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First-Year Secondary Teachers' Perceptions of Their Preparedness to Integrate 21st Century Skills into the Technology-Rich Classroom

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First-Year Secondary Teachers' Perceptions of Their Preparedness to Integrate 21st Century Skills into the Technology-Rich Classroom

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University

by

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List of Abbreviations

CAEP	Council for the Accreditation of Educator Preparation
ICT	Information and Communication Technology
IT	Instructional Technology
NCATE	National Council for Accreditation of Teacher Education
SACS	Southern Association of Colleges and Schools
TEAC	Teacher Education Accreditation Council
TIP-C	Teaching Innovation Progression Chart
TPCK	Technological Pedagogical Content Knowledge

Abstract

FIRST-YEAR SECONDARY TEACHERS' PERCEPTIONS OF THEIR PREPAREDNESS TO INTEGRATE 21ST CENTURY SKILLS INTO THE TECHNOLOGY-RICH CLASSROOM

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School districts continue to integrate emerging technologies and expectations for 21st century teaching and learning. This movement began with release of Goals 2000 (1994) and has continued through National Education Technology Plan (2010) that noted the "challenge for our education system is to leverage technology to create relevant learning experiences that mirror students' daily lives and the reality of their futures." In order to meet that challenge, schools must enlist teachers who are prepared to teach 21st century skills in the technology-rich classroom. Teacher education programs also need to align their preparation models to prepare teachers for that challenge. There are a variety of models – stand-alone instructional technology courses, online courses, content methods courses, practicum and student teaching experiences –

used to achieve this. Several grant programs provided financial support in the early 21st century to help institutions implement new models of instruction for preservice teachers. Also, several frameworks emerged to guide classroom instruction as teachers implemented 21st century skills into technology-rich classrooms. The purpose of the current study was to understand teachers' perceptions of their preparedness to teach 21st century skills in the technology-rich classroom. The study was driven by research questions which sought to understand (a) teacher preparation models in the areas of technological, pedagogical, and content knowledge, (b) teachers' perceptions of their teacher education programs effectiveness for teaching 21st century skills in the technology-rich classroom, (c) teachers' feelings of efficacy and self-confidence for first-year implementation, and (d) if relationships exist between particular teacher preparation models and teachers' perceptions of effectiveness and adequacy. A mixed method design was used to explore the research questions. Twenty-nine first-year high school teachers in a technology-rich school district with a framework for 21st century skills integration participated in a survey. Six teachers participated in follow-up focus groups at the end of their first-year of teaching. The researcher used quantitative analysis for the survey and qualitative coding for the focus group interviews. The two analyses were reported together to develop findings in response to the research questions.

Chapter 1. Introduction

In 1994 the United States Congress enacted *Goals 2000*, educational legislation to meet the needs of the 21st century citizenry. One of the goals (House of Representatives 103d, 1994) stated that "the nation's teaching force will have access to programs for the continued improvement of their professional skills and the opportunity to acquire the knowledge and skills needed to instruct and prepare all American students for the next (21st) century." This goal spoke to the need for appropriate professional development for existing teachers, as well as, the need for appropriate preparation for the pre-service teacher. Since 1994 a great deal has changed on the educational landscape including, but not limited to, the incorporation of new technologies in the classroom.

Prior to *Goals 2000*, classroom technologies meant chalk, textbooks, overhead projectors, VCRs and a single desktop computer. Currently, technology has expanded to one-to-one laptops, tablets, handheld devices, interactive whiteboards, BYOD (Bring your own device), and web-based applications. Because of this expansion, the US Department of Education released the *National Education Technology Plan* in 2010. It stated that "the challenge for our education system is to leverage technology to create relevant learning experiences that mirror students' daily lives and the reality of their futures". Over the last two decades, the changes of the educational landscape with respect to technology and outcomes have sparked the need for a paradigm shift in pre-service teacher preparation.

In order to prepare teachers for technology integration, several new components of teacher preparation emerged: stand-alone instructional technology (IT) courses, student teaching/mentoring opportunities, methods-infused courses, and faculty training. The US Department provided this recommendation.

