 2006). Professional development that focuses on technology integration positively influences classroom practice. For this impact to be felt, teachers must be given the opportunity to learn new instructional strategies to improve student learning. Teachers must also be given time to practice these new strategies before implementing them in the classroom (U.S. Department of Education, 2005). According to The National Staff Development Council (2009), teachers must experience an instructional method in the same manner in which their students will experience it. This practice is based on the belief that teachers teach in the same way they were taught.

Lawless and Pellegrino (2007) completed a meta-analysis on professional development programs that produced changes in technology integration practices of teachers. Workshops with follow-up provided over an extended time for continued learning and feedback were the most common professional development design. Three effective design components were identified from the research literature. One, opportunities provided for teachers to learn how to use the technology within a specific context to meet teaching and learning needs were essential. This design component resulted in increased ownership, increased confidence in using the technology tool, and beliefs that the technology tool when used in teaching and learning can positively impact student learning. Two, reflection was also identified as an effective design-based component. Reflection helped to build community of practices and sustained long-term efforts of continued technology integration practices after the professional development training ended. Three, mentoring and coaching models supported changes in teacher technology integration practices. The mentor or coach focused on the teacher's needs which led to increased proficiency in using technology and teachers feeling more comfortable using the technology. Lawless and Pellegrino (2007) concluded the literature indicated that teachers who participated in technology integration professional development reported greater confidence in using technology and improved abilities for integrating technology in classrooms. Yet, the authors state that more experimental and quasi-experimental research designs with theoretically driven research questions that approach evaluation in a longitudinal manner are needed.

Tiemann (2009) expanded upon Lawless and Pellegrino's (2007) meta-analysis to include technology integration professional development programs that produced changes in teacher beliefs, attitudes or levels of efficacy for technology integration. Studies that included professional development meant to increase technology integration, but instead evaluated the participants' change in computer skills or attitudes towards using computers were eliminated. While computer skills are a necessary prerequisite for technology integration, computer skills do not necessarily lead to technology integration in classroom practice. Based upon this analysis, the author agreed that more research is needed to identify specific elements of effective technology integration professional development programs.

Mouza (2009) investigated whether professional development built on research-based practices would produce a change in technology integration practices of teachers. From the findings, the author concluded that when training is based on the best practices of professional development, teacher learning improves and subsequently, teacher practice is positively influenced. This three-year longitudinal study revealed not only short-term changes in teacher technology integration practice but evidence of increased capacity for continued learning. The author suggests that the relationship between knowledge of technology integration and beliefs merits further investigation.

School-based, job-embedded professional development moves beyond just providing formal teacher training at workshops. The majority of the professional development occurs on the job within the context of the school. It is important that professional development directly relate to the work teachers are doing in their classrooms. When the professional development is job-embedded, teachers are able to solve day-to-day problems (Sparks & Hirsh, 1999).

Sparks, emeritus executive director of the National Staff Development Council, advocates for a more personalized approach to professional development that includes joint problem-solving related to the issues teachers face on a daily basis. Teams of teachers must work together, share ideas and resources and plan together. Sparks believes this school-based, job-embedded professional development should account for 80 percent of the professional development with approximately 20 percent allocated to formal teacher training sessions (Mather, 2000).

Garet, Porter, Desimone, Birman, and Yoon (2001) believe professional development is effective when a change in teachers' knowledge and practices are evident. The authors studied the structural features of professional development that enhance these changes. These include 1) opportunities were provided for active, hands-on learning focusing on specific learning goals; 2) collective participation of a group of teachers from the same school, same grade, or same subject is required; and 3) extended length of professional development. These features led to increased opportunities for in-depth conversations related to implementation successes and challenges.

When a context is shared, relevant feedback can be provided. When teachers from the same school, same grade, or same subject work with similar students, there are increased opportunities to discuss how implementing what was learned in the professional development in their classrooms affected student learning (Garet, Porter, Desimone, Birman, & Yoon, 2001). Guskey (2000) believes that until teachers have evidence that student learning is positively influenced by implementing new strategies learned in professional development in their classroom, teacher attitudes and beliefs will not change.

Professional development that builds upon a school-based learning community provides a support network for teachers as changes in classroom practice are attempted. To support each member in increasing proficiency levels, responsibility, collaboration and commitment are required (Fulton, Yoon, & Lee, 2005). According to the National Staff Develoment Council, the goal of a professional learning community is for teachers to help one another improve their work so that student learning improves. Teachers must strive for continuous improvement, problem solve together, meet on a consistent basis, and plan together (National Staff Development Council, 2009).

According to Wenger (2007), domain, community and practice are needed to ensure a community's success in providing members support for sustained learning. Domain refers to a group's shared identity and commitment to a common goal. In 21st century professional development, the goal is equipping students with 21st century knowledge and skills. Community refers to building of relationships that allow the members to learn from one another. With technology tools that promote collaboration, community no longer needs to be limited to individuals in one's immediate environment. Practice refers to the shared practices among the group. These practices include routines involving teaching a shared body of students using certain tools and resources. Wenger believes that communities can be strengthened as teachers engage in the following activities: problem-solve, request information, seek experiences, reuse assets, coordinate activities, discuss developments, document projects, visit and identify knowledge gaps.

Windschitl and Sahl (2002) studied how teachers learned to use their laptop computers to support instruction. The researchers found that teachers who engaged more often in informal conversations and collaborative lesson planning integrated technology in more innovative ways than those who engaged in those activities less often. The authors make the observation that the teachers learned about new technologies in formal professional development trainings, yet learned how to integrate the new technology into practice from informal conversations with colleagues. The interaction that occurs among teachers is necessary in supporting meaningful use of technology integration.

Joyce and Showers' research supports the importance of teacher interaction to facilitate the transfer of new skills learned in professional development into classroom practice. Peer coaching or collegial support was found to be the most effective form of professional development. Teachers who participated in professional development using this model reported a 95% gain in knowledge, mastery of new skills, and ability to transfer the new skills into the classroom (Joyce & Showers, 2002).

In conjunction with collegial support, sustained professional development is needed if teachers are to transfer the learning from the professional development experience into their own classroom. An expert mentor can help teachers make that transfer. Committed to teachers' success, the mentor collaborates with teachers to work as an additional problem-solver. With sustained involvement between the mentor and mentees in connection to the teachers' real work with specific students, the mentor can provide differentiated support to meet the specific the needs of the teachers (Neufeld & Roper, 2003).

An expert mentor who regularly visits with the teachers in their classrooms can provide the just-in-time support that is needed to turn knowledge into practice (Salpeter, 2003). An online mentor can also provide timely support for teachers. When online mentoring is paired with onsite visits, this source of support can prove to be valuable. Online mentoring in isolation, however, has not proven to be as effective (National Foundation for the Improvement of Education, 2000).

In a study conducted by Boone (2005), the author found that the coaching provided by a mentor influenced the teachers' use of technology in their instruction. Teachers from two different elementary schools served as the population in this mixed-method, quasi-experimental study. The experimental group received coaching from a mentor, the control group did not. Both groups had access to the same technology resources. A quantitative analysis revealed that even though the experimental group used computers slightly less often daily when compared to the control group, the teachers who did receive the mentoring used the computers more often in instructional practice when compared to the teachers who did not receive mentoring. This result indicates that mentoring can facilitate teachers through meaningful use of technology to affect student learning. In a qualitative analysis, interviews with the teachers from the experimental group revealed that the teachers acquired new technology skills and increased their confidence in their ability to use technology in teaching. The author concluded that increasing mentor time with teachers in the school may increase technology integration.

In professional development focusing on technology integration, a mentor can provide the link from teachers using the computer to using the computer as a tool to enhance student learning. With an understanding of content and how students learn that content, the mentor can show teachers how to integrate technology to support student learning within that context. In this way, the focus stays on sound pedagogy and not on the technology application (Morrison & Lowther, 2002).

## Efficacy

Efficacy has been identified as a reliable characteristic in predicting teacher practices and subsequent student achievement (Woolfolk & Hoy, 1990). The framework of Social Cognitive Theory explains how efficacy predicts behavior. Efficacy beliefs affect how one perceives and cognitively processes an experience in the environment. Through introspection, one uses different sources of information to filter an experience to assign it meaning. These include personal, behavioral and environmental sources. Personal sources of information include cognitive, affective and biological influences. Behavioral sources of information include actions. Environmental sources of information include external conditions. Judgments are then formed based on those perceptions.

As an individual interprets the perceived outcome of his behavior, this influences his environment and personal factors that in turn will continue to affect future behavior (Bandura, 1997). Bandura (1986) refers to this process as triadic reciprocal causation. He suggests that each of these influences are bi-directional, dynamic, context-specific, and exert varying levels of influence that may or may not have an immediate effect. It is when an individual cognitively processes the interplay between these influences that the opportunity to exert control over future behaviors exist.

**Teacher Efficacy**

An individual will choose to engage in or avoid an activity based on a judgment of perceived capabilities to succeed. Time, effort and resources will be invested in proportion to this judgment. An individual with high efficacy will persist in overcoming obstacles to meet the challenge of succeeding in mastering a difficult task. If he does succeed in mastering that task, he contributes his success to effort, persistence and commitment. If he fails, he contributes his failure to factors that were beyond his control. An individual low efficacy most likely will feel threatened by the task and avoid it altogether. If avoidance is not an option, such as in required professional development training, little effort, persistence or commitment will be given (Bandura, 1997).

Bandura (1997) states that the theory of self-efficacy provides an explanation as to how an individual can learn to exert control over any behavior. Because of the interactions of the personal, behavior, and environmental factors that result in a triadic reciprocity, Pajares (2002) explains that by addressing any of these factors, efficacy can be strengthened. For example, if the learning environment (environmental factor) is improved by providing a support system for teachers, this will affect how the teacher feels (personal factor) prompting the teacher to try out a new instructional strategy in the classroom (behavioral factor) with students responding positively by being engaged in the learning activity (environmental factor). As an individual encodes these interactions, he constructs a perceived reality which allows him to regulate and perform future behaviors. In this way, "what people think, believe and feel affects how they behave" (Bandura, 1986, p. 25).

Individuals form their efficacy beliefs based on different sources of information. As an individual reflects on these sources of information, efficacy beliefs are either strengthened or weakened. Listed in order of degree of influence, mastery experiences, vicarious experiences, social persuasions, and somatic and emotional states, provide the sources of information that influence efficacy (Bandura, 1997).

Mastery experiences, or the result of a previous performance, determine whether an individual believes he will experience success or failure in performing similar behaviors. Pajares (2002) suggests that the mastery experience is raw data that the individual then interprets before forming a judgment on the outcome of that experience.

It is possible that actual performance may differ from perceived performance. Mastery experiences enhance teachers' knowledge and skills. When teachers engage in professional development opportunities that focus on integrating new learning into the curriculum, teachers and students can benefit (Garet, Porter, Desimone, Birman, & Yoon, 2001).

Vicarious experiences refer to observing a model perform a task. The closer an individual identifies with the model, the greater likelihood that this source will impact the individual's sense of self-efficacy. For example, if a teacher views another teacher with similar ability succeed, the teacher will make the generalization that he, too, can succeed. Pajares (2002) states that individuals seek out models they admire with abilities they aspire to attain. A significant model can exert a powerful influence over self beliefs.

Social persuasion, consisting of encouraging or discouraging feedback, can either increase or decrease self-efficacy (Bandura, 1997). Discouragement has more of an effect on self-efficacy beliefs than encouragement (Pajares, 2002). Two factors contribute to a teacher's interpretation of social persuasion. One, the isolation that teachers experience on a daily basis results in less opportunities for feedback on teaching performance. Because there are no instructional techniques that are agreed upon for every circumstance, little assurance exists as to whether teaching decisions made were the most effective. This isolation has the potential to contribute to teachers' feelings of vulnerability and self-doubt. Two, the influence of teachers' efforts on student achievement cannot always be directly observed. Without evidence of student success or positive reinforcement of effort, feelings of competency may be compromised. Teachers need to know that their efforts are worthwhile, feel a sense of competency and be recognized for their achievement (Ashton & Webb, 1986). Positive feedback and recognition contribute to a teachers' sense of efficacy.

Physiological factors, such as physical symptoms of increased heart rate, perspiration, and nausea, can be perceived in different ways by an individual. If these symptoms are interpreted as being a confirmation that he is lacking the ability to be successful in completing the task, this will contribute to lowering self-efficacy. If these physical symptoms are interpreted as completely normal, this will not affect the individual's efficacy. Maintaining an optimistic attitude versus a defeatist attitude can have a bearing on self-efficacy beliefs since an individual has the ability to control his thought patterns and interpretation (Bandura, 1997).

Because teacher efficacy is related to the teaching context, physiological and affective states can be affected when teachers are expected to change teaching practices to accommodate reform efforts. This relationship, teaching context and efficacy, has been explained by Tschannen-Moran, et. al. (1998). Teachers feel a level of comfort and confidence using certain methods to teach certain subjects and certain students. When the teaching context changes, efficacy is affected. Teachers who may be highly efficacious in teaching math may feel lower levels of efficacy if they are required to change the context. The context for teaching math changes if a teacher is required to teach math by infusing technology into the lesson. Levels of efficacy may vary for teaching math and teaching math with technology.

Self-reflection becomes the medium that transforms experiences, thoughts and actions to an altered form (Bandura, 1997). Dewey (1910) believes that reflection promotes thinking and learning, which in turn promotes critical thinking and self-evaluation. Reflection is what prompts teachers to identify problems and work toward creating possible solutions. When teachers engage in problem-solving, an opportunity to turn knowledge into practice exists (Brubacher, Case, & Reagan, 1994).

Teacher reflection has been identified by the International Society for Technology in Education (2008) as a necessary component of professional growth and leadership. As technology is integrated into practice to support student learning, teachers must evaluate and reflect on their practice to inform instructional decisions. Not only are teachers responsible for supporting student learning, they are also called to contribute to the professional growth of other educators (International Society for Technology in Education, 2008).

Reflection is a socially mediated activity. When teachers share their reflections, other teachers can benefit as multiple perspectives are considered that may lead to new insights and ultimately enrich individual reflection (Collins, 1991). As new questions are asked and advice is considered, teachers may adapt their instructional practice based on this new knowledge (National Commission on Teaching and America's Future, 1996).

Ross and Bruce (2007) place teacher self-assessment at the center of teacher change. Teacher change is dependent on the sources of information that a teacher reflects upon. As the teacher uses an instructional strategy in the classroom, he filters that experience through observations and judgments on student achievement. This information results in either enhancing or reducing efficacy beliefs. Goal setting and effort expenditure will be in relation to efficacy levels. Efficacy levels, in turn, will inform the teacher's future instructional practice.

**Individual Teacher Efficacy and Professional Development**

Professional development programs that address the four sources of efficacy do have an effect on teachers' sense of efficacy. Ross and Bruce (2007) designed a professional development program that studied whether teachers' sense of efficacy would increase in teaching standards-based math when the presenters explicitly focused on creating conditions that would enhance the four sources of efficacy information. Although all areas showed an increase in efficacy, a significant difference was noted in the management of a standards-based math learning environment. The authors concluded that even though skill acquisition is a critical part of professional development, attention to enhancing the efficacy beliefs of participants is also needed. If the goal of professional development is to develop the capacity to apply knowledge to evolving classroom practice, teachers must persist in setting and meeting challenging goals when they are confronted with adversity.

Professional development programs that foster efficacy can assist teachers in learning new skills. Two criteria must be met if teachers are to learn and apply the new skills to their classroom. First, teachers must judge the information to be reasonable and worthwhile. Second, teachers must feel confident that they will experience success as they apply the knowledge, skills and instructional practices in their classroom (Wolfe, Viger, Jarvinen, & Linksman, 2007).

Efficacy scales can provide important diagnostic information about levels of efficacy to determine areas that need attention. In a standards-aligned assessment training program, six potential barriers were identified that may prevent teachers from translating new learning into classroom practice: (1) confidence in aligning assessment with standards, (2) impact on student learning, (3) utilization of standards as a basis to create assessments, (4) utility of standards-aligned assessments, (5) extent of experience with standards, and (6) extent students can be involved in assessment. In a validation study, the researchers determined that these six traits were valid and reliable measures of teacher efficacy in aligning assessment with standards-based math (Wolfe, Viger, Jarvinen, & Linksman, 2007). Based on the information that teachers provided on this particular efficacy scale, developers of professional development can use this information to determine what areas need greater emphasis in future teacher trainings.

Hall (2008) studied the relationships among computer self-efficacy, professional development, teaching experience and technology integration among teachers. Based upon the findings in this study, the researcher concluded that there was a moderately statistically significant relationship between computer self-efficacy and technology integration among teachers who taught high school students. Quantitative data were triangulated with qualitative data from teacher interviews, lesson plans and classroom observations to reach this conclusion.

Okoye (2010) also found a significant positive relationship between technology coaching, computer efficacy and levels of technology implementation in her study of K-12 inservice teachers. The author also concluded that technology coaching and computer efficacy were useful in predicting levels of technology implementation. Teachers who were high implementers of technology viewed the technology coach as a factor in increasing levels of technology integration and efficacy.

Johnson's (2006) study of K-12 inservice teachers produced findings that contrasted with Hall's (2008) and Okoye's (2010) findings. In Johnson's study, he concluded that there was no statistically significant relationship between current instructional practices and computer self-efficacy. Participants in a technology professional development program reported high levels of efficacy, yet low levels of technology integration in classroom practice were evident.

In Borman's and Rachuba's (1999) study, researchers investigated whether elementary school teachers of varying socio-economic levels had access to equal opportunities for professional growth and the resultant effect on efficacy and quantity of reformed instructional practices in the classroom. Their findings revealed that an unequal distribution of professional development opportunities exist between high and low poverty schools. Teachers who were given better quality professional development opportunities improved in efficacy levels. These teachers also demonstrated an increased number of reformed instructional practices into their teaching. The researchers concluded that differences in professional development opportunities are linked to differences in efficacy levels and evidence of increased levels of reformed instruction in the classroom.

Eun and Heining-Boynton (2007) studied the impact of professional development on teacher efficacy to determine whether classroom practices changed after the training. While teacher efficacy and organizational support were determined to be a predictor of whether a teacher would translate knowledge and skills learned into instructional practice, the researchers hypothesized different teacher characteristics would influence the outcome. The findings revealed that efficacy is the strongest predictor of the impact of professional development on teaching practices. School support was also a strong predictor. Without perceived support and resources at the school level, even teachers with high levels of efficacy may not change teaching practices. Even though efficacy is necessary, it was not sufficient. Finally, teaching experience did not have an effect on teaching practices changing as a result of attending professional development. Based on these findings, it is clear that regardless of teaching experience, all teachers need support as they engage in mastery experiences.

In another study, Overbaugh and Lu (2008) found that participants' demographic information did not have a significant effect on teachers' sense of efficacy. Factors considered include the number of previous professional development courses offered by the same provider, the participants' school and grade level placement, educational attainment, age, and gender. According to Bandura (1997) individuals engage in behaviors that lead to favorable results and retain those for future use. However, if the behavior leads to unfavorable results, the behavior will be discarded. Mastery experiences in which participants experience success are an important element in enhancing efficacy.

In Kemp's (2002) study, years of teaching experience were shown to have an inverse relationship with technology integration. The lower the number of years of teaching experience was correlated with higher levels of efficacy for technology integration, while the greater the number of years of teaching experience was correlated with lower levels of efficacy for technology integration. Hall's (2008) study, however, found that teachers' years of full-time teaching experience were not significantly correlated with levels of technology integration or with efficacy in integrating technology in classroom practice.

Because efficacy is formed as individuals interpret mastery experiences, vicarious experiences, social persuasion and affective states in regard to a specific goal, interventions should be task and situation-specific (Pajares, 1996). If the goal of 21st century professional development is to infuse 21st century content and tools into the fabric of every classroom, then professional development should foster the conditions that promote collective and individual teacher efficacy in regard to applying 21st century content and tools in the context of their own classroom.

**Collective Teacher Efficacy and Professional Development**

Because teacher efficacy beliefs are influenced by beliefs held by the school organization, attending to the needs of teachers in professional development can influence efficacy. When professional development provides opportunities for teachers to collaborate and provide support to each other, the intensity and depth of learning increases (Fullan, 1982).

Guskey (2000) points out that the real challenge in any professional development is after the professional development session ends and implementation begins. Plair (2008) argues that despite the changes made in the format of professional development, teachers are not transferring the skills and knowledge learned in the training into their classrooms. Without a model to provide just-in-time guidance, teachers will not change classroom practices. If professional development is to change classroom practice, the author believes changes need to be made in the format of professional development so that opportunities for developing teachers' sense of efficacy and confidence can be extended.

A professional learning community can provide the support needed as teachers attempt to transfer what they have learned in professional development into their classroom practice. According to Bandura (2002), efficacy will influence behavior in four ways: cognition, motivation, affect, and selection. One, cognition will influence the challenge of the goal set. Two, motivation will determine how much time and energy is expended and how persistent the individual will be in overcoming obstacles based on previous successes and failures. Three, affect refers to the ability to develop coping strategies to control thoughts, beliefs and feelings. Four, selection is the type of task chosen to attempt or avoid. Teachers will need support in setting challenging goals, staying motivated, developing coping strategies, and selecting appropriate tasks.

Ropp (1999) found that participants with higher levels of efficacy for computer technology used more computer technology coping strategies. Additionally, these participants reported feeling less anxious about using the computer, having positive attitudes toward technology and increased confidence in teaching with technology.

Professional development programs that promote learning communities provide increased opportunities for dialogue, reflection and learning (Darling-Hammond & McLaughlin, 1995). Rowan (1990) found that increased professional development opportunities led to improved instruction, improved teacher efficacy and communication, and improved student outcomes. In a literature review compiled by Calcasola (2009), five characteristics were identified as being essential to a learning community. These include shared decision-making, common vision, collaboration, shared practice and being a part of a supportive environment.

Calcasola (2009) surveyed eighty-six professional learning communities to determine the relationship between professional learning communities and collective teacher efficacy. Findings from the study reveal a significant positive relationship between successful professional learning communities and collective teacher efficacy. The researcher concluded that time was a critical factor contributing to the success of a learning community. This conclusion was evidenced with ninety-four percent of the respondents reported meeting with their team for a minimum of forty-five minutes per week. Furthermore, the researcher concluded that teams who viewed their professional learning community as effective believed they could positively influence student achievement. This belief, in turn, contributed to higher levels of collective teacher efficacy.

Plair (2008) described the importance of a knowledge broker. She believes that many teachers, despite being confident and comfortable with their content knowledge, often resist changing teaching practices if it requires integrating technology into their teaching. A knowledge broker, or mentor, can become a resource and support for teachers infusing the technology with the pedagogy and content knowledge after the professional development session ends. The authors describe the knowledge broker as one who is knowledgeable of current literature on best practices, strategies and techniques and tailors those best practices to fit into a specific content within a unique context. On-the-spot support is vital to enhance teacher efficacy and transform the information from professional development into useable knowledge for the classroom.

Ahmad and Farnam (2006) found that a site-based professional development program that provided collaboration, mentoring and coaching was effective in increasing efficacy as teachers created and implemented technology-infused lessons in the classroom. Results from a self-reported teacher self-efficacy survey revealed short-term gains. Within one year, all participants reported that they identified themselves at the program's identified target level for technology integration in the curriculum. The authors posit that it is the just in-time support that led to that success. In addition, the teachers reported that that by using the interactive, web-based activities presented in the professional development training and transferring those activities into the classroom, a benefit of understanding difficult concepts was provided to students and teachers alike. The researchers reported they observed the teachers implementing more creative technology-infused lessons in their classroom resulting in students creating more multimedia projects. The authors concluded that teachers were developing an increased capacity for implementing technology-infused lessons in the classroom.

The way that a school structures the daily schedules and routines of teachers can either enhance or inhibit the creation of a supportive learning environment. If teachers are not given time to converse, limited opportunities for support and feedback will exist (Smylie, Lazarus, Brownlee-Conyers, 1996). Fullan (1993) identifies dialogue as a necessary component of change. Participating in dialogue allows each individual to develop capacity for change. When adversity occurs in a system, dialogue becomes the medium that allows the system to grow and sustain change.

Senge (1990), too, discusses the importance of dialogue. He believes it is critical in sustaining a learning organization. He defines a learning organization as a place "where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning to see the whole together" (p. 3). Through Senge's choice of words in his definition, a group has the power to actively change and create a system to meet their vision rather than passively accept their role within a defined, static system. Systems will be empowered and will experience success if the individuals who make up the system are empowered and experience success. When individual members collaborate with others, the organization as a whole learns to be more effective and productive. In this way, an individual in a system is greater than he would be on his own. If a school is to become a learning organization, conversation is needed to overcome obstacles when presented.

Senge (1990) believes that when barriers are identified, leverage can be applied to overcome these obstacles. Bandura (1997) identifies this leverage as coping strategies. Social persuasion supports individual ability to adopt coping strategies that will lead one to persist and overcome difficulties. Schools with high collective efficacy flourish academically as compared to schools with low collective efficacy. Two factors that contribute to enhancing or reducing collective efficacy are perceived control and social support. When individuals perceive that they have control in affecting change in their environment and perceive that they are supported in making changes, collective efficacy is affected. The just-in-time support that teachers receive while implementing new strategies into their classroom practice enhances both teachers' efficacy and students' learning (Ahmad & Farnam, 2006).

The feedback and support teachers receive from their principal and co-teachers can influence efficacy. According to the National Commission on Teaching and America's Future (NCTAF) (2003), ongoing teacher growth requires a long-term commitment in gaining new knowledge and skills. A principal and co-teachers have limited time to provide constructive feedback and support in helping teachers gain new knowledge and skills.

Best practices in professional development reveal that building the capacity of models and mentors is an effective strategy in enhancing the impact of professional development. Teachers within an individual school are trained to become the mentors or experts for other teachers. These early adopters are then able to influence change in classroom teaching practices (Salpeter, 2003). According to Rogers Theory of Individual Innovativeness (Rogers, 1995), certain personalities more readily adopt innovations based on their willingness to adapt and embrace change. In any population, a small group of innovators and early adopters account for approximately 14 to 15 percent of the population. Their opinions greatly influence others in being receptive to change or to a new innovation (Wilson, Sherry, Dobrovolny, Batty, & Ryder, 2000). As in the case of any population, teachers in a school look toward the early adopters as a model for effective technology integration practices.

As fellow teachers are being trained as mentors, so, too, are students. According to Dennis Harper of Generation Yes, students account for 92 percent of a school population, so they must have a voice in reform efforts. A professional development model that includes a teacher training a group of students in how to support and provide technology training to the remaining teachers and staff can be effective (Salpeter, 2003).

Learning communities can be enhanced through the design features of a professional development program. Overbaugh and Lu (2008) studied a professional development training consisting of a 6-week PBS asynchronous online course and two week-long, face-to-face sessions. A discussion board promoted active participation among the facilitator and learners. Threaded discussions were used at regular intervals in the course to engage in focused thematic discussion following the posting of a prompt by the facilitator. Virtual spaces, such as email, promoted open communication. Assignments were created to meet the course goals. Finally, turning content into usable knowledge was evident as teachers developed lessons that could be implemented in their classrooms.

Although it is expected that participants in a professional development program would experience enhanced efficacy directly following a program, Overbaugh and Lu (2008) found that participants had maintained those elevated levels as measured in a follow-up survey months after the program had ended. This finding is significant because the participants would have had an opportunity to implement the new knowledge, skills and instructional strategies into their classroom. Teachers reported feelings of increased confidence in their ability to help their students meet standards in specific subject areas through selecting and implementing new instructional strategies involving technology.

Online components of professional development programs provide mastery experiences in several forms. One such format is online discussions in which participants are required to post responses to prompts and then to reply to the postings of others. The premise is that participants will apply the course content to their specific context. The instructor will then be able to assess how participants are applying the course content to their classroom and to determine the level of support still needed. When students engage in instructional conversations, or mediation, learning occurs (Meskill & Anthony, 2007).

Collaboration becomes an important component as students explore ideas and compare their understandings with others' perspectives. Vygotsky (1981) describes this socio-cognitive activity as joint problem-posing and joint problem-solving.

Hughes, Kerr, and Ooms (2005) found that online communities provide a forum for principals and teachers to exchange ideas, instructional practices and beliefs related to specific grade level content. As teachers implement ideas shared in the forum in their own teaching, the group offers feedback and support as they collaboratively work on solutions to problems.

In another study, teachers were placed in teams based on the content area they taught. The team met during shared planning time twice a week and interacted online. The efficacy of the participants increased as the principal and teachers provided encouraging words (social persuasion) and shared solutions to specific issues as they attempted to change teaching practices to meet new curriculum standards. The authors found that teachers whose overall efficacy significantly increased also noted a favorable response to the principal's presence in the online community (Vavasseur & MacGregor, 2008). This finding reveals that social persuasion contributes to growth in efficacy, and that leadership may contribute as well.

Facilitators in online professional development provide yet another source of mentoring. In an experimental study that compared three groups of participants who received varying levels of support in an online professional development program targeting early literacy strategies, materials, and degree of participation, those identified as having the highest level of support participated more frequently and at longer durations with the course materials than those who were identified as having a lower level of support. Participants with the highest level of support had access to a consultant with opportunities to express opinions, identify needs and discuss possible solutions to problems. The participants stated they believed that professional development is most effective when the content is personally and professionally helpful. Because of this individualized support these participants received, the authors concluded that the interaction between the consultant and participant can facilitate this understanding (Whitaker, Kinzie, Kraft-Sayer, Mashburn, & Pianta, 2007).

Instructors act as coaches for participants as they provide feedback on course assignments and engage in online discussions (Salpeter, 2003). Consistent with the role of the 21st century instructor, a shift is observed from expert to facilitator or connector of knowledge. Fellow participants also act as mentors and support one another as they engage in online discussions and provide feedback on others' work.

## Summary

Technology integration requires teachers taking their understanding of their content, their knowledge of how best to teach that content, and exploring how technology best supports students in learning that content (Koehler & Mishra, 2006). Gaining knowledge about technology integration and applying that knowledge in classroom practice remains a challenge for many teachers. Theory and practice can merge when teachers become engaged in using technology to solve real problems that involve designing activities that promote collaboration, reflection and creation of artifacts to represent learning. The West Virginia State Educational Technology Plan states that teachers must be prepared to integrate technology into instruction to promote student learning. The West Virginia Content Standards and Objectives have been revised to reflect the competencies outlined by ISTE and the Partnership for 21st Century Skills. With these revisions, greater emphasis is placed on using technology to promote critical thinking, reasoning, and problem-solving skills. In addition, increased technology resources, accessible professional development, and assessment and evaluation practices have been provided to facilitate teachers' technology integration practices.

Integrating technology builds 21st century skills and enhances student achievement in core subjects such as reading, writing, math and science (ISTE, 2008). Grappling's Spectrum of Technology and Learning provides an instructional framework for using technology in transforming ways to impact student learning (Porter, 2002). Because 21st century knowledge and skills, such as critical thinking, innovation, problem-solving and teamwork, cannot easily be assessed with traditional assessments, a rubric is an alternative assessment tool that can assess both basic skills and twenty-first century skills (Cowan, 2008). A rubric provides both a quantitative and qualitative analysis of an individual's level of performance, communicates expectations for an assignment, provides consistency in assessment, encourages self-assessment and reflection, and provides evaluative feedback useful in planning for additional instruction (Allen and Tanner, 2006; Tierney and Marielle, 2004).

With an emphasis on improving teacher quality to increase student learning, professional development has progressed from disconnected, one-day workshops to sustained, focused efforts. Just as the 21st century curriculum has increased in rigor and relevance, so, too, have the expectations for professional development. The research states that for professional development to be effective, it should contain specific content in support of learning goals with an emphasis on providing opportunities for active learning involving differentiation for both teacher and student learning. This content should have a direct link to classroom practice. The context should include a collaborative learning environment to help build teachers' capacity for continued growth so that student learning will be influenced (Association for Supervision and Curriculum Development, 2009; West Virginia Center for Professional Development, 2009).

A teacher's sense of efficacy serves as a strong predictor of whether content learned in professional development will be translated into classroom practice. Persistence in overcoming obstacles is related to efficacy levels. Time, effort and resources will be invested in proportion to this judgment. Efficacy levels are influenced as teachers are given opportunities to experience and reflect on mastery experiences, vicarious experiences, social persuasion, and physiological and emotional states.

Because collective efficacy influences individual teacher efficacy, a professional learning community consisting of a mentor and fellow teachers can provide the support teachers need as they change their instructional practice to include technology integration. A positive relationship exists between collective efficacy and effective professional learning communities with time spent in sharing resources, planning and problem-solving identified as a central factor contributing to its success. Even though the literature reveals the impact of professional development on teacher efficacy, few studies investigate the impact of a school-based, job-embedded professional development program on teacher efficacy for technology integration for inservice teachers.

# CHAPTER THREE: RESEARCH METHODS

This study investigated the impact of a school-based, job-embedded professional development program on teacher efficacy for technology integration by elementary and middle school teachers. The purpose of this chapter is to describe the research design, population, intervention, instrumentation, and data collection and analysis procedures.

## Research Design

The research design used in this study was a conversion mixed-methods quasi-experimental design. A conversion mixed-methods design includes both quantitative and qualitative data collection and analysis. Qualitative data are quantified when converted into categorical codes for statistical analysis (Tashakkori & Teddlie, 2003). A quasi-experimental study uses "nonrandomized, concurrent controls…in which at least two already existing groups, one of which is designated experimental, are compared" (Fink, 2003, p. 35). By using a mixed-methods design, both quantitative and qualitative data can be used to inform future efforts and provide rich information contributing to a fuller understanding of the effectiveness of the intervention (Anderson, Miles, Mahoney, & Robinson, 2002).

## Population

The population for this study included 65 elementary and middle school teachers in West Virginia. Thirty-seven teachers who participated in the first phase (2009-2010) of a two-phase intervention, the Infusing Technology Professional Development Program, were classified as the experimental group. Twenty-eight teachers who were recruited to participate in the second phase (2010-2011) of the Infusing Technology

Professional Development Program, but who had not yet received the intervention, were classified as the comparison group.

Subjects in the experimental group represented four elementary and four middle schools. Each school team, consisting of four to six teachers per team, was selected through a competitive application process to participate in a two-year professional development program with phase one beginning with a five-day Infusing Technology Camp in the summer of 2009, with additional professional development provided through the 2009-2010 school year.

The comparison group was composed of four to six additional teachers from each of the same eight schools from which the experimental group was selected. The teachers in the comparison group were recruited by the teachers in the experimental group to participate in the second year of the Infusing Technology Professional Development. These 28 teachers included in the comparison group had not participated in any of the training provided as a part of the study intervention prior to serving as the comparison group.

## Instrumentation

Two instruments were used in the study. The Grappling's Technology and Learning Spectrum was used to measure levels of technology integration. Permission to use this instrument was granted by Porter (2002) (Appendix A). The Computer Technology Integration Survey was used to measure levels of efficacy for technology integration. Permission to use this instrument was granted by Wang (2004) (Appendix A). Copies of these instruments are included in Appendix B.

Grappling's Technology and Learning Spectrum (Porter, 2002) was used to measure teachers' level of technology integration in classroom practice. Porter originally developed this instrument in 1997 to use in school building walk-through observations to evaluate how technology was being used in the classroom to influence student learning. Over 2,300 studies have been completed using this instrument.