> All institutions involved in preparing educators should provide technology-supported learning experiences that promote and enable the use of technology to improve learning, assessment, and instructional practices. This will require colleges of education and postsecondary institutions generally to draw from advances in learning science and technology to change what and how they teach when they prepare teachers, keeping in mind that everything we now know about how people learn applies to new teachers as well. (US Department of Education, 2010, p. 44)

Recent experience in hiring first-year teachers has shown that there is a wide variety of teacher preparation with respect to technology integration as a tool for 21st century teaching and learning. As school districts work within their professional development programs to move existing teachers toward 21st century teaching and learning, similarly, pre-service teacher education programs should be poised to graduate students who can move seamlessly into districts utilizing technology as an instructional tool. More specifically, as school districts with one-to-one laptop initiatives, work to hire new teachers, they face a unique need for teachers prepared to teach in the technology-rich classroom.

One urban/suburban school district utilizes a Teacher Innovation Progression-Chart (TIP-C) with four instructional components to guide instructional practices for the 21st century classroom. The four basic components for teaching and learning in this district are: Research

and Information Fluency, Collaboration and Communication, Creativity and Innovation, and Critical Thinking and Problem Solving. The components of the TIP-chart are based on the Technological Pedagogical Content Knowledge (TPCK) framework (Figure 1) developed by Mishra and Koehler (2006). The basic tenets included Technological Knowledge (TK), Pedagogical Knowledge (PK) and Content Knowledge (CK). According to Mishra and Koehler (2006), Content Knowledge (CK) is the "teachers' knowledge about the subject matter to be learned or taught." Pedagogical Knowledge (PK) is a "teachers' deep knowledge about the processes and practices or methods of teaching and learning." Technology Knowledge (TK) encompasses "certain ways of thinking about, and working with technology, tools and resources" These components can be combined into dual knowledges – Pedagogical Content (PCK), Technological Content (TCK) and "Technological Pedagogical (TPK). The ultimate confluence of these three knowledge bases (TK, PK and CK) formed the TPCK model (Figure 1) for delivering instruction in the technology-rich classroom. In turn, university schools of education have begun to align their content and curriculum to meet the needs of the 21st century, technology-rich classroom.

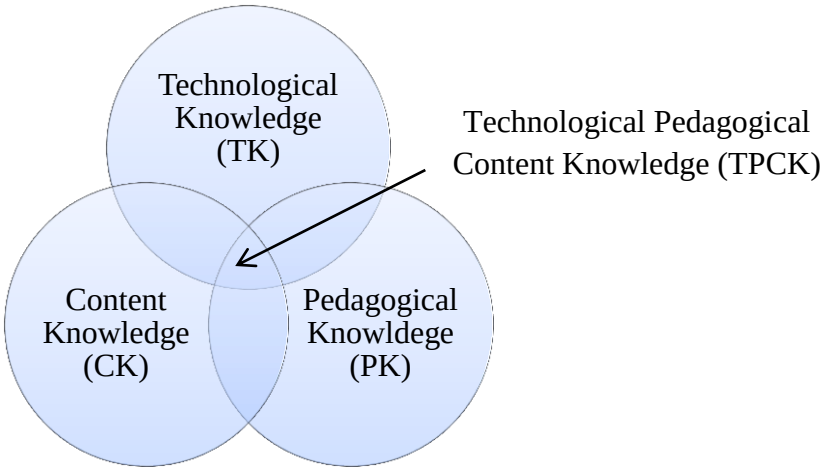

Figure 1. Mishra and Koehler's Technological Pedagogical Content Framework (2006)

Overview of the Study

This study serves to determine the preparedness and confidence of first-year teachers to teach 21st century skills in a technology-rich secondary classroom with a one-to-one laptop initiative. It also provides information about accredited pre-service teacher education programs to prepare teachers to teach 21st century skills. This study considers first-year, core-curriculum high school teachers in a large urban/suburban school district. Teachers describe their pre-service teacher education programs and their curriculum offerings, either stand–alone technology courses, student-teaching programs or courses that fused technology, pedagogy and content. Further, the study examines the teacher education program and its alignment with the TIP-C framework developed by a school division with a one-to-one laptop initiative. Finally, it reviews which model of teacher preparation provides greatest confidence for the first-year teacher working in the technology-rich classroom.

Overview of the Literature

Understanding that technology has become a growing component of the educational process, it is important to ensure teachers are prepared for its effective use in the classroom. As a result, several organizations have established frameworks for instruction and professional development around technology-rich learning environments. These organizations include the International Society for Technology in Education (ISTE), Partnership for 21st Century Skills (P21) and Henrico 21 (H21).