Grappling's Technology and Learning Spectrum (Porter, 2002) outlines three broad categories of technology use for learning: literacy use, adapting use, and transforming use. Literacy use focuses on learning how to use the technology. Instruction is technology-centered with the goal of acquiring technical skills. Adapting use of technology focuses on using technology as an optional way to present information or reinforce concepts. Instruction is teacher-centered and although the technology is not necessary for students to attain the same level of learning as without technology, the use of technology often captivates the interest of the students, which often leads to greater involvement. Transforming use focuses on using technology seamlessly in learning to collaborate, construct new knowledge, and represent that new knowledge by sharing it with others. Without the technology, the same level of learning could not occur.

The Computer Technology Integration Survey (Wang, 2004) was originally used with a population of preservice teachers and was extended for use with this study's population of inservice teachers. The Computer Technology Integration Survey is a 21-item Likert scale survey in which respondents were asked to rate how confident they were in integrating technology into classroom teaching. A definition for technology integration was provided to use as a baseline in answering the questions on the survey. Response options included strongly disagree (1); disagree (2); neither agree nor disagree

(3); agree (4); and strongly agree (5). Following these 21 questions, respondents were asked to provide information on the number of years of full-time teaching experience, the school taught in 2009-2010, the grade level(s) taught in 2009-2010, and the subject(s) taught in 2009-2010.

## Validity and Reliability

Fink (2003) defines interrater reliability as “the extent to which two or more individuals agree in their ratings of given items” (p. 50). Interrater reliability was established by the researcher in using Grappling’s Technology and Learning Spectrum to identify level of technology integration. The researcher read each experimental group teachers’ bi-monthly journal postings and independently rated each posting using Grappling’s Technology and Learning Spectrum. These researcher ratings were then compared with the Infusing Technology Professional Development mentor (Appendix C) ratings for five of the eight participating schools for a total of 264 journal postings. The researcher was the mentor for the three remaining schools, so there was not another rating for those journal postings to use for comparison. Of those 264 journal postings, six data points were missing, leaving a total of 258 data points. Of the 258 data points, the researcher had rated 253 of the journal postings identically to the mentors’ ratings, a 98.1% interrater reliability. The research literature supports a 70% or greater consensus of the scores to qualify as high interrater reliability (Stemler, 2004).

Wang (2004) established the Computer Technology Integration Survey’s validity by conducting a factor analysis of the 21-items with a two factor solution. Factor one represented computer technology capabilities and strategies (eigenvalue=9.85) explaining 46.92% of the covariance. Loadings ranged from .51 to .84. Factor two represented external influences of computer technology uses (eigenvalue=1.77) explaining 8.4% of the covariance. Loadings ranged from .56 to .77. Wang established the survey's reliability by calculating Cronbach alpha coefficients of .94. The instrument's construct validity and reliability were also confirmed by the developer (Wang, Ertmer, & Newby, 2004).

A validation study was conducted to determine the content and face validity of the Computer Technology Integration Survey for use in this study. According to Fink (2003), face validity measures how an instrument appears on the surface. Marshall University's curriculum and instruction doctoral students and one course instructor participating in EDF 711 Survey Research provided feedback on the clarity of the instrument's directions, readability, and format.

Although no substantive changes were made in the instrument, minor formatting changes were made as a result of this review. In the directions, the definition of technology integration formatted in bold text was placed as the first sentence followed by the sentence on the purpose of the survey. In addition, examples of technology integration were removed from the directions in the survey because they were not examples of technology integration utilized in the study's intervention provided in the Phase I Infusing Technology Professional Development Program.

In Part A, each survey item included the sentence stem "I feel confident that I can." To reduce the redundancy of repeating the phrase in each survey item, the sentence stem "I feel confident that I" was formatted in bold text in the directions. Each survey item then began with the word "can." For each survey item, respondents were asked to indicate their level of agreement or disagreement by circling one of the choices provided.

The choices of SD, D, ND/NA, A, SA were replaced with the choices of 1, 2, 3, 4, 5 associated with the text strongly disagree, disagree, neither disagree/agree, agree, and strongly agree. This formatting change increased the survey's readability and facilitated scoring.

## Intervention

The intervention in this study was the Phase I Infusing Technology Professional Development Program, a program offered through the Governor's Academy for Teaching Excellence (GATE) and sponsored by the West Virginia Center for Professional Development (WVCPD). The goal of the professional development program was to increase the meaningful use of technology to promote students' acquisition of 21st century knowledge and skills. The intervention included the first phase of a two-phase professional development program. The experimental group participated in a five-day Infusing Technology Camp in summer 2009 with additional training provided through the 2009-2010 school year.

Components of the professional development included modeled best-practice transformational use of technology, hands-on opportunities to gain mastery of technology resources, establishment of a school-based and extended learning community, on-site monthly mentoring, online bi-monthly mentoring and WebEx conferences as needed. The Infusing Technology Professional Development Program was aligned with the International Society for Technology in Education's (ISTE) National Educational Technology Standards for Teachers (NETS-T) (Appendix D). Each school team received $4,000 for materials and supplies, and each participating teacher received a stipend and three hours of graduate credit. A description of the Infusing Technology Professional Development Program may be found in Appendix E.

## Data Collection Procedures

Qualitative data were collected from the experimental group's learning journals and quantified to identify the level of technology integration in classroom practice. The researcher read each journal entry posted on the wiki and rated the level of technology integration. A score was assigned based on the descriptors set forth in Grappling's Technology and Learning Spectrum (Porter, 2002): zero for no technology used, one for a technology literacy use, two for an adapting technology use, and three for a technology transforming use.

Two ranges of dates were used to determine pretest data and posttest data. The first range of dates included bi-monthly journal postings from September, 2009 through November, 2009. These journal entry scores were aggregated and became the pretest data points. The total pretest score was determined by summing each of the pretest data points. Journal entries were posted on September 15, 2009, September 30, 2009, October 15, 2009, October 30, 2009, November 15, 2009, and November 30, 2009. The second range of dates included bi-monthly journal postings from March, 2010 through May, 2010. These journal entry scores were aggregated and became the posttest data points. The total posttest score was determined by summing each of the posttest data points. Journal entries were posted on March 15, 2010, March 30, 2010, April 15, 2010, April 30, 2010, May 15, 2010, and May 30, 2010. The total technology integration score was determined by summing the total pretest score and the total posttest score. The technology integration mean difference scores were calculated by determining the difference between the total pretest score and the total posttest score.

The Computer Technology Integration Survey (Wang, 2004) was administered to both the experimental and comparison groups prior to the beginning of the Phase II Infusing Technology Camp conducted in the summer of 2010. The instrument was administered in a group format using paper-and-pencil techniques.

## Data Analysis Procedures

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) 18.0. For research question one, a t-test for paired samples ($p<.05$) was used to determine whether there was a change in experimental group teachers' levels of technology integration after participation in a school-based, job-embedded professional development program. To answer the parallel research question two, an Analysis of Variance (ANOVA) was used to determine whether statistically significant differences existed in experimental group teachers' levels of technology integration based on years of full-time teaching experience, grade level, and subject area taught in 2009-2010.

For research question three, data from the Computer Technology Integration Survey were analyzed using a t-test for independent samples to determine whether a statistically significant difference ($p<.05$) existed between the mean scores of those who participated in the professional development program and those who did not. Three measures of efficacy for technology integration were used: total efficacy, Factor One, computer technology capabilities and strategies, and Factor Two, external influences of computer technology use. For research question four, an ANOVA was used to determine whether statistically significant differences existed in the experimental and comparison groups mean scores on the Computer Technology Integration Survey based on years of full-time teaching experience, grade level, and subject area taught in 2009-2010. Experimental and comparison group mean scores were compared for total efficacy for technology integration, Factor One, computer technology capabilities and strategies, and Factor Two, external influences of computer technology use, within each of the categories of teaching experience, grade level, and subject area taught.

To answer research question five, data collected from Grappling's Technology and Learning Spectrum and the Computer Technology Integration Survey were analyzed using Pearson Correlation to determine whether a statistically significant relationship existed between the experimental group teachers' efficacy for technology integration and levels of technology integration. To answer research question six, ANOVA was used to determine whether statistically significant differences ($p<.05$) existed in the relationship between the experimental group efficacy for technology integration and levels of technology integration based on teaching experience, grade level, and subject area taught in 2009-2010.

## Limitations of the Study

In a quasi-experimental research design, there is always a concern of equivalence of the experimental and comparison groups (Fink, 2003). Another possible limitation associated with a quasi-experimental research design is the bias associated with the Hawthorne Effect in which people may respond in a way that they believe is expected or favored (Fink, 2003). Finally, the Computer Technology Integration Survey (Wang, 2004) was validated for use with a population of preservice teachers, and this study's population consisted of inservice teachers.

## Summary

This chapter described the research design and procedures that were used to investigate the impact of a school-based, job-embedded professional development program on teacher efficacy for technology integration. The first phase of the research design consisted of analyzing the experimental group journal postings. These data were quantified to determine whether there were statistically significant changes in levels of technology integration after participation in a school-based, job-embedded professional development program.

The second phase of the research design consisted of surveying the experimental and comparison groups regarding their efficacy for technology integration. These data were analyzed to determine whether statistically significant differences existed between the two groups. Teachers who participated in Phase I of the Infusing Technology Professional Development Program, sponsored by the West Virginia Center for Professional Development, were identified as the experimental group. Teachers, who were recruited to participate in Phase II of the Infusing Technology Professional Development Program by the experimental group, but who had not yet received any intervention, were identified as the comparison group.

The third phase of the research design consisted of determining whether a relationship existed between efficacy for technology integration and technology integration. Data collected in the first and second phases of the research design were used in this analysis.

# CHAPTER FOUR: PRESENTATION AND ANALYSIS OF DATA

## Introduction

The purpose of this mixed-methods quasi-experimental study was to investigate the impact of a school-based, job-embedded professional development program on elementary and middle school teacher efficacy for technology integration. Findings presented in this chapter are organized around the following sections: (a) participant characteristics, (b) major findings for each of the six research questions investigated in this study, and (c) a summary of the findings.

## Participant Characteristics

The population in this study included 65 elementary and middle school teachers in West Virginia. Thirty-seven teachers, identified as the experimental group, had received one year of the intervention, Phase I of the Infusing Technology Professional Development Program. The West Virginia Center for Professional Development sponsored this professional development program beginning in summer, 2009 and continuing through the summer, 2010. Twenty-eight teachers recruited to participate in Phase II of the Infusing Technology Professional Development Program were identified as the comparison group but had not yet received any intervention. The experimental group was composed of 56.92% (n = 37) of the participating teachers. The comparison group was composed of 43.08% (n = 28) of the participating teachers.

Participants were asked to identify their total number of years of full-time teaching experience. Quartiles were calculated to group subjects according to years of full-time teaching experience: (a) 0 – 6 years, (b) 7 - 12 years, (c) 13 - 23 years, and

(d) 24 - 35 years. Participating teachers in the experimental group reported the following total years of full-time teaching experience: 21.6 % (n = 8) indicated 0 – 6 years, 21.6% (n = 8) indicated 7 – 12 years, 27% (n = 10) indicated 13 – 23 years, and 24.3% (n = 11) indicated 24 – 35 years. The mean number of years of teaching experience for this group was 16.1 (SD = 9.0). Participating teachers in the comparison group reported the following total years of full-time teaching experience: 32.2% (n = 9) indicated 0 – 6 years, 35.7% (n = 10) indicated 7 – 12 years, 17.9% (n = 5) indicated 13 – 23 years of experience, and 14.4% (n = 4) indicated 24 – 35 years. The mean number of years of teaching experience for the comparison group was 11.5 (SD = 9.5).

Participants were asked to identify the grade level at which they taught in the 2009-2010 school year. Categories were collapsed to ensure sufficient cell size. Respondents were categorized as teaching in an elementary school or middle school. In the experimental group, 54.05% (n = 20) of the participants taught in an elementary school, and 45.95% (n = 17) of the participants taught in a middle school. In the comparison group, 42.86% (n = 12) of the participants taught in an elementary school, and 57.14% (n = 16) of the participants taught in a middle school.

Participants were asked to identify the primary subject taught in 2009 – 2010. Categories were collapsed to ensure sufficient cell size. Responses were coded as multi-subjects or single subject. In the experimental group, 51.35% (n = 19) of the participants taught multi-subjects and 48.65% (n = 18) of the participants taught a single subject. In the comparison group, 32.14% (n = 9) of the participants taught multi-subjects and 67.86% (n = 19) of the participants taught a single subject. Findings are presented in Table 1.

Table 1. *Demographic Characteristics of Experimental and Comparison Groups*

| Characteristic | Experimental Group | | Comparison Group | |
|---|---|---|---|---|
| | n | % | n | % |
| Grade level taught | | | | |
| Elementary | 20 | 54.05 | 12 | 42.86 |
| Middle | 17 | 45.95 | 16 | 57.14 |
| Subjects taught | | | | |
| Multi-subjects | 19 | 51.35 | 9 | 32.14 |
| Single subject | 18 | 48.65 | 19 | 67.86 |
| Teaching experience | | | | |
| 0 - 6 years | 8 | 21.62 | 9 | 32.14 |
| 7 - 12 years | 8 | 21.62 | 10 | 35.71 |
| 13 - 23 years | 10 | 27.03 | 5 | 17.86 |
| 24 - 35 years | 11 | 29.73 | 4 | 14.29 |

*Note.* Experimental Group (N=37). Comparison Group (N=28).

## Major Findings

The major findings are presented to address each research question investigated in this study. A summary of the major findings concludes the chapter.

**Research Question One: What is the change, if any, in teachers' level of technology integration in classroom practice after participation in a school-based, job-embedded professional development program?**

Journal postings rated at each technology integration level based on Grappling's Technology and Learning Spectrum are provided in Table 2. Total pretest and posttest scores reflect the total number of ratings at each level for the six pretest and six posttest observations. On the pretest, 7.24% (n = 16) of the journal postings received a score of zero (no technology use), 21.27% (n = 47) of the journal postings received a score of one (literacy technology use), 68.78% (n = 152) of the journal postings received a score of two (adapting technology use), and 2.71% (n = 6) of the journal postings received a score of three (transforming technology use). On the posttest, 2.37% (n = 5) of the journal postings received a score of zero (no technology use), 23.33% (n = 49) of the journal postings received a score of one (literacy technology use), 56.87% (n = 120) of the journal postings received a score of two (adapting technology use), and 17.54% (n = 37) of the journal postings received a score of three (transforming technology use).

Percentage differences between the total pretest and posttest scores indicated a 4.87% (n = 11) decrease in the frequency of zero as a score (no technology was used), a 1.95% (n = 2) increase in the frequency of one as a score (literacy technology use), a 11.91% (n = 32) decrease in the frequency of two as a score (adapting technology use), and a 14.83% (n = 31) increase in the frequency of three as a score (transforming technology use) from pretest to posttest. Data related to these findings are found in Table 2.

The six pretest and six posttest scores from the Grappling's Technology and Learning Spectrum were summed and total pretest and posttest mean scores were calculated. The overall mean score of the pretest journal postings was 9.97 (SD = 1.81), and the overall mean score of the posttest journal postings was 10.81 (SD = 2.54). A t-test for paired samples indicated that no statistically significant difference existed, $t$ (37) = -1.79, $p$ = 0.08, between the total pretest and posttest mean scores. These data are provided in Table 3.

Table 2. *Pretest and Posttest Frequencies of Technology Integration Scores for Experimental Group*

| | Technology Integration Score | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 0 | | 1 | | 2 | | 3 | |
| Data Point | n | % | n | % | n | % | n | % |
| Pretest | | | | | | | | |
| One | 2 | 5.4 | 8 | 21.6 | 27 | 73.0 | 0 | 0 |
| Two | 1 | 2.7 | 6 | 16.2 | 29 | 78.4 | 0 | 0 |
| Three | 5 | 13.5 | 7 | 18.9 | 25 | 67.6 | 0 | 0 |
| Four | 3 | 8.1 | 8 | 21.6 | 23 | 62.2 | 3 | 8.1 |
| Five | 1 | 2.7 | 10 | 27.0 | 26 | 70.3 | 0 | 0 |
| Six | 4 | 10.8 | 8 | 21.6 | 22 | 59.5 | 3 | 8.1 |
| Total Pretest | 16 | 7.24 | 47 | 21.27 | 152 | 68.78 | 6 | 2.71 |
| Posttest | | | | | | | | |
| Seven | 0 | 0 | 7 | 18.9 | 23 | 62.2 | 6 | 16.2 |
| Eight | 1 | 2.7 | 6 | 16.2 | 24 | 64.9 | 4 | 10.8 |
| Nine | 2 | 5.4 | 7 | 18.9 | 20 | 54.1 | 7 | 18.9 |
| Ten | 1 | 2.7 | 11 | 29.7 | 15 | 40.5 | 10 | 27.0 |
| Eleven | 0 | 0 | 8 | 21.6 | 21 | 56.8 | 6 | 16.2 |
| Twelve | 1 | 2.7 | 10 | 27.0 | 17 | 45.9 | 4 | 10.8 |
| Total Posttest | 5 | 2.37 | 49 | 23.22 | 120 | 56.87 | 37 | 17.54 |
| Difference Between Total Pretest and Total Posttest | (11) | (4.87) | 2 | 1.95 | (32) | (11.91) | 31 | 14.83 |

*Note.* Technology Integration Score: 0 = No technology use; 1 = Literacy Technology Use; 2 = Adapting Technology Use; 3 = Transforming Technology Use. N=37.

Table 3. *Total Experimental Group Pre- and Post- Differences in Levels of Technology Integration*

| | Pretest | | Posttest | | | | |
|---|---|---|---|---|---|---|---|
| Technology Integration | M | SD | M | SD | df | t | p |
| | 9.97 | 1.81 | 10.81 | 2.54 | 36 | -1.79 | .080 |

*Note.* R = 0 – 18. N = 37.

**Research Question Two: What is the change, if any, in teachers' level of technology integration in classroom practice after participation in a school-based, job-embedded professional development program based on a selected list of attribute variables (e.g., teaching experience, grade level, and subject area)?**

To determine the change in the experimental group's level of technology integration, the difference between the Grappling's Technology and Learning Spectrum total pretest and posttest scores were computed. An Analysis of Variance (ANOVA) was used to analyze this mean score difference based on (a) years of full-time teaching experience, (b) grade level taught, and (c) subject area taught.

**Teaching experience**. The mean differences in the level of technology integration for the experimental group were analyzed based on the number of years of full-time teaching experience disaggregated into quartiles. Mean difference scores were reported for each group: 0 – 6 years had a mean difference score of 1.5 (SD = 2.56), 7 – 12 years had a mean difference score of .25 (SD = 3.77), 13 – 23 years had a mean difference score of .20 (SD = 2.34), and 24 – 35 years had a mean difference score of 1.36 (SD = 2.83). Data related to these findings may be found in Table 4.

An ANOVA revealed no statistical significance, $F$ (3, 33) = .534, $p$ = .662, in mean difference scores of the experimental group's levels of technology integration based on years of teaching experience. Data related to these findings are found in Table 5.

**Grade level.** The mean differences in the level of technology integration for the experimental group were analyzed based on grade level taught in 2009 – 2010. To ensure sufficient cell size, categories were collapsed and recoded as teaching in an elementary or middle school. Mean difference scores were reported for each group of teachers. Those who taught in an elementary school had a mean difference score of .50 (SD = 2.35), and those who taught in a middle school had a mean difference score of 1.23 (SD = 3.34). Data related to these findings may be found in Table 4.

An ANOVA revealed no statistical significance, $F$ (1, 35) = .534, $p$ = .439, in mean difference scores of the experimental group's levels of technology integration based on grade level taught in 2009-2010. Data related to these findings are found in Table 5.

**Subject area.** The mean differences in the level of technology integration for the experimental group were analyzed based on subject area taught in 2009 – 2010. To ensure sufficient cell size, categories were collapsed and recoded as taught multi-subject or a single subject. Those who taught multi-subjects had a mean difference score of .57 (SD = 2.38), and those who taught a single subject had a mean difference score of 1.11 (SD = 3.34). Data related to these findings are found in Table 4.

An ANOVA revealed no statistical significance, $F$ (1, 35) = .320, $p$ = .575, between the mean difference scores of the experimental group's levels of technology integration based on subject taught in 2009-2010. Data related to these findings are found in Table 5.

Table 4. *Experimental Group Pre-Post Total Mean Differences in Technology Integration Levels Based on Teaching Experience, Grade Level, and Subject Area*

| Variable | M Diff. | SD | N |
|---|---|---|---|
| Teaching Experience | | | |
| 0 – 6 years | 1.5 | 2.56 | 8 |
| 7 – 12 years | .25 | 3.77 | 8 |
| 13 – 23 years | .20 | 2.34 | 10 |
| 24 – 35 years | 1.36 | 2.83 | 11 |
| Grade level | | | |
| Elementary school | .50 | 2.35 | 20 |
| Middle school | 1.23 | 3.34 | 17 |
| Subject area | | | |
| Multi-subjects | .57 | 2.38 | 19 |
| One subject | 1.11 | 3.28 | 18 |
| Total difference mean score | .83 | 2.83 | 37 |

N=37

Table 5. *ANOVA for Experimental Group Pre-Post Total Mean Differences in Technology Integration Based on Teaching Experience, Grade Level, and Subject Area*

| Source | df | SS | MS | F value | p |
|---|---|---|---|---|---|
| Teaching experience | | | | | |
| Between | 3 | 13.382 | 4.461 | .534 | .662 |
| Within | 33 | 275.645 | 8.353 | | |
| Grade level | | | | | |
| Between | 1 | 4.968 | 4.968 | .612 | .439 |
| Within | 35 | 284.059 | 8.116 | | |
| Subject area | | | | | |
| Between | 1 | 2.618 | 2.618 | .320 | .575 |
| Within | 35 | 286.409 | 8.183 | | |

N=*37*

**Research Question Three: What is the difference, if any, in efficacy levels for technology integration between teachers who have participated in a school-based, job-embedded professional development program and those who have not?**

Overall efficacy levels for technology integration were determined by summing each of the scores for the 21 items on the Computer Technology Integration Survey and computing the mean score for both the experimental and comparison groups. Factor One, computer technology capabilities and strategies, and Factor Two, external influences of computer technology use, mean scores were determined by summing the individual items identified for each of the factors and computing the mean scores for each group.

The mean total score for the experimental group was 89.70 (SD = 9.09, R = 21 – 105), and the mean total score for the comparison group was 82.35 (SD = 15.41, R = 21 - 105). A t-test for independent samples revealed a statistically significant difference, $t$ (63) = 2.28, $p$ = .026, existed between the total mean scores between the experimental and comparison groups. Data related to these findings are found in Table 6.

For Factor One, computer technology capabilities and strategies, the mean score for the experimental group was 67.69 (SD = 6.96, R = 16 - 80), and the mean score for the comparison group was 62.78 (SD = 11.93, R = 16 - 80). A t-test for independent samples revealed a statistically significant difference, $t$ (63) = 2.56, $p$ = .013, existed between the mean scores for the experimental and comparison groups for Factor One. Data related to these findings are found in Table 6.

For Factor Two, external influences of computer technology use, the experimental group mean score was 21.42 (SD = 2.2, R = 5 - 25), and the comparison group mean score was 19.57 (SD = 3.74, R = 5 - 25). A t-test for independent samples revealed a statistically significant difference, *t* (63) = 2.40, *p* = .019, between the mean scores for the experimental and comparison groups for Factor Two. Data related to these findings are found in Table 6.

Individual item analysis using a t-test for independent samples revealed greater mean scores for the experimental group compared to the comparison group on all 21 items on the survey. In addition, the standard deviations for the comparison group's mean scores were greater compared to the standard deviations for the experimental group's mean scores on all 21 items on the survey.

A significant difference ($p<.05$) existed between the experimental and comparison group mean scores for 12 of the 21 (57.14%) survey items. These included the following survey items identified as Factor One, computer technology capabilities and strategies: (1) understand computer capabilities well enough to maximize them in my classroom, (2) have the skills necessary to use the computer for instruction, (3) can successfully teach relevant subject content with appropriate use of technology, (9) can mentor students in appropriate uses of technology, (10) can consistently use educational technology in effective ways, (12) can regularly incorporate technology into my lessons, when appropriate to student learning, (13) can select appropriate technology for instruction based on curriculum standards, (14) can assign and grade technology-based projects, (18) can be responsive to students' needs during computer use. Data related to these findings are found in Table 6.

For Factor Two, external influences of computer technology uses, three of the five individual items were statistically significant. These items were (17) can be comfortable using technology in my teaching, (19) can continue to improve in my ability to address my students' technology needs, and (21) can carry out technology-based projects even when I am opposed by skeptical colleagues. The data related to these findings are found in Table 6.

Table 6. *Group Differences in Efficacy Levels for Technology Integration for Individual Survey Items*

| | Efficacy for Technology Integration Mean Scores | | | | | | |
|---|---|---|---|---|---|---|---|
| | Experimental Group | | Comparison Group | | | | |
| | M | SD | M | SD | Df | t value | p |
| Survey Item | | | | | | | |
| **Factor One: Computer Technology Capabilities and Strategies** | | | | | | | |
| 1. Understand computer capabilities well enough to maximize them in my classroom. | 4.35 | .71 | 3.85 | .97 | 63 | 2.36 | .021* |
| 2. Have the skills necessary to use the computer for instruction. | 4.56 | .55 | 4.17 | .81 | 63 | 2.28 | .026* |
| 3. Can successfully teach relevant subject content with appropriate use of technology. | 4.37 | .54 | 3.96 | .79 | 63 | 2.49 | .015* |
| 4. Can evaluate software for teaching and learning. | 3.94 | .74 | 3.67 | 1.02 | 63 | 1.22 | .226 |
| 5. Can use correct computer technology when directing students' computer use. | 4.21 | .53 | 3.96 | .83 | 63 | 1.47 | .145 |

*Note.* Experimental Group (N=37). Comparison Group (N=28).
*p<.05

Table 6. *Group Differences in Efficacy Levels for Technology Integration for Individual Survey Items*

| | Efficacy for Technology Integration Mean Scores | | | | | | |
|---|---|---|---|---|---|---|---|
| | Experimental Group | | Comparison Group | | | | |
| Survey Item | M | SD | M | SD | Df | t value | p |
| **Factor One: Computer Technology Capabilities and Strategies** | | | | | | | |
| 6. Can help students when they have difficulty with the computer. | 4.24 | .59 | 3.92 | .85 | 63 | 1.74 | .086 |
| 7. Can effectively monitor students' computer use for project development in my classroom. | 4.16 | .76 | 3.78 | 1.03 | 63 | 1.69 | .096 |
| 8. Can motivate my students to participate in technology-based projects. | 4.37 | .59 | 4.10 | .83 | 63 | 1.53 | .130 |
| 9. Can mentor students in appropriate uses of technology. | 4.32 | .57 | 3.92 | .89 | 63 | 2.15 | .035* |
| 10. Can consistently use educational technology in effective ways. | 4.27 | .60 | 3.82 | .81 | 63 | 2.53 | .014* |

*Note.* Experimental Group (N=37). Comparison Group (N=28).
*p<.05

Table 6. *Group Differences in Efficacy Levels for Technology Integration for Individual Survey Items*

| | Efficacy for Technology Integration Mean Scores | | | | | | |
|---|---|---|---|---|---|---|---|
| | Experimental Group | | Comparison Group | | | | |
| | M | SD | M | SD | Df | t value | p |
| Survey Item | | | | | | | |
| **Factor One: Computer Technology Capabilities and Strategies** | | | | | | | |
| 11. Can provide individual feedback to students during technology use. | 4.10 | .65 | 3.78 | .87 | 63 | 1.69 | .095 |
| 12. Can regularly incorporate technology into my lessons, when appropriate to student learning. | 4.35 | .63 | 3.96 | .88 | 63 | 2.06 | .043* |
| 13. Can select appropriate technology for instruction based on curriculum standards. | 4.27 | .60 | 3.82 | .90 | 63 | 2.39 | .020* |
| 14. Can assign and grade technology-based projects. | 4.21 | .75 | 3.75 | .96 | 63 | 2.19 | .032* |
| 16. Can use technology resources to collect and analyze data from student tests and products to improve instructional practices. | 4.00 | .74 | 3.78 | 1.03 | 63 | .973 | .186 |
| 18. Can be responsive to students' needs during computer use. | 4.43 | .68 | 3.96 | .88 | 63 | 2.40 | .019* |

*Note.* Experimental Group (N=37). Comparison Group (N=28).
*p<.05

Table 6. *Group Differences in Efficacy Levels for Technology Integration for Individual Survey Items*

| | Efficacy for Technology Integration Mean Scores | | | | | | |
|---|---|---|---|---|---|---|---|
| | Experimental Group | | Comparison Group | | | | |
| | M | SD | M | SD | Df | t value | p |
| Survey Item | | | | | | | |
| **Factor Two: External Influences of Computer Technology Uses** | | | | | | | |
| 15. Can keep curricular goals and technology uses in mind when selecting an ideal way to assess student learning. | 4.13 | .53 | 3.89 | .91 | 63 | 1.33 | .186 |
| 17. Can be comfortable using technology in my teaching. | 4.54 | .60 | 3.96 | 1.03 | 63 | 2.81 | .007** |
| 19. Can continue to improve in my ability to address my students' technology needs. | 4.72 | .45 | 4.32 | .81 | 63 | 2.56 | .013* |
| 20. Can develop creative ways to cope with system constraints (such as budget cuts on technology facilities) and continue to teach effectively with technology. | 3.83 | .76 | 3.67 | .81 | 63 | .807 | .423 |
| 21. Can carry out technology-based projects even when I am opposed by skeptical colleagues. | 4.24 | .54 | 3.82 | .94 | 63 | 2.26 | .027* |

*Note.* Experimental Group (N=37). Comparison Group (N=28).
*p<.05. **p<.01.

Table 6. *Group Differences in Efficacy Levels for Technology Integration for Individual Survey Items*

| | Efficacy for Technology Integration Mean Scores | | | | | | |
|---|---|---|---|---|---|---|---|
| | Experimental Group | | Comparison Group | | | | |
| | M | SD | M | SD | Df | t value | p |
| Total for Factor One, Computer Technology Capabilities and Strategies | 67.69 | 6.96 | 62.78 | 11.98 | 63 | 2.28 | .026* |
| Total for Factor Two, External Influences of Computer Technology Uses | 21.42 | 2.2 | 19.57 | 3.74 | 63 | 2.56 | .013* |
| Overall Total | 89.70 | 9.09 | 82.35 | 15.41 | 63 | 2.40 | .019* |

*Note.* Factor One (R = 16 – 80). Factor Two (R = 5 – 25). Overall Total (R = 21 – 105). Experimental Group (N=37). Comparison Group (N=28).
*p<.05.

**Research Question Four: What is the difference, if any, based on a selected list of attribute variables (e.g., teaching experience, grade level, and subject area), in efficacy levels for technology integration for teachers who have participated in a school-based, job-embedded professional development program and those who have not?**

The differences in the experimental and comparison group efficacy levels for technology integration were analyzed based on (a) teaching experience, (b) grade level, and (c) subject area. An Analysis of Variance (ANOVA) was conducted to determine statistical significance based on each of the attribute variables.

**Teaching experience**. Differences in the experimental and comparison groups' levels of efficacy for technology integration were analyzed based on the number of years of full-time teaching experience. Efficacy for technology integration mean scores for teachers in the experimental group reporting 0 – 6 years of full-time teaching experience were 91.50 (SD = 8.38, R = 21 - 105) for total efficacy, 69.62 (SD = 7.11, R = 16 - 80) for Factor One, computer technology capabilities and strategies, and 21.87 (SD = 1.72, R = 5 - 25) for Factor Two, external influences of computer technology use. For teachers reporting 7 – 12 years of full-time teaching experience, efficacy for technology integration mean scores were 90.50 (SD = 7.81, R = 21 - 105) for total efficacy, 69.00 (SD = 5.85, R = 16 - 80) for Factor One, and 21.50 (SD = 2.13, R = 5 - 25) for Factor Two. For teachers reporting 13 – 23 years of full-time teaching experience, efficacy for technology integration mean scores were 87.70 (SD = 8.56, R = 21 - 105) for total efficacy, 66.50 (SD = 6.50, R = 16 - 80) for Factor One, and 21.20 (SD = 2.29, R = 5 - 25) for Factor Two. For teachers reporting 24 – 35 years of full-time teaching experience, efficacy for technology integration mean scores were 89.63 (SD = 11.51, R = 21 - 105) for total efficacy, 68.18 (SD = 8.85, R = 16 - 80) for Factor One, and 21.45 (SD = 2.80, R = 5 - 25) for Factor Two. Data related to these findings are found in Table 7.

An ANOVA revealed no statistical significance for the differences in the experimental group's levels of efficacy for technology integration based on years of full-time teaching experience for total, $F$ (3, 33) = .269, $p$=.847, Factor One, $F$ (3, 33) = .314, $p$=.815, and Factor Two, $F$ (3, 33) = .125, $p$=.944. Data related to these findings are found in Table 8.

Efficacy for technology integration mean scores for teachers in the comparison group reporting 0 – 6 years of full-time teaching experience were 90.44 (SD = 10.15, R = 21 - 105) for total efficacy, 69.11 (SD = 7.25, R = 16 - 80) for Factor One, computer technology capabilities and strategies, and 21.33 (SD = 3.16, R = 5 - 25) for Factor Two, external influences of computer technology use. For teachers reporting 7 – 12 years of full-time teaching experience, efficacy for technology integration mean scores were 85.00 (SD = 12.19, R = 21 - 105) for total efficacy, 64.60 (SD = 9.62, R = 16 - 80) for Factor One, and 20.40 (SD = 2.87, R = 5 - 25) for Factor Two. For teachers reporting 13 – 23 years of full-time teaching experience, efficacy for technology integration mean scores were 80.00 (SD = 15.06, R = 25 - 105) for total efficacy, 61.80 (SD = 11.73, R = 16 – 80) for Factor One, and 18.20 (SD = 3.70, R = 5 - 25) for Factor Two. For teachers reporting 24 – 35 years of full-time teaching experience, efficacy for technology integration mean scores were 60.50 (SD = 15.75, R = 21 - 105) for total efficacy, 45.25 (SD = 11.75, R = 16 - 80) for Factor One, and 15.25 (SD = 4.11, R = 5 - 25) for Factor Two. Data related to these findings are found in Table 7.

An ANOVA revealed statistical significance for the differences in the comparison group's levels of efficacy for technology integration based on years of full-time teaching experience for total, $F$ (3, 24) = 5.446, $p$=.005, Factor One, $F$ (3, 24) = 5.864, $p$=.004, and Factor Two, $F$ (3, 24) = 3.659, $p$=.027. Data related to these findings are found in Table 8.