Even with these established frameworks for technology integration, there is a great deal of variation in practice. This occurs among schools nationally, between local school districts, and even within individual schools. And while more schools and districts have moved to technology-rich environments, the instructional practices within those schools and districts have

not fully incorporated technology as a tool for teaching 21st century skills. Certainly, there is evidence of pockets of excellence, as noted in the H21 awards program, but the research shows that there are many barriers to technology integration. One of those barriers to greater levels of technology integration is pre-service teacher education programs. Therefore, it is important to study how teachers are prepared and how well they believe they are prepared to teach in technology-rich environments.

Due to the relatively new phenomenon of technology-rich secondary classrooms, the research on pre-service teacher programs and their impact on 21st century skills' teaching and learning is limited, but has increased over the last decade. Several studies focus on barriers to technology integration in the classroom. Several other studies focus on the coursework in teacher education programs as it relates to instructional technology. One study "investigated major course changes in … stand-alone educational technology courses redesigned around 21st century skill sets as opposed to technical skill development" (Lambert and Gong, 2010, p. 54). The results of Lambert's study showed that teachers were more comfortable infusing technology into the classroom when it is part of the content and pedagogy, not just stand-alone technology.

In another analysis, Chan and vanAlstat (2006) created a framework for teacher education programs that not only used technology, but also incorporated the collaborative and communication component, that are championed by The Partnership for 21st Century Skills (2010). The Partnership for 21st Century Skills (P21) is a "national organization that advocates for 21st century readiness for every student." It utilizes the TPCK framework developed by Mishra and Koehler (2006), and promotes the fusion of core curriculum with the 4Cs of critical thinking and problem solving, communication, collaboration, and creativity and innovation.

There also appears to be a variety of resources for teacher education programs to assist in the development of curriculum around 21st century teaching and learning (Jones, 2002). Cohen, Brody and Sapon-Shevin (2004) and Griffin (2002) have all compiled anthologies dedicated to teacher education programs. In each of the anthologies, the authors provide curriculum and resources for colleges and universities to use with pre-service teachers.

There is a greater volume of information analyzing professional development practices of practicing teachers and school districts as they relate to infusing 21st century skills into the classroom. Both Tullis (2010) and Golston (2008) studied the work of schools in Tucson, Arizona. In the Catalina Foothills School District (CFSD), administration has re-structured content to "focus curriculum on 21st Century Skills" (Tullis, 2010, p.26). Another example is the work of Bell (2010) and Bellanca (2010) who provide resources for current practitioners for incorporating 21st century skills into their classrooms. Bell provides a framework for project-based learning, while Bellanca creates resources for collaborative and enriched learning projects.

There are several studies that researched pre-service teacher education programs and the incorporation of technology in classroom instruction. Dutt-Doner, Allen and Corcoran (2008) conducted a study that looked at digital learners that enrolled in teacher pre-service programs. This case study identified specific strategies in pre-service courses that used technology for learning, not just simply as a tool for management. This study used the T-PCK model as the foundation for the evaluation. Polly and Moore (2008) did an extensive review of America's schools, colleges and departments of educations (SDCEs) to hold a "critical lens up to the current status of technology integration" (p. 17).

From this very cursory review of the literature, it appears that there is a good deal of evaluation and information related to classroom teachers' use of both technology as a classroom

tool and teaching and learning utilizing 21st century skills, such as the TPCK model. In addition, there is guidance on how teacher education programs may include use of 21st century skills in their curriculum. Studies are beginning to emerge that evaluate schools of education and their integration of the TPCK and similar models into the curriculum. There is not a study that correlates the instructional needs and expectations of technology-infused secondary public schools and the preparation of pre-service teachers.

Rationale for the Study

There are several reasons for research on this topic. From an outcome-based perspective, in 1999, the U.S. Departments of Commerce, Education, and Labor, in conjunction with the National Institute of Literacy and Small Business Administration, developed a review of workplace preparedness in the 21st century. In its report *21st Century Skills for 21st Century Jobs* (1999), these governmental agencies noted that technology skills (21%) and communications/quality (13%) were the job skills most often required for workplace competence.