Table 7. *Group Differences in Efficacy for Technology Integration Based on Teaching Experience*

| | Total Efficacy for Technology Integration | | | | | |
|---|---|---|---|---|---|---|
| | Experimental Group | | | Comparison Group | | |
| Teaching Experience | M | SD | n | M | SD | n |
| Total Efficacy | | | | | | |
| 0 – 6 years | 91.50 | 8.38 | 8 | 90.44 | 10.15 | 9 |
| 7 – 12 years | 90.50 | 7.81 | 9 | 85.00 | 12.19 | 10 |
| 13 – 23 years | 87.70 | 8.56 | 10 | 80.00 | 15.06 | 5 |
| 24 – 35 years | 89.63 | 11.51 | 11 | 60.50 | 15.75 | 4 |
| Factor One, Computer Technology Capabilities and Strategies | | | | | | |
| 0 – 6 years | 69.62 | 7.11 | 8 | 69.11 | 7.25 | 9 |
| 7 – 12 years | 69.00 | 5.85 | 8 | 64.60 | 9.62 | 10 |
| 13 – 23 years | 66.50 | 6.50 | 10 | 61.80 | 11.73 | 5 |
| 24 – 35 years | 68.18 | 8.85 | 11 | 45.25 | 11.75 | 4 |
| Factor Two, External Influences of Computer Technology Uses | | | | | | |
| 0 – 6 years | 21.87 | 1.72 | 8 | 21.33 | 3.16 | 9 |
| 7 – 12 years | 21.50 | 2.13 | 8 | 20.40 | 2.87 | 10 |
| 13 – 23 years | 21.20 | 2.29 | 10 | 18.20 | 3.70 | 5 |
| 24 – 35 years | 21.45 | 2.80 | 11 | 15.25 | 4.11 | 4 |

*Note.* Total Efficacy (R = 21 – 105). Factor One (R = 16 – 80). Factor Two (R = 5 – 25). Experimental Group (N=37). Comparison Group (N=28).
*p<.05.

Table 8. *ANOVA for Group Differences in Efficacy for Technology Integration Mean Scores Based on Teaching Experience*

| Efficacy for Technology Integration | df | SS | MS | F value | p |
|---|---|---|---|---|---|
| | | Experimental group | | | |
| Total Efficacy | | | | | |
| Between-group | 3 | 71.084 | 23.695 | .269 | .847 |
| Within-group | 33 | 2906.645 | 88.080 | | |
| Factor One, Computer Technology Capabilities and Strategies | | | | | |
| Between-group | 3 | 50.259 | 16.753 | .314 | .815 |
| Within-group | 33 | 1758.011 | 53.273 | | |
| Factor Two, External Influences of Computer Technology Uses | | | | | |
| Between-group | 3 | 2.041 | .680 | .125 | .944 |
| Within-group | 33 | 179.202 | 5.430 | | |
| | | Comparison group | | | |
| Total Efficacy | | | | | |
| Between-group | 3 | 2597.206 | 865.735 | 5.446 | .005** |
| Within-group | 24 | 3815.222 | 158.968 | | |
| Factor One, Computer Technology Capabilities and Strategies | | | | | |
| Between-group | 3 | 1627.875 | 542.625 | 5.864 | .004** |
| Within-group | 24 | 1758.011 | 53.273 | | |
| Factor Two, External Influences of Computer Technology Uses | | | | | |
| Between-group | 3 | 118.907 | 39.636 | 3.659 | .027* |
| Within-group | 24 | 259.950 | 10.831 | | |

*Note.* Experimental Group (N=37). Comparison Group (N=28).
*p<.05.

**Grade level.** Differences in levels of efficacy for technology integration were analyzed based on whether the teacher taught at the elementary or middle school level. The experimental group efficacy for technology integration mean scores of teachers who reported teaching in an elementary school were 87.05 (SD = 9.15) for total efficacy, 66.10 (SD = 7.26) for Factor One, and 20.95 (SD = 2.23) for Factor Two. For experimental group teachers who reported teaching in a middle school, efficacy for technology integration mean scores were 92.82 (SD = 8.21) for total efficacy, 70.70 (SD = 6.18) for Factor One, and 22.11 (SD = 2.14) for Factor Two. Data related to these findings are found in Table 9.

The comparison group efficacy for technology integration mean scores of teachers who reported teaching in an elementary school were 87.33 (SD = 9.36) for total efficacy, 66.83 (SD = 6.61) for Factor One, and 20.50 (SD = 3.23) for Factor Two. For comparison group teachers who reported teaching in a middle school, efficacy for technology integration mean scores were 78.62 (SD = 18.12) for total efficacy, 59.75 (SD = 14.19) for Factor One, and 18.37 (SD = 4.04) for Factor Two. Data related to these findings are found in Table 9.

An ANOVA revealed a statistically significant difference, $F$ (1, 35) = 4.229, $p$ = .047, between the experimental group's mean scores for Factor One, efficacy for computer technology capabilities and strategies, for teachers who reported teaching in an elementary school and those who reported teaching in a middle school. No significant differences were found between the comparison group's mean scores for technology efficacy based on grade level. Data related to these findings are found in Table 10.

Table 9. *Group Differences in Efficacy for Technology Integration Mean Scores Based on Grade Level*

| | Total Efficacy for Technology Integration | | | | | |
|---|---|---|---|---|---|---|
| | Experimental Group | | | Comparison Group | | |
| Teaching level | M | SD | n | M | SD | n |
| Total Efficacy | | | | | | |
| Elementary School | 87.05 | 9.15 | 20 | 87.33 | 9.36 | 12 |
| Middle School | 92.82 | 8.21 | 17 | 78.62 | 18.12 | 16 |
| Factor One, Computer Technology Capabilities and Strategies | | | | | | |
| Elementary school | 66.10 | 7.26 | 20 | 66.83 | 6.61 | 12 |
| Middle school | 70.70 | 6.18 | 17 | 59.75 | 14.19 | 16 |
| Factor Two, External Influences of Computer Technology Uses | | | | | | |
| Elementary school | 20.95 | 2.23 | 20 | 20.50 | 3.23 | 12 |
| Middle school | 22.11 | 2.14 | 17 | 18.37 | 4.04 | 16 |

Note. Total Efficacy (R = 21 – 105). Factor One (R = 16 – 80). Factor Two (R = 5 – 25). Experimental Group (N=37). Comparison Group (N=28).
*p<.05.

Table 10. *ANOVA Group Differences in Efficacy for Technology Integration Mean Scores Based on Grade Level*

| Efficacy for Technology Integration | df | SS | MS | F value | p |
|---|---|---|---|---|---|
| | | | Experimental group | | |
| Total Efficacy | | | | | |
| Between-group | 1 | 306.309 | 306.309 | 4.013 | .053 |
| Within-group | 35 | 2671.421 | 76.326 | | |
| Factor One, Computer Technology Capabilities and Strategies | | | | | |
| Between-group | 1 | 194.941 | 194.941 | 4.229 | .047* |
| Within-group | 35 | 1613.329 | 46.095 | | |
| Factor Two, External Influences of Computer Technology Uses | | | | | |
| Between-group | 1 | 12.529 | 12.529 | 2.599 | .116 |
| Within-group | 35 | 168.715 | 4.820 | | |
| | | | Comparison group | | |
| Total Efficacy | | | | | |
| Between-group | 1 | 520.012 | 520.012 | 2.295 | .142 |
| Within-group | 26 | 5892.417 | 226.631 | | |
| Factor One, Computer Technology Capabilities and Strategies | | | | | |
| Between-group | 1 | 344.048 | 344.048 | 2.552 | .122 |
| Within-group | 26 | 3504.667 | 134.795 | | |
| Factor Two, External Influences of Computer Technology Uses | | | | | |
| Between-group | 1 | 18.107 | 18.107 | 1.305 | .264 |
| Within-group | 26 | 360.750 | 13.875 | | |

*Note.* Experimental Group (N=37). Comparison Group (N=28).
*p<.05.

**Subject area.** The differences in levels of efficacy for technology integration were analyzed based on whether the teacher taught multi-subjects or a single subject in the 2009-2010 school year. The experimental group efficacy for technology integration mean scores of teachers who reported teaching multi-subjects were 86.47 (SD = 9.02) for total efficacy, 65.63 (SD = 7.14) for Factor One, Computer Technology Capabilities and Strategies and 20.84 (SD = 2.24) for Factor Two, External Influences of Computer Technology Uses. For teachers who reported teaching a single subject, efficacy for technology integration mean scores were 93.11 (SD = 8.05) for total efficacy, 70.94 (SD = 6.08) for Factor One, and 22.16 (SD = 2.09) for Factor Two. Data related to these findings are found in Table 11.

The comparison group efficacy for technology integration mean scores of teachers who reported teaching multi-subjects were 88.00 (SD = 10.59) for total efficacy, 67.88 (SD = 7.35) for Factor One, and 20.11 (SD = 3.33) for Factor Two. For teachers who reported teaching a single subject, efficacy for technology integration mean scores were 79.68 (SD = 16.81) for total efficacy, 60.36 (SD = 13.06) for Factor One, Computer Technology Capabilities and Strategies and 19.31 (SD = 3.98) for Factor Two, External Influences of Computer Technology Uses. Data related to these findings are found in Table 11.

An ANOVA determined statistical significance for two measures of efficacy for technology integration for the experimental group based on subject area taught: total efficacy mean scores, $F$ (1, 35) = 5.545, $p$=.024, and Factor One, Computer Technology Capabilities and Strategies, mean scores, $F$ (1, 35) = 5.901, $p$=.020. No statistical significance was found for the comparison group mean scores for efficacy for technology integration based on subject area. These data are found in Tables 12.

Table 11. *Group Differences in Efficacy for Technology Integration Mean Scores Based on Subject Area*

| | Total Efficacy for Technology Integration | | | | | |
|---|---|---|---|---|---|---|
| | Experimental Group | | | Comparison Group | | |
| Subject area | M | SD | n | M | SD | n |
| Total Efficacy | | | | | | |
| Multi-subjects | 86.47 | 9.02 | 19 | 88.00 | 10.59 | 9 |
| Single subject | 93.11 | 8.05 | 18 | 79.68 | 16.81 | 19 |
| Factor One, Computer Technology Capabilities and Strategies | | | | | | |
| Multi-subjects | 65.63 | 7.14 | 19 | 67.88 | 7.35 | 9 |
| Single subject | 70.94 | 6.08 | 18 | 60.36 | 13.06 | 19 |
| Factor Two, External Influences of Computer Technology Uses | | | | | | |
| Multi-subjects | 20.84 | 2.24 | 19 | 20.11 | 3.33 | 9 |
| Single subject | 22.16 | 2.09 | 18 | 19.31 | 3.98 | 19 |

*Note.* Total Efficacy (R = 21 – 105). Factor One (R = 16 – 80). Factor Two (R = 5 – 25). Experimental Group (N=37). Comparison Group (N=28).
*p<.05.

Table 12. *ANOVA Group Differences in Efficacy for Technology Integration Mean Scores Based on Subject Area*

| Efficacy for Technology Integration | df | SS | MS | F value | p |
|---|---|---|---|---|---|
| | | Experimental group | | | |
| Total Efficacy | | | | | |
| Between-group | 1 | 407.215 | 407.215 | 5.545 | .024* |
| Within-group | 35 | 2570.515 | 73.443 | | |
| Factor One, Computer Technology Capabilities and Strategies | | | | | |
| Between-group | 1 | 260.905 | 260.905 | 5.901 | .020* |
| Within-group | 35 | 1547.365 | 44.210 | | |
| Factor Two, External Influences of Computer Technology Uses | | | | | |
| Between-group | 1 | 16.217 | 16.217 | 3.439 | .072 |
| Within-group | 35 | 165.026 | 4.715 | | |
| | | Comparison group | | | |
| Total Efficacy | | | | | |
| Between-group | 1 | 422.323 | 422.323 | 1.833 | .187 |
| Within-group | 26 | 5990.105 | 230.389 | | |
| Factor One, Computer Technology Capabilities and Strategies | | | | | |
| Between-group | 1 | 345.404 | 345.404 | 2.563 | .121 |
| Within-group | 26 | 1758.011 | 53.273 | | |
| Factor Two, External Influences of Computer Technology Uses | | | | | |
| Between-group | 3 | 3.863 | 3.863 | .268 | .609 |
| Within-group | 24 | 374.994 | 14.423 | | |

*Note*. Experimental Group (N=37). Comparison Group (N=28).
*p<.05.

**Research Question Five: What is the relationship, if any, between teachers' efficacy levels for technology integration and technology integration in the classroom for teachers who have participated in a school-based, job-embedded professional development program?**

Research question five was answered using the findings for the technology integration levels identified from the Grappling's Technology and Learning Spectrum and the findings from the Computer Technology Integration Survey to represent efficacy for technology integration. These data were used to determine whether a significant relationship existed between the experimental group's efficacy levels for technology integration and technology integration in classroom practice. The pretest technology integration scores and the posttest technology integration scores were summed to represent total technology integration. The mean value of total technology integration was determined to be 20.70 (SD = 3.45, R = 0 - 36). The mean value of total efficacy for technology integration was 89.70 (SD = 9.09, R = 21 - 105). The Factor One, computer technology capabilities and strategies, mean value was 68.21 (SD = 7.08, R = 16 - 80). The Factor Two, external influences of computer technology uses, mean value was 21.48 (SD = 2.24, R = 5 - 25). These data are reported in Table 13.

Computing the Pearson r correlation coefficient, no statistically significant relationship was found to exist between technology integration and efficacy for technology integration for all three measures: total efficacy had a $r$ value of .17 ($p$ = .29), Factor One, computer technology capabilities and strategies, had a $r$ value of .21 ($p$=.19), and Factor Two, external influences of computer technology uses, had a $r$ value of .03 ($p$ = .84). These data are presented in Table 14.

Table 13. *Experimental Group Means and Standard Deviations for Efficacy for Technology Integration and Technology Integration*

| Measure | *M* | *SD* |
|---|---|---|
| Total Efficacy for Technology Integration | 89.70 | 9.09 |
| Factor One, Computer Technology Capabilities and Strategies | 68.21 | 7.08 |
| Factor Two, External Influences of Computer Technology Uses | 21.48 | 2.24 |
| Technology Integration | 20.70 | 3.45 |

*Note.* Total Efficacy for Technology Integration (R = 21 – 105). Factor One (R = 16 – 80). Factor Two (R = 5 – 25). Technology Integration (R = 0 – 36). N=37

Table 14. *Experimental Group Correlations for Efficacy for Technology Integration and Technology Integration*

| Measure | Total Efficacy for Technology Integration | Factor One, Computer Technology Capabilities and Strategies | Factor Two, External Influences of Computer Technology Use |
|---|---|---|---|
| Total Efficacy for Technology Integration | _ | | |
| Factor One, Computer Technology Capabilities and Strategies | .99 (.00)** | _ | |
| Factor Two, External Influences of Computer Technology Use | .91 (.00)** | .86 (.00)** | _ |
| Technology Integration | .17 (.29) | .21 (.19) | .03 (.84) |

*Note.* *p* values are presented in parentheses.
***p<.01*

**Research Question Six: What are the differences in the relationship, if any, between teachers' levels of efficacy for technology integration and technology integration in the classroom, based on a selected list of attribute variables (e.g., teaching experience, grade level, and subject area), for teachers who have participated in a school-based, job-embedded professional development program?**

The relationship between efficacy levels for technology integration and technology integration in classroom practice was analyzed based on teaching experience, grade level, and subject area for the experimental group.

**Teaching experience.** No statistically significant differences were found to exist in the relationship between technology integration and efficacy for technology integration between experimental group teachers based on years of full-time teaching experience. The Pearson Correlation Coefficient was reported for total efficacy, Factor One, computer technology capabilities and strategies, and Factor Two, external use of computer technology. The r value for total efficacy was .31 ($p$ = .44) for teachers with 0 – 6 years of full-time teaching experience, -.08 ($p$ = .84) for 7 – 12 years, .27 ($p$ = .44) for 13 – 23 years, and .32 ($p$ = .33) for 24 – 35 years. These data are reported in Table 15.

The r value for Factor One, computer technology capabilities and strategies, was .34 ($p$ = .40) for teachers who reported 0 – 6 years of full-time teaching experience, -.01 ($p$ = .97) for 7 – 12 years, .31 ($p$ = .38) for 13 – 23 years, and .36 ($p$ = .26) for 24 – 35 years. These data are reported in Table 16.

The r value for Factor Two, external influences of computer technology uses, was .11 ($p$ = .79) for teachers who reported 0 – 6 years of full-time teaching experience, -.27

(*p* = .51) for 7 – 12 years, .15 (*p* = .68) for 13 – 23 years, and .16 (*p* = .62) for 24 – 35 years. These data are reported in Table 17.

**Grade level.** No statistically significant differences were found to exist in the relationship between total technology integration and efficacy for technology integration based on grade level taught in 2009-2010. The Pearson Correlation Coefficient was computed at .07 (*p* = .74) for total efficacy for teachers who reported teaching in an elementary school and .265(*p* = .30) for teachers reporting teaching in a middle school. These data are reported in Table 15.

The r value for Factor One, computer technology capabilities and strategies, was .12 (*p* = .61) for teachers who reported teaching in an elementary school and .31 (*p* = .21) for teachers who reported teaching in a middle school. These data are reported in Table 16.

The r value for Factor Two, external influences of computer technology uses, was -.07 (*p* = .73) for teachers who reported teaching in an elementary school and .10 (*p* = .68) for teachers who reported teaching in a middle school. These data are reported in Table 17.

**Subject area.** No statistically significant differences were found to exist in the relationship between total technology integration and efficacy for technology integration based on subject area. The Pearson Correlation Coefficient was computed at .11 (*p* = .62) for total efficacy for teachers who reported teaching multi-subjects and .24 (*p* = .32) for teachers who reported teaching a single subject. These data are reported in Table 15.

The r value for Factor One, computer technology capabilities and strategies, was .16 (*p* = 49) for teachers who reported teaching multi-subjects and .29 (*p* = .24) for teachers who reported teaching a single subject. These data are reported in Table 16.

The r value for Factor Two, external influences of computer technology uses, was -.05 (*p* = .82) for teachers who reported teaching multi-subjects and .09 (*p* = .71) for teachers who reported teaching a single subject. Data related to these findings are found in Table 17.

Table 15. *Experimental Group Differences in the Relationship between Technology Integration and Total Efficacy for Technology Integration Based on Teaching Experience, Grade Level, and Subject Area Taught*

| | Technology Integration | Total Efficacy for Technology Integration | | | |
|---|---|---|---|---|---|
| | M | M | r | p | n |
| Teaching Experience | | | | | |
| 0 – 6 years | 20.24 | 91.50 | .316 | .446 | 8 |
| 7 – 12 years | 19.25 | 90.50 | -.084 | .843 | 8 |
| 13 – 23 years | 21.70 | 87.70 | .276 | .441 | 10 |
| 24 – 35 years | 21.18 | 89.63 | .322 | .334 | 11 |
| Grade Level | | | | | |
| Elementary school | 20.55 | 87.05 | .077 | .747 | 20 |
| Middle school | 20.88 | 92.83 | .265 | .304 | 17 |
| Subject area | | | | | |
| Multi-subjects | 20.63 | 86.47 | .119 | .626 | 19 |
| Single subject | 20.77 | 93.11 | .244 | .329 | 18 |

*Note*. Technology Integration (R = 0 – 36). Total Efficacy for Technology Integration (R = 21 – 105). N=37

Table 16. *Experimental Group Differences in the Relationship between Technology Integration and Factor One Efficacy for Technology Integration Based on Teaching Experience, Grade Level, and Subject Area*

| | Technology Integration | Factor One, Computer Technology Capabilities and Strategies | | | |
|---|---|---|---|---|---|
| | M | M | r | p | n |
| Teaching Experience | | | | | |
| 0 – 6 years | 20.25 | 69.62 | .34 | .40 | 8 |
| 7 – 12 years | 19.25 | 69.00 | -.01 | .97 | 8 |
| 13 – 23 years | 21.70 | 66.50 | .31 | .38 | 10 |
| 24 – 35 years | 21.18 | 68.18 | .36 | .26 | 11 |
| Grade Level | | | | | |
| Elementary school | 20.55 | 66.10 | .12 | .61 | 20 |
| Middle school | 20.88 | 70.70 | .31 | .21 | 17 |
| Subject area | | | | | |
| Multi-subjects | 20.63 | 65.63 | .16 | .49 | 19 |
| Single subject | 20.77 | 70.94 | .29 | .24 | 18 |

*Note.* Technology Integration (R = 0 – 36). Factor One (R = 16 – 80).
N=37

Table 17. *Experimental Group Differences in the Relationship between Technology Integration and Factor Two Efficacy for Technology Integration Based on Teaching Experience, Grade Level, and Subject Area*

| | Technology Integration | Factor Two, External Influences of Computer Technology Uses | | | |
|---|---|---|---|---|---|
| | M | M | r | p | n |
| Teaching Experience | | | | | |
| 0 – 6 years | 20.25 | 21.87 | .11 | .79 | 8 |
| 7 – 12 years | 19.25 | 21.50 | -.27 | .51 | 8 |
| 13 – 23 years | 21.70 | 21.20 | .15 | .68 | 10 |
| 24 – 35 years | 21.18 | 21.45 | .16 | .62 | 11 |
| Grade Level | | | | | |
| Elementary school | 20.55 | 20.95 | -.07 | .73 | 20 |
| Middle school | 20.88 | 22.11 | .10 | .68 | 17 |
| Subject area | | | | | |
| Multi-subjects | 20.63 | 20.84 | -.05 | .82 | 19 |
| One subject | 20.77 | 22.16 | .09 | .71 | 18 |

*Note*. Technology Integration (R = 0 – 36). Factor Two (R = 16 – 80).
N=37

## Summary of Findings

The purpose of this chapter was to present data collected to measure the differences in elementary and middle school teachers' efficacy for technology integration after participation in a school-based, job-embedded professional development program. Grappling's Technology and Learning Spectrum (Porter, 2002) was used to measure technology integration levels, and the Computer Technology Integration Survey (Wang, 2004) was used to measure efficacy levels for technology integration and to collect demographic information.

Analysis of the demographic information indicated that the experimental group reported a mean of 16.1 years of full-time teaching experience, 54.05% taught elementary school, 45.95% taught middle school, 51.35% taught multi-subjects, and 48.65% taught a single subject in 2009-2010. The comparison group reported a mean of 11.5 years of full-time teaching experience, 42.86% taught elementary school, 57.14% taught middle school, 32.14% taught multi-subjects, and 67.86% taught a single subject in 2009-2010.

No statistically significant difference was found in the experimental group's technology integration mean scores from pretest to posttest. In addition, no statistically significant difference was found for the experimental group's level of technology integration mean scores based on years of full-time teaching experience, grade level taught, and subject area taught in 2009-2010.

Statistically significant differences were found between the experimental and comparison groups mean scores on all three measures of efficacy for technology integration: total efficacy ($p=.026$), Factor One, computer technology capabilities and strategies (p=.013), and Factor Two, external influences of computer technology use (p=.019).

Statistically significant differences were found for the comparison group total efficacy for technology integration (p=.005), Factor One, computer technology capabilities and strategies (p=.004), and Factor Two, external influences of computer technology (p=.027) based on the years of full-time teaching experience. No statistical significance existed for the differences in the experimental group's levels of total efficacy for technology integration, Factor One, and Factor Two, based on the years of full-time teaching experience in 2009-2010.

Statistically significant differences were found for the experimental group Factor One efficacy for technology, computer technology capabilities and strategies (p=.047), based on whether the teacher taught in an elementary or middle school. No statistically significant differences were found for the comparison group based on grade level taught in 2009-2010.

Statistically significant differences were found for the experimental group total efficacy for technology integration (p=.024) and Factor One, computer technology capabilities and strategies (p=.020), based on whether the teacher taught multi-subjects or a single subject. No statistically significant differences were found for the comparison group efficacy for technology integration based on subject area taught in 2009-2010.

No statistically significant relationship was found between the experimental group's technology integration and efficacy for technology integration for all three measures of efficacy: total efficacy, Factor One, computer technology capabilities and strategies, and Factor Two, external influences of computer technology uses. In addition, no significantly significant relationships were found between the experimental group's technology integration and total efficacy, Factor One, and Factor Two based on teaching experience, grade level taught, and subject area taught in 2009-2010.

# CHAPTER FIVE: CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

In this chapter, the purpose of the study, methods, summary of the findings and conclusions related to the impact of a school-based, job-embedded professional development on elementary and middle school teacher efficacy for technology integration are presented. A discussion of the study implications and recommendations for further research conclude the chapter.

## Purpose of the Study

The purpose of this conversion mixed-methods quasi-experimental study was to investigate the impact of a school-based, job-embedded professional development program on elementary and middle school teacher efficacy for technology integration. The following research questions guided the study.

1. What is the change, if any, in teachers' level of technology integration in classroom practice after participation in a school-based, job-embedded professional development?
2. What is the change, if any, in teachers' level of technology integration in classroom practice after participation in a school-based, job-embedded professional development based on a selected list of attribute variables (e.g., teaching experience, grade level, and subject area)?
3. What is the difference, if any, in efficacy levels for technology integration for teachers who have participated in a school-based, job-embedded professional development program and those who have not?
4. What is the difference, if any, based on a selected list of attribute variables (e.g., teaching experience, grade level, and subject area) in efficacy levels for

technology integration for teachers who have participated in a school based, job-embedded professional development program and those who have not?

5. What is the relationship, if any, between teachers' efficacy levels for technology integration and technology integration in the classroom for teachers who have participated in a school-based, job-embedded professional development program?
6. What are the differences in the relationship, if any, between teachers' levels of efficacy for technology integration and technology integration in the classroom based on a selected list of attribute variables (e.g., teaching experience, grade level, and subject area) for teachers who have participated in a school-based, job-embedded professional development program?

## Population

The population for this study included 65 elementary and middle school teachers in West Virginia. Thirty-seven of those teachers participated in the first phase of a two-phase intervention, Infusing Technology Professional Development Program, and were classified as the experimental group. This group consisted of four to six teachers per team, representing four elementary and four middle schools in West Virginia. This study was limited to Phase I of the professional development program beginning in the summer, 2009 with additional training through the 2009-2010 school year.

The comparison group consisted of 28 teachers, representing four to six additional teachers from each of the same eight school teams as in the experimental group. This group was recruited by the teachers in the experimental group to participate in the second phase of the Infusing Technology Professional Development Program. At the time of the study, they had not yet received the intervention.

## Methods

This was a conversion mixed-methods quasi-experimental study designed to measure the impact of a school-based, job-embedded professional development program on elementary and middle school teacher efficacy for technology integration. Grappling's Technology and Learning Spectrum (Porter, 2002) was used to measure levels of technology integration. Qualitative data were collected from the experimental group's bi-monthly journal postings from September, 2009 through May, 2010, analyzed and quantified to determine change in levels of technology integration from pretest to posttest. The Computer Technology Integration Survey (Wang, 2004) was used to measure levels of efficacy for technology integration. Quantitative data were collected from the experimental group, who had received one year of the intervention (Phase I of the Infusing Technology Professional Development) and from the comparison group, who had not yet received any intervention.

## Summary of Findings

Based on the demographic data, the experimental group had a mean of 16.1 years of full-time teaching experience, 54.05% taught elementary school, 45.95% taught middle school, 51.35% taught multi-subjects, and 48.65% taught a single subject in 2009-2010. The comparison group had a mean of 11.5 years of full-time teaching experience, 42.86% taught elementary school, 57.14% taught middle school, 32.14% taught multi-subjects, and 67.86% taught a single subject in 2009-2010.

No statistically significant difference was found in the experimental group's technology integration mean difference scores from pretest to posttest. No statistically significant differences were found in the experimental group's technology integration mean difference scores based on teaching experience, grade level, and subject area taught in 2009-2010.

Statistically significant differences were found between the experimental and comparison groups mean scores on all three measures of efficacy for technology integration: total efficacy (p=.026), Factor One, computer technology capabilities and strategies (p=.013), and Factor Two, external influences of computer technology use (p=.019).

Statistically significant differences were found for the comparison group total efficacy for technology integration (p=.005), Factor One, computer technology capabilities and strategies (p=.004), and Factor Two, external influences of computer technology (p=.027) based on the years of full-time teaching experience, while no statistically significant differences were found for the experimental group.

Statistically significant differences were found for the experimental group Factor One efficacy for technology, computer technology capabilities and strategies (p=.047), based on whether the teacher taught in an elementary (M=66.10) or middle school (M=70.70), but no statistically significant differences were found for the comparison group.

Statistically significant differences were found for the experimental group total efficacy for technology integration (p=.024) based on whether teachers taught multi-subjects (M=86.47) or a single subject (M=93.11), and Factor One, computer technology capabilities and strategies (p=.020), based on whether the teacher taught multi-subjects (M=65.63) or a single subject (M=70.94).

No statistically significant relationship was found between technology integration and efficacy for technology integration for all three measures of efficacy: total efficacy, Factor One, computer technology capabilities and strategies, and Factor Two, external influences of computer technology uses.

## Conclusions

The following conclusions can be supported based on the findings of this study.

**1. What is the change, if any, in teachers' level of technology integration in classroom practice after participation in a school-based, job-embedded professional development program?**

No statistically significant differences were found in the experimental group's technology integration mean difference scores. Therefore, there was no statistically significant change in the teachers' level of technology integration in classroom practice after participation in a school-based, job-embedded professional development program.

**2. What is the change, if any, in teachers' level of technology integration in classroom practice after participation in a school-based, job-embedded professional development program based on a selected list of attribute variables (e.g., teaching experience, grade level taught, and subject area taught)?**

No statistically significant differences were found in the experimental group's level of technology integration mean difference scores based on teaching experience, grade level, and subject area taught. Therefore, there were no statistically significant differences in teachers' levels of technology integration in classroom practice after participation in a school-based, job-embedded professional development program based on years of full-time teaching experience, whether teachers taught in an elementary or middle school, and whether teachers taught multi-subjects or a single subject.

**3. What is the difference, if any, in efficacy levels for technology integration for teachers who have participated in a school-based, job-embedded professional development program and those who have not?**

Statistically significant differences in levels of efficacy for technology integration were found between the experimental and comparison groups on all three measures of efficacy: total efficacy for technology integration, computer technology capabilities and strategies, and external influences of computer technology use. Therefore, teachers who participated in a school-based, job-embedded professional development program scored at significantly higher levels of efficacy for technology integration on all three measures of efficacy compared to those who had not participated.

**4. What is the difference, if any, based on a selected list of attribute variables (e.g., teaching experience, grade level taught, and subject area taught) in efficacy levels for technology integration for teachers who have participated in a school- based, job-embedded professional development program and those who have not?**

***Teaching experience.*** There were no statistically significant differences in levels of efficacy for technology integration for the experimental group based on years of full-time teaching experience. There were statistically significant differences in levels of efficacy for technology integration for the comparison group based on years of full-time teaching experience. Therefore, there were no statistically significant differences in teachers' efficacy levels for technology integration after participating in a school-based, job-embedded professional development program based on years of full-time teaching experience.

***Grade level.*** Statistically significant differences for Factor One, computer capabilities and strategies, were found for the experimental group based on grade level taught in 2009 – 2010. No statistically significant differences were found for efficacy for technology integration for the comparison group based on grade level taught. Therefore, middle school teachers who participated in a school-based, job-embedded professional development program scored significantly higher in levels of efficacy for computer technology capabilities and strategies compared to elementary school teachers.

***Subject area.*** Statistically significant differences in levels of efficacy for technology integration were found for the experimental group teachers based on subject taught in 2009-2010. No statistically significant differences were found for the comparison group based on subject taught. Therefore, teachers who taught a single subject who participated in a school-based, job-embedded professional development program scored significantly higher in levels of efficacy for technology integration compared to teachers who taught multi-subjects.

**5. What is the relationship, if any, between teachers' efficacy levels for technology integration and technology integration in the classroom for teachers who have participated in a school-based, job-embedded professional development program?**

No statistically significant correlation existed between the experimental group efficacy for technology integration and levels of technology integration. Therefore, there was no relationship between teachers' efficacy levels for technology integration and technology integration in classroom practice for those teachers who participated in a school-based, job-embedded professional development program.

**6. What are the differences in the relationship, if any, between teachers' levels of efficacy for technology integration and technology integration in the classroom based on a selected list of attribute variables (e.g., teaching experience, grade level taught, and subject area taught) for those who participated in a school-based, job-embedded professional development program?**

No statistically significant correlations existed for the differences in the relationship between teachers' levels of efficacy for technology integration and technology integration based on teaching experience, grade level, and subject taught in 2009 - 2010. Therefore, there was not a relationship between teachers' levels of efficacy for technology integration and technology integration in classroom practice for those teachers who participated in a school-based, job-embedded professional development program based on years of full-time teaching experience, whether teachers taught in an elementary or middle school and whether teachers taught multi-subjects or a single subject.

## Discussion and Implications

The findings of this study indicated that no statistically significant change in teachers' level of technology integration was found after participation in a school-based, job-embedded professional development program. According to Mishra and Koehler (2006) technology integration is a complex, dynamic process that continues to pose challenges for teachers. The framework of Technology Pedagogical Content Knowledge (TPCK) may prove useful in explaining why teachers in this study may not have experienced statistically significant changes in levels of technology integration. Technology integration requires that teachers not only gain an understanding of the interrelatedness of technology, pedagogy, and content knowledge, they must commit to applying this understanding as they integrate technology in meaningful ways to promote critical thinking, reasoning, and problem-solving skills. Teachers will need to take their understanding of content, their knowledge of how to best teach that content, and explore how technology can be used to support students in learning that content in ways that support 21st century knowledge and skills.

Data collected in this study indicated that the majority of the teachers were at the adapting level of technology use. Instruction was being adapted to add technology to an existing lesson to introduce, reinforce, or reteach concepts outlined in the West Virginia Content Standards and Objectives (WVCSO). Examples included teacher-directed uses of technology such as drill-and-practice activities, instructional games and word processing. Even though the technology gained the interest of the students, the same level of learning could have occurred without the use of technology. The majority of the teachers, according to Mishra and Koehler (2006), treated technology as a separate entity apart from pedagogical content knowledge.

Cuban's (2001) study and Lawless and Pellagrino's (2007) meta-analysis revealed similar findings. Although technology was meant to transform instructional practices and subsequent student learning, computers were being used in ways that maintained current teaching practices. Low-level drill and practice activities or games were common computer uses.

Although not statistically significant, the findings in this study do suggest a trend of increased levels of technology integration during teacher participation in the professional development program. From pretest to posttest, there was a 4.87% decrease in no uses of technology, a 11.91% decrease in adapting uses of technology and a 14.83% increase in transforming uses of technology. It is hypothesized that with increased time, these levels of technology integration may increase when teachers participate in phase II of the Infusing Technology Professional Development Program. According to Porter's (2002) work in over 2,300 studies in which she completed building walk-throughs to code technology and learning uses using the Grappling's Technology and Learning Spectrum, she found that "only 3 - 4% of all technology uses are at the transforming level" (B. Porter, personal communication, May 13, 2010). Based on this comparison, the findings in this study are promising.

Finally, even though care was taken to reduce measurement error by establishing validity and interrater reliability of the Grappling's Technology and Learning Spectrum (Porter, 2002), the levels of technology integration ratings were limited to what each teacher chose to include in their journal posting. For example, if a teacher discussed that he was thinking about having his students use a wiki in a unit of study during the next semester, the rater identified this as a "no technology use." However, the teacher may have used technology in another lesson during this posting period but chose not to write about it in the journal. In Hall's (2008) study on the relationship of efficacy for technology integration and actual technology integration in the classroom, the researcher found that using classroom observations in addition to relying solely on technology integration documentation found within lesson plans allowed for increased precision in identifying levels of technology integration in the classroom.

With only three broad levels identified on the Grappling's Technology and Learning Spectrum (Porter, 2002), the measurement of more specific movement within the levels was limited. Although the findings indicated that no statistically significant differences existed between the experimental group's levels of technology integration from pretest to posttest, the instrument's ability to measure this change may have influenced these findings.

An individual chooses to engage in or avoid an activity based on the judgment of perceived capabilities to succeed. Bandura (1997) identified four sources of information that an individual uses to form this judgment: mastery experiences (results of one's previous performances on similar tasks), vicarious experiences (observing a model perform a task), social persuasion (encouragement) and somatic and emotional states (how one feels when performing a particular task). The perception of an unsuccessful behavior is often discarded and a successful behavior is often repeated. Applying this theory to the professional development program, if teachers were continually at the adapting level of technology use with no feedback of progress, it may be discouraging to participants. As a result, some participants may have reduced their levels of effort and persistence in overcoming obstacles in attempting to reach transforming uses of technology. Additionally, because teachers were experiencing success at the adapting technology use, they may have been more motivated to repeat those behaviors.

No statistically significant differences were found in levels of technology integration for teachers after participation in a school-based, job-embedded professional development program based on years of full-time teaching experience, whether teachers taught in an elementary or middle school, or whether teachers taught multi-subjects or a single subject. Eun and Heining-Boynton (2007) and Hall (2008) also reported similar findings in that teachers' years of full-time teaching experience were not significantly correlated with levels of technology integration in classroom practice. Yet Kemp's (2002) study led to different conclusions. Years of teaching experience were shown to have an inverse relationship with levels of technology integration. Fewer years of teaching experience were correlated with higher levels of technology integration, and greater years of teaching experience were correlated with lower levels of technology integration.

Garet, Porter, Desimone, Birman, and Yoon (2001) studied elements of professional development that were identified as being effective in changing teachers' knowledge and classroom practice. These elements included 1) opportunities for active, hands-on learning focusing on specific learning goals; 2) collective participation of a group of teachers from the same school, same grade, or same subject is required; and 3) extended length of professional development.

Each of these design features was included in the Infusing Technology Professional Development Program. Implicit in these conclusions is that, when teachers from the same school, same grade, or same subject collectively participate, there are increased opportunities to discuss how implementing what was learned in the professional development in their classrooms affected their students' learning. Even though the professional development program provided a wiki for participants to share descriptions and reflections regarding their experiences with integrating technology in their classroom, some of the participants did not make this portion of the professional development program a priority. Limited information may have been shared, thus reducing the potential of the effectiveness of a professional learning community. Also, beyond meeting with the mentor for monthly meetings, there was no requirement for teachers to meet on a consistent basis to share their experiences.

Windschitl and Sahl (2002) found that teachers often learn about new technologies through formal professional development programs, yet learned how to integrate these new technologies into classroom practice through informal conversations with colleagues. Joyce and Showers (2002) also found that teachers who participated in a professional development using peer coaching or collegial support reported a 95% gain in knowledge, mastery of new skills and ability to transfer the new skills into the classroom. Time spent in informal discussions related to technology integration challenges and successes are needed.

Hughes, Kerr, and Ooms (2005) found that an online forum provided a place for a group to offer feedback as they collaboratively work on solutions to problems. Little feedback was provided on the journal postings from other teachers on the wiki used in the Infusing Technology Professional Development Program, thus limiting opportunities to collaborate and compare their understandings with perspectives of others. Vygotsky (1981) believes reflection, a socio-cognitive activity of joint problem-posing and problem-solving, is what leads learners in internalizing concepts. Brubacher, Case, and Reagan (1994) found that when teachers engage in problem-solving, opportunities to turn knowledge into practice increase. Mouza (2002-2003) also supports this finding that teachers who reflect on their practices to assign meaning to their experiences are more likely to transfer this new knowledge to their classrooms. These conclusions lead the researcher to believe that these attribute variables may have had more of an influence on the participating teachers' levels of technology integration if greater emphasis was placed on the importance of reflection, feedback, and creating a strong professional learning community.

Findings in this study revealed that teachers who participated in a school-based, job-embedded professional development had statistically significant levels of efficacy for technology integration compared to teachers who had not participated. A comparable study of a two-year, two-phase, technology professional development program based on the International Society for Technology in Education's (ISTE) NETS standards was completed by Brinkerhoff (2006). The researcher found that levels of efficacy for technology integration changed very little at the end of the first phase. However, there was a statistically significant difference ($p<.001$) at the end of the second phase of the professional development. Based on these findings, it may be hypothesized that teachers who participate in the second phase of the Infusing Technology Professional Development Program will experience even greater levels of efficacy for technology integration compared to the significant ($p < .05$) efficacy levels at the end of phase one.

Findings in this study indicated no statistically significant differences in teachers' efficacy levels for technology integration after participating in a school-based, job-embedded professional development program based on years of full-time teaching experience. Overbaugh and Lu (2008) reported similar findings in that participants' demographic information did not have a significant effect on teachers' sense of efficacy.

However, statistically significant differences in levels of efficacy for technology integration were found for teachers after participation in the professional development program based on whether teachers taught in an elementary or middle school, and whether teachers taught a single subject or multi-subjects. It may be reasonable to suggest that teachers who taught in a middle school or who taught a single subject may have more focused opportunities to integrate technology in their classroom. For example, a teacher who teaches math only as compared to teaching multi-subjects in a self-contained classroom may be able to focus on technology integration in math versus technology integration across many subjects. With increased opportunities for mastery experiences, greater levels of efficacy may result. In addition, middle school teachers often teach less subject areas with more time devoted to shared planning times of grade level teachers. This time may provide increased opportunities for collaboration and dialogue leading to increased opportunities to enhance efficacy.

No relationship between efficacy for technology integration and levels of technology integration in classroom practice was found for teachers after participation in the professional development program. Additionally, no differences in this relationship were found for teachers after participation in the professional development program based on years of full-time teaching experience, whether teachers taught in an elementary or middle school, or whether teachers taught multi-subjects or a single subject.

Johnson (2006) reported similar findings in which he concluded that there was no statistically significant relationship between current instructional practices and computer self-efficacy. Participants in a technology professional development program reported high levels of efficacy and low levels of technology integration in classroom practice. Okoye (2010) and Hall (2008) found a significant positive relationship between computer efficacy and levels of technology implementation. The differences in findings may be explained by Bandura's (1986) theory of triadic reciprocal causation that explains how influences of efficacy are bi-directional, dynamic and exert varying levels of influence that may or may not have an immediate effect. As hypothesized with greater time, the relationship of efficacy for technology integration and levels of technology integration in classroom practice may exhibit a stronger relationship.

## Recommendations for Further Research

This study investigated and provided insight into the impact of a school-based, job-embedded professional development program on elementary and middle school teacher efficacy for technology integration. Other questions raised by this study may be answered by further research as summarized below:

1. This study focused on a school-based, job-embedded professional development program to determine its impact on West Virginia elementary and middle school teacher efficacy for technology integration. Extending this study to include high school teachers in the study population may lend additional insight into how this type of professional development program impacts high school teacher efficacy for technology integration.
2. This study relied on using journal postings to determine the teachers' levels of technology integration. By repeating this study and adding classroom observations as part of the data collection and analysis, levels of technology integration may be identified more accurately.
3. Because Grappling's Technology and Learning Spectrum (Porter, 2002) identified three broad levels of technology integration use, measurement of

change within the instrument was limited. Using a more detailed instrument may provide increased levels of specificity to gauge progress in how technology is being integrated in classroom practice.

4. Even though the study findings indicated that there was no significant correlation between efficacy for technology integration and levels of technology integration, more time may be needed before this relationship becomes apparent. Repeat this study after the experimental group completes Phase II of the Infusing Technology Professional Development Program.

5. The Infusing Technology Professional Development Program attempted to create a professional learning community by selecting teams of teachers from the same schools to participate in the professional development program, providing a collaborative workspace through journal posting on the wiki, and providing a mentor to enhance participant success in integrating technology in transforming ways in their classrooms. The research literature supports increased efficacy for technology integration when the principal provides constructive feedback in an online forum. This study should be repeated with the addition of the principal as a member of the professional learning community.

6. Repeat this study and collect pretest and posttest data from the Computer Technology Integration Survey to determine changes in levels of efficacy for technology integration before and after participating in the professional development program.

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# APPENDICES

Appendix A:  Permission Granted
Institutional Review Board Approval
Participant Consent Form
West Virginia Center for Professional Development Approval
Permission to Use Computer Technology Integration Survey
Permission to Use Grappling's Technology and Learning Spectrum

Appendix B:  Instrumentation
Computer Technology Integration Survey (Wang, 2004)
Grappling's Technology and Learning Spectrum (Porter, 2002)

Appendix C:  Panel of Experts

Appendix D:  Alignment of International Society for Technology Integration (ISTE) National Educational Standards for Teachers (NETS-T), Computer Technology Integration Survey, and Infusing Technology Professional Development Program

Appendix E:  Description of the Infusing Technology Professional Development Intervention

## Appendix A: Permission Granted

Institutional Review Board Approval
Participant Consent Form
West Virginia Center for Professional Development Approval
Permission to Use Computer Technology Integration Survey
Permission to Use Grappling's Technology and Learning Spectrum

MARSHALL UNIVERSITY
www.marshall.edu

**Office of Research Integrity**
Institutional Review Board
401 11th St., Suite 1300
Huntington, WV 25701

FWA 00002704

IRB1 #00002205
IRB2 #00003206

April 14, 2010

Ronald Childress, Ed.D.
Graduate School of Education and Professional Development, MUGC

RE: IRBNet ID# 162516-1
**At**: Marshall University Institutional Review Board #2 (Social/Behavioral)

Dear Dr. Childress:

| | | |
|---|---|---|
| **Protocol Title**: | [162516-1] A Study of the Impact of a School-Based, Job-Embedded Professional Development Program on Elementary and Middle School Teacher Efficacy for Technology Integration | |
| **Expiration Date**: | April 14, 2011 | |
| **Site Location**: | MUGC | |
| **Type of Change**: | New Project | APPROVED |
| **Review Type**: | Exempt Review | |

In accordance with 45CFR46.101(b)(2), the above study and informed consent were granted Exempted approval today by the Marshall University Institutional Review Board #2 (Social/Behavioral) Chair for the period of 12 months. The approval will expire April 14, 2011. A continuing review request for this study must be submitted no later than 30 days prior to the expiration date.

This study is for student Yvonne Skoretz.

If you have any questions, please contact the Marshall University Institutional Review Board #2 (Social/ Behavioral) Coordinator Bruce Day, CIP at (304) 696-4303 or day50@marshall.edu. Please include your study title and reference number in all correspondence with this office.

Marshall University IRB

| | |
|---|---|
| Approved on: | 4/14/10 |
| Expires on: | 4/14/11 |
| Study number: | 162516 |

Dear Teacher:

You are invited to participate in a research project entitled "A Study of the Impact of a School-Based, Job-Embedded Professional Development Program on Elementary and Middle School Teacher Efficacy for Technology Integration" designed to analyze differences in efficacy levels for technology integration. The study is being conducted by Dr. Ron Childress from Marshall University and has been approved by the Marshall University Institutional Review Board (IRB). This research is being conducted as part of the dissertation for Yvonne Skoretz.

This survey is comprised of 21 items and will take about 10 minutes to complete. Your replies will be anonymous, so do not write your name anywhere on the form. There are no known risks involved with this study. Participation is completely voluntary. If you choose to not participate in this research study, there will be no penalty or loss of benefits. If you choose not to participate, please return the blank survey. You may choose to not answer any question by simply leaving it blank. Completing the survey indicates your consent for use of the answers you supply. If you have any questions about the study, you may contact Dr. Ron Childress at (304) 746-1942 and Yvonne Skoretz at (304) 253-1396.

If you have any questions concerning your rights as a research participant, you may contact the Marshall University Office of Research Integrity at (304) 696-4303.

By completing this survey and returning it, you are also confirming that you are **18** years of age or older. You may choose to keep a copy of this letter for your records. Your participation is greatly appreciated.

Sincerely,

Ron Childress, Ed.D.,
Marshall University, Professor

From: dbillheimer@wvcpd.org
Date: Mon, Apr 5, 2010 at 10:40 AM
Subject: RE: Dissertation Study
To: yskoretz@gmail.com

Dear Yvonne,

I have reviewed the study proposal and you have permission to continue the study with the CPD professional development project.

Best wishes,

Dixie

Dr. Dixie Billheimer
Chief Executive Officer
West Virginia Center for Professional Development
208 Hale Street
Charleston, West Virginia 25301
1-800-982-7348 or 304-558-0539
FAX: 304-558-0989

---------- Forwarded message ----------
From: Yvonne Skoretz <yskoretz@gmail.com>
Date: Thu, Mar 18, 2010 at 3:44 PM
Subject: Dissertation Study
To: Dixie Billheimer <dbillheimer@wvcpd.org>
Cc: "Childress, Ronald B." <rchildress@marshall.edu>

Dr. Billheimer:

When I met with you in November to discuss my dissertation proposal, you had given me a verbal approval to complete the study. Now that I am submitting documentation to the IRB, I realize I need to have written permission to complete the study. Would you be willing to write a letter granting permission? It would be helpful if you could include a statement about providing me with access to the evaluation data collected for the project. I am attaching a copy of the study proposal. Please let me know if you have any questions.

Thank You,
Yvonne Skoretz

Date: **Wed, 13 Jan 2010 11:10:54 -0500**
From: "Ling Wang" <lingwang@nova.edu> **Block Address**
To: "'Yvonne Michelle Skoretz'" <skoretz1@marshall.edu>

Cc: rchildress@marshall.edu
Subject: **RE: Computer Technology Integration Survey Permission Request**

Yvonne,

Thank you for your interest in my study and the survey! Please feel free to use the survey in your work.

Best wishes!

Ling


Ling Wang, Ph.D.
Associate Professor
Nova Southeastern University
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Web: http://scis.nova.edu/~lingwang


**From:** Yvonne Michelle Skoretz [mailto:skoretz1@marshall.edu]
**Sent:** Wednesday, January 13, 2010 9:05 AM
**To:** lingwang@nova.edu
**Cc:** rchildress@marshall.edu
**Subject:** Computer Technology Integration Survey Permission Request

Dr. Wang:

My name is Yvonne Skoretz, and I am a doctoral student at Marshall University. For my dissertation, I am investigating the impact of a school-based, job-embedded professional development on teacher efficacy for technology integration. I am requesting your permission to use your Computer Technology Integration Survey with a population of inservice teachers. Please feel free to contact me with any questions at skoretz1@marshall.edu. In addition, feel free to contact the chair of my dissertation committee, Dr. Ron Childress, at rchildress@marshall.edu . I look forward to your response.

Sincerely,

Yvonne Skoretz

| | |
|---|---|
| Date: | **Fri, 14 May 2010 13:47:41 -0600** |
| From: | "Bernajean Porter" <Bernajean@DigiTales.us> **Block Address** |
| To: | "Yvonne Michelle Skoretz" <skoretz1@marshall.edu> |
| Subject: | **Re: Permission to use Grappling's in dissertation study** |

Reply | Reply All | Forward | Print | Delete

Yvonne - a delight to talk with you and share the experiences and results that the Grappling Spectrum has provided my work over the years. I understand that after our conversations - you have found a method of using the Spectrum without modifications. I am attaching an updated version that may be useful.

You have my permission - good speed to your work ahead
Bernajean

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| | | |
|---|---|---|
| Spectrum 2010.pdf | Name: | Spectrum 2010.pdf |
| | Type: | |
| | Encoding: | BASE64 |

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On May 14, 2010, at 11:50 AM, Yvonne Michelle Skoretz wrote:

Dear Ms. Porter:

My name is Yvonne Skoretz, and I am a doctoral student at Marshall University. For my dissertation, I am investigating the impact of a school-based, job-embedded professional development program on teacher efficacy for technology integration. I am requesting your permission to use your Grappling's Technology and Learning Spectrum within my study with a population of in-service teachers. I will gladly share the results of the study with you.

Please feel free to contact me with any questions at skoretz1@marshall.edu.
In addition, feel free to contact the chair of my dissertation committee, Dr. Ron Childress, at rchildress@marshall.edu . I look forward to your response.

Sincerely,

Yvonne Skoretz,

Marshall University Graduate Student

## Appendix B: Instrumentation

Computer Technology Integration Survey (Wang, 2004)
Grappling's Technology and Learning Spectrum (Porter, 2002)

## Computer Technology Integration Survey

**Technology Integration is defined as using computer technology to support students as they construct their own knowledge through the completion of authentic, meaningful tasks.** The purpose of this survey is to determine how confident you feel about integrating technology into classroom teaching. Please respond to each item in Parts A and B. In Part A, please circle one response for each of the statements in the table. In Part B, please provide the requested information.

| **Part A:** For each statement, indicate the strength of your agreement or disagreement by circling one of the five choices.<br><br>**I feel confident that I…** | **Strongly Disagree** | **Disagree** | **Neither Disagree/Agree** | **Agree** | **Strongly Agree** |
|---|---|---|---|---|---|
| 1. understand computer capabilities well enough to maximize them in my classroom. | 1 | 2 | 3 | 4 | 5 |
| 2. have the skills necessary to use the computer for instruction. | 1 | 2 | 3 | 4 | 5 |
| 3. can successfully teach relevant subject content with appropriate use of technology. | 1 | 2 | 3 | 4 | 5 |
| 4. can evaluate software for teaching and learning. | 1 | 2 | 3 | 4 | 5 |
| 5. can use correct computer terminology when directing students' computer use. | 1 | 2 | 3 | 4 | 5 |
| 6. can help students when they have difficulty with the computer. | 1 | 2 | 3 | 4 | 5 |
| 7. can effectively monitor students' computer use for project development in my classroom. | 1 | 2 | 3 | 4 | 5 |
| 8. can motivate my students to participate in technology-based projects. | 1 | 2 | 3 | 4 | 5 |
| 9. can mentor students in appropriate uses of technology. | 1 | 2 | 3 | 4 | 5 |
| 10. can consistently use educational technology in effective ways. | 1 | 2 | 3 | 4 | 5 |
| 11. can provide individual feedback to students during technology use. | 1 | 2 | 3 | 4 | 5 |
| 12. can regularly incorporate technology into my lessons, when appropriate to student learning. | 1 | 2 | 3 | 4 | 5 |
| 13. can select appropriate technology for instruction based on curriculum standards. | 1 | 2 | 3 | 4 | 5 |

| I feel confident that I … | Strongly Disagree | Disagree | Neither Disagree/Agree | Agree | Strongly Agree |
|---|---|---|---|---|---|
| 14. can assign and grade technology-based projects. | 1 | 2 | 3 | 4 | 5 |
| 15. can keep curricular goals and technology uses in mind when selecting an ideal way to assess student learning. | 1 | 2 | 3 | 4 | 5 |
| 16. can use technology resources to collect and analyze data from student tests and products to improve instructional practices. | 1 | 2 | 3 | 4 | 5 |
| 17. can be comfortable using technology in my teaching. | 1 | 2 | 3 | 4 | 5 |
| 18. can be responsive to students' needs during computer use. | 1 | 2 | 3 | 4 | 5 |
| 19. can continue to improve in my ability to address my students' technology needs. | 1 | 2 | 3 | 4 | 5 |
| 20. can develop creative ways to cope with system constraints (such as budget cuts on technology facilities) and continue to teach effectively with technology. | 1 | 2 | 3 | 4 | 5 |
| 21. can carry out technology-based projects even when I am opposed by skeptical colleagues. | 1 | 2 | 3 | 4 | 5 |

**Part B:** Please provide the following information.

1. I am attending ☐ Infusing Technology Camp I (1st year).
   ☐ Infusing Technology Camp II (2nd year).

2. School in which you taught in 2009-2010: ________________________

3. Grade level(s) you taught in 2009-2010: _____

4. Primary subject(s) you taught in 2009-2010: ______________________

5. Number of years of full-time teaching experience: _____

**Thank you for your time!**

# Grappling's TECHNOLOGY AND LEARNING SPECTRUM

## Technology Literacy Uses

Technology Focus - Learning/Acquiring/Practicing Technology Skills **NOT Curriculum** *

"Just-in-case" technology skills are acquired for possible future needs

- *Literacy classes*
- *Learning hardware and software*
- *Students projects are technology focused rather than expecting standards to intentionally drive the use of technology for learning*
- *Curriculum provides "topics" for technology uses*

Instructional Focus

Technology-centered pedagogy

- *Teacher talk is "technology talk" rather than "learning talk."*

Technology uses are organized for their own sake

- *Acquiring and assessing technical skills*
- *Offered as separate and/or optional experiences/programs*
- *Allowed when "real work" is completed or considered alternative/"reward" activities*
- *Research done to learn tools and processes*
- *Teachers view technology as something to learn or do*

* NOTS Content

Staff Development Focus

Designated "experts" tend to be self-initiating in learning on their own. Other interested staff mostly learn on their own time and own dime.

## Adapting Uses

Technology Focus - Optional/Adaptive Learning Tasks-InformationConsumers *

Integrating is translated into "use it for something, anything…just use it"

- *Drill and practice with content software*
- *Instructional games*
- *Productivity tools used to adapt assignments/tasks given in the past without technology*
- *Curriculum provides "topics" for technology uses*

Instructional Focus

Teacher-centered, Direct Instruction pedagogy

- *Teacher talk is "same stories with new tools" – there is confusion that new tools make new instructional stories.*

Technology uses are adapted/provided but still optional for traditional curriculum goals.

- *Teacher and student roles remain the same*
- *Learning/assessment practices are unchanged*
- *Student experiences depend upon teacher directed assignments*
- *Research is "go look up" and "tell me back" (LOTS)*
- *Teachers view technology as interesting but optional and not necessary to achieve present curriculum goals*

* CLOSED or LOTS Questions

Staff Development Focus

Participation and support while encouraged is still optional as well as unfocused. Staff development funding is inadequate – less than 30% of total technology budget supports staff development.

## Transforming Uses

Technology Focus - Essential -Information Producers *

Integrating is "just-in-time" technology skills as needed for learning tasks /projects

- *Complex learning and thinking tools*
- *Community learning tools*
- *Assessment tools*
- *Productivity tools used to construct meaning, and produce information useful and beneficial to others*

Instructional Focus

Student-centered, constructivist pedagogy

- *Teacher talk is "new stories with new tools."*

Technology uses enable new learning tasks not possible without technology

- *Student roles expand to include explorers, producers of knowledge, communicators and self-directed learners*
- *Teacher roles expand to include facilitators, designers, learners, and researchers*
- *Learning and assessment practices are changed*
- *Students initiate technology uses as they create their own learning experiences*
- *Research is sustained inquiry for original thinking and conclusions useful to others*
- *Teachers view technology as essential for development of higher-order thinking skills (HOTS)*

* OPEN or HOTS Questions

Staff Development Focus

Essential skills and practices are articulated, expected, supported and measured for *all* teachers. Adequate funding of at least 30% of technology budget is in place.

## Appendix C: Panel of Experts to Determine Interrater Reliability

1. Leah Sparks, Program Coordinator for Instructional Technology, WV Center for Professional Development, Charleston, WV

2. Missy Spivy, Mentor, WV Center for Professional Development, Charleston, WV and Assistant Professor, West Virginia University, Parkersburg, WV

3. Nanette Argabrite, Mentor, WV Center for Professional Development, Charleston, WV and Title I Technology Integration Specialist, Cabell County Schools, WV

**Appendix D: Alignment of International Society for Technology Integration's (ISTE) National Educational Standards for Teachers (NETS-T), Computer Technology Integration Survey, and Infusing Technology Professional Development**

| CTI Survey Questions | ISTE NETS-T Standards | Infusing Technology Professional Development |
|---|---|---|
| 1. I feel confident that I understand computer capabilities well enough to maximize them in my classroom.<br><br>4. I feel confident in my ability to evaluate software for teaching and learning.<br><br>5. I feel confident that I can use correct computer technology when directing students' computer use.<br><br>8. I feel confident that I can motivate my students to participate in technology-based projects. | **1. Facilitate and Inspire Student Learning and Creativity.** Teachers use their knowledge of subject matter, teaching and learning, and technology to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments. | • Instructional Strategies<br>• Online Learning Tools<br>• Production Process |
| 2. I feel confident that I have the skills necessary to use the computer for instruction.<br><br>3. I feel confident that I can successfully teach relevant subject content with appropriate use of technology.<br><br>6. I feel confident that I can help students when they have difficulty with the computer.<br><br>7. I feel confident I can effectively monitor students' computer use for project development in my classroom.<br><br>12. I feel confident I can regularly incorporate technology into my lessons, when appropriate to student learning.<br><br>13. I feel confident about selecting appropriate technology for instruction based on curriculum standards | **2. Design and Develop Digital-Age Learning Experiences and Assessments.** Teachers design, develop, and evaluate authentic learning experiences and assessments incorporating contemporary tools and resources to maximize content learning in context and to develop the knowledge, skills, and attitudes identified in the NETS-S. | • Instructional Strategies<br>• Online Learning Tools<br>• Production Process<br>• Software Tutorials<br>• Rubrics |

| CTI Survey Questions | ISTE NETS-T Standards | Infusing Technology Professional Development |
|---|---|---|
| 14. I feel confident about assigning and grading technology-based projects.<br><br>15. I feel confident about keeping curricular goals and technology uses in mind when selecting an ideal way to assess student learning.<br><br>17. I feel confident that I will be comfortable using technology in my teaching. | | |
| 9. I feel confident that I can mentor students in appropriate uses of technology.<br><br>10. I feel confident I can consistently use educational technology in effective ways.<br><br>16. I feel confident about using technology resources to collect and analyze data from student tests and products to improve instructional practices. | **3. Model Digital-Age Work and Learning.** Teachers exhibit knowledge, skills, and work processes representative of an innovative professional in a global and digital society. | • Instructional Strategies<br>• Online Learning Tools<br>• Production Process<br>• Software Tutorial |
| 11. I feel confident I can provide individual feedback to students during technology use.<br><br>18. I feel confident I can be responsive to students' needs during computer use. | **4. Promote and Model Digital Citizenship and Responsibility.** Teachers understand local and global societal issues and responsibilities in an evolving digital culture and exhibit legal and ethical behavior in their professional practice. | • Online Learning Tools<br>• Legal and Ethical Technology Use |

| **CTI Survey Questions** | **ISTE NETS-T Standards** | **Infusing Technology Professional Development** |
|---|---|---|
| 19. I feel confident that, as time goes by, my ability to address my students'technology needs will continue to improve.<br><br>20. I feel confident that I can develop creative ways to cope with system restraints (such as budget cuts on technology facilities) and continue to teach effectively with technology.<br><br>21. I feel confident that I can carry out technology-based projects even when I am opposed by skeptical colleagues. | **5. Engage in Professional Growth and Leadership.** Teachers continuously improve their professional practice, model lifelong learning, and exhibit leadership in their school and professional community by promoting and demonstrating the effective use of digital tools and resources. | • Online Learning Tools<br>• Group Discussion<br>• Software Tutorials |

## Appendix E: Description of the Infusing Technology Professional Development Intervention

The intervention in this study is the Infusing Technology professional development, a program under the Governor's Academy for Teaching Excellence (GATE), sponsored by the West Virginia Center for Professional Development (WVCPD) from the summer of 2009 through the summer of 2010. While teachers made a two year commitment to participate in the professional development training and to sustain school-wide engagement, this study will be limited to the time period specified. Establishing a school-based team learning community as well as an extended learning community through the use of a wiki, participants provided support to one another as they infused technology into their classroom practice to promote 21$^{st}$ century skills to include critical thinking, reasoning, and problem solving skills.

Components of the professional development included modeled best-practice transformational use of technology, hands-on opportunities to gain mastery of technology resources, onsite monthly mentoring, online bi-monthly mentoring, and WebEx conferences as needed. Incentives were provided for implementation to be paid over the two year period. Each school team will receive $8,500 for materials and supplies. In addition, each team teacher will receive a stipend of $2,500 and six hours of graduate credit.

In the summer of 2009, teachers participated in an intensive five days of professional development, referred to as Infusing Technology Camp Phase I, at the West Virginia Center for Professional Development in Charleston, West Virginia. During this training, facilitators guided teachers in technology-infused activities focusing on using technology as a tool to enhance critical thinking, collaborative learning and problem solving skills. The following online learning tools were introduced and were explored by all participants for use in their own classrooms:

- Thinkfinity, a resource with lesson plans and interactives for teaching 21$^{st}$ century skills
- Delicious, a social bookmarking site,
- Wetpaint, a wiki that would be used as the online journal
- ePals, a blog and email that focuses on collaborative learning
- Skype, software that provides free voice and video calling
- WebEx, a web conferencing system using desktop sharing and telephones

Participants were then introduced to Grappling's Technology and Learning Spectrum, an instructional framework outlining three different levels of technology use and its impact on student learning (Porter, 2001). Next, a rationale for using problem based learning (PBL) and the changing role of the 21$^{st}$ century teacher and student was presented. Several instructional techniques were introduced in support of the PBL model. One of which was the creation of a public service announcement (PSA) as a final product represented the learning that occurred as students worked through the various phases of a PBL.

Participants were presented with a PBL scenario in which they worked collaboratively in small groups to investigate and analyze a problem and then provide a solution to the problem to be presented in a one minute PSA video. Just-in-time learning became the theme as participants were provided instruction on each element of the process. Topics included research skills, file management tips, classroom management, conferencing, technical aspects of video production, using rubrics for digital product assessment, and legal and ethical technology issues. Following each day's session, participants reflected on the day's activities in their learning journal created on the Wetpaint wiki. On the final day of the training, the PSAs created by each group were unveiled in celebration of the hard work accomplished through the week.

The final activity was the creation of five team goals for infusing technology into their curriculum once they returned to their classroom in the fall. One required goal was engaging students in project based learning and creating a PSA as a final product to be entered in the WVCPD Public Service Announcement Video Contest in May, 2010. The final product would be judged on technical components, PSA message, content knowledge, social benefit, creativity and originality, and adherence to copyright and fair use laws. The participants chose the final four goals. These goals were posted on each school team's homepage on the wiki. Team teachers were also required to identify materials and technology resources needed to achieve their goals and submit a budget not to exceed $4,000 for the 2009-2010 school year. In the fall of 2010-2011, they would receive an additional $4,000 for materials and software.

In the fall of 2009, team teachers began implementation of the activities used during the Infusing Technology Camp Phase I. Participants were required to describe and reflect upon the activities implemented in their classrooms in their learning journals on the wiki. The following questions were provided to guide responses:

1. Describe the activities/lessons you have used in the last two weeks that directly relate to the summer instruction that you received?
2. Where does the activity/lesson fall on Grappling's Technology and Learning Spectrum? Why?
3. How did the students react/respond to the activity?
4. How does this activity help meet your personal and/or team goals?
5. What did YOU learn by conducting the activity?
6. Did you or your students have any "aha moments"?

Participants also read other participants' journal postings and provided feedback or comments on at least one posting. The online mentor also provided feedback on each participant's journal posting to prompt additional description and reflection.

Onsite mentoring was provided once per month at each school. The mentor met with each participant in flexible grouping arrangements and discussed implementation challenges and possible solutions. In addition to the onsite mentoring, teachers participated in WebEx meetings led by the program director. A monthly implementation schedule was used to guide the participants in meeting team goals with a focus on meeting the goal of each teacher guiding students through PBL with the culmination of a PSA video to submit to the WVCPD Public Service Announcement Video Contest in April, 2010.

In March, 2010, teachers participated in one day of professional development held at the WVCPD in Charleston, West Virginia. Participants shared successes and challenges experienced in implementing technology into their classrooms. School-wide engagement strategies were introduced in preparation for recruiting teachers for year two of the program (West Virginia Center for Professional Development, 2009).

In the spring of 2010, teachers continued implementation of infusing technology activities in their classrooms and provided documentation of their implementation in the online journal. In conjunction with the mentor, the team teachers planned a Showcase IT in which the school staff and parents were invited to view the students' work as a result of teachers participating in the professional development. Each school received a $500 stipend to fund these activities. Participants also recruited four to six teachers to participate in the second year of the program. The participants would act as mentors for the recruited teachers and attend professional development training in the summer of 2010.

In the summer of 2010, both the participating teachers and recruited teachers attended an intensive week of professional development. The participating teachers attended the Infusing Technology Camp Phase II, and the recruited teachers attended the Infusing Technology Camp Phase I, the same training the participating teachers attended in the summer of 2009. Infusing technology activities were implemented by both groups of teachers for the 2010-2011 school year. While teachers would not participate in any additional formal professional development, a mentor continued to provide monthly onsite and bi-monthly online support.

**YVONNE M. SKORETZ**
Skoretz1@marshall.edu

## EDUCATION

Marshall University
**Doctor of Education in Curriculum and Instruction, 2011**
**Education Specialist in Curriculum and Instruction, 2009**

University of Pittsburgh
**Master of Education in Reading Education, 1998**
**Bachelor of Science in Elementary Education, 1990**

## CERTIFICATION

State of West Virginia, Multi-Subjects, K-8, Professional
State of West Virginia, Reading Specialist, K-12, Professional

## PROFESSIONAL EXPERIENCE

2011-present Assistant Professor, Marshall University, South Charleston, WV

2009-present Mentor, Infusing Technology, West Virginia Center for Professional Development, Charleston, WV

2008-2010 Adjunct Instructor, Marshall University, South Charleston, WV

2003-2007 Adjunct Instructor, Appalachian Bible College, Bradley, WV

2001-2004 Adjunct Instructor, Mountain State University, Beckley, WV

1996-2001 Reading Specialist, Raleigh County Schools, Beckley, WV

1995-1996 Teacher, Sto-Rox School District, Pittsburgh, PA

1995-1995 Admissions Representative, Western School of Health & Business, Pittsburgh, PA

1992-1994 Teacher, Lexington #4 School District, Swansea, SC

**PRESENTATIONS/WORKSHOPS**

Skoretz, Y. (2010, October). *Getting Involved.* Marshall University Doctoral Seminar, Charleston,WV.

Skoretz, Y. (2010, August). *Student conferencing.* Session presented for the West Virginia Center for Professional Development's Infusing Technology Professional Development Program, Charleston, WV.

Skoretz, Y., & Cottle, A. (2010, March). *Blogs, wikis, and twitter: Oh my!* Session presented for the West Virginia Center for Professional Development's Beginning Teacher Academy, Charleston, WV.

Skoretz, Y., Singleton, R., & Cottle, A. (2009, October). *Social bookmarking.* Marshall University Doctoral Seminar, Charleston, WV.

Skoretz, Y., & Cottle, A. (2009, August). *Thinkfinity Awareness Session.* Lighthouse Christian Academy, Hurricane, WV.

Skoretz, Y., Downard, D., Irvin, A., & Stephens, A. (2008, September). *Using multimedia to enhance instruction*. Poster session presented at the annual meeting of the West Virginia Higher Education Technology Conference, Morgantown, WV.

Skoretz, Y., Goodman, A., Downard, D., & Cottle, A. (2008, March). *21st century technology: Tools for the classroom.* Marshall University Doctoral Seminar, Charleston, WV.

Skoretz, Y. (2005, November). *Linking assessment and instruction: Improving reading ability.* Workshop presented at Jefferson Christian Academy Teacher's Conference, Bradley, WV.

**PUBLICATIONS**

Allenger, M., Jeffers, C., & Skoretz, Y. (2008, Winter). Book review: Best practices in literacy education (3rd ed.). *The Reading Professor*, *30*(2), 45-47.

Skoretz, Y. (2008, February). Bootstrapping: Help for the struggling reader. *West Virginia Online Action Research Journal.* Retrieved November 8, 2008, from http://www.wvcpd.org/PLAJournal

Skoretz, Y. (2007, Summer). Read to me + three. *West Virginia Early Childhood Provider Quarterly*, *8*(3), 24-25.

Skoretz, Y., & Cottle, A. (2011). Meeting ISTE competencies with a problem-based video framework. *Society for Information Technology and Teacher Education International Conference Proceedings(SITE).*