This basic working definition of 21st century skills must be translated to the educational setting. The Partnership for 21st Century Skills (P21) developed the common standard for educators. This organization is a consortium founded in 2002 with partners including the U.S. Department of Education, several technology and communications companies and the National Education Association. By 2015, the mission of P21 was "to serve as catalyst for 21st century learning to build collaborative partnerships among education, business, community and government leaders so that all learners acquire the knowledge and skills they need to thrive in a world where change is constant and learning never stops." In addition to core content competencies, P21 promotes four C's: Creativity; Critical Thinking, Communication, and

Collaboration. Another similar standard was promoted at the World Conference on Educational Sciences. According to Sahin (2009), 21st century "learning skills can be summarized under three main subtitles: information and communication skills, thinking and problem-solving skills, interpersonal and self-directional skills" (p. 1460).

Table 1

The ISTE Standards•Students (formerly known as NETS•S)

Performance Indicator	Description of Competency	Student Outcomes
Creativity and Innovation	Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology	a. apply existing knowledge to generate new ideas, products, or processes b. create original works as a means of personal or group expression c. use models and simulations to explore complex systems and issues d. identify trends and forecast possibilities
Communication and Collaboration	Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.	a. interact, collaborate, and publish with peers, experts, or others employing a variety of digital environments and media b. communicate information and ideas effectively to multiple audiences using a variety of media and formats c. develop cultural understanding and global awareness by engaging with learners of other cultures d. contribute to project teams to produce original works or solve problems
Research and Information Fluency	Students apply digital tools to gather, evaluate, and use information	a. plan strategies to guide inquiry b. locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media c. evaluate and select information sources and digital tools based on the appropriateness to specific tasks d. process data and report results
Critical Thinking, Problem Solving, and Decision Making	Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources	a. identify and define authentic problems and significant questions for investigation b. plan and manage activities to develop a solution or complete a project c. collect and analyze data to identify solutions and/or make informed decisions d. use multiple processes and diverse perspectives to explore alternative solutions
Digital Citizenship	Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior	a. advocate and practice safe, legal, and responsible use of information and technology b. exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity c. demonstrate personal responsibility for lifelong learning d. exhibit leadership for digital citizenship
Technology Operations and Concepts	Students demonstrate a sound understanding of technology concepts, systems, and operations.	a. understand and use technology systems b. select and use applications effectively and productively c. troubleshoot systems and applications d. transfer current knowledge to learning of new technologies

From an educational technology perspective, the International Society for Technology in Education (ISTE) created the ISTE Standards (formerly known as NETS, National Educational Technology Standards). The mission of ISTE has evolved from a focus to advance "excellence in learning and teaching through innovative and effective uses of technology" to "empower learners to flourish in a connected world by cultivating a passionate professional learning community, linking educators and partners, leveraging knowledge and expertise, advocating for strategic policies, and continually improving learning and teaching" (2010). ISTE has created five separate sets of standards -- for students, teachers, administrators, coaches and computer science educators. These standards are used by school districts and teacher education programs to guide practices for teaching and learning. Table 1 illustrates the current ISTE standards for student learning by creating performance indicators and core competencies in six areas.

Now that several standards for 21st century skills and instructional technology-integration have been established, there is a need to understand better the effectiveness of teacher pre-service programs. This study includes several components, including an analysis of the confidence of the first-year teacher in a technology-rich classroom utilizing 21st century teaching and learning methods.

Purpose for the Study / Statement of the Problem

There is a great deal of emphasis on preparing students for the 21st century workforce. To insure the preparation of the 21st century workforce, educational institutions must adequately prepare students. In turn, pre-service teacher programs must prepare teachers to use 21st century teaching and learning in the technology-rich classroom. The purpose of this study is to understand the effectiveness of teacher pre-service programs for preparing teachers to teach 21st

century skills in technology-rich public high school classrooms containing a one-to-one laptop to student ratio in a mid-Atlantic state.

The analysis demonstrates which types of teacher preparation activities are meeting the needs of school districts that are working to infuse 21st century teaching and learning skills into their technology-rich classrooms. It also shows school districts which types of teacher education programs best align with their hiring needs.

Research Questions

Since the purpose of this study is to gauge first-year secondary teachers' perceptions of their preparedness for technology-rich classrooms, as well as determine relationships between their perceptions and type of preparation programs, the following research questions will guide this mixed-methods study:

1. What types of teacher preparation models did participants experience in terms of:
    a. technological knowledge
    b. content knowledge
    c. pedagogical knowledge
2. What are participants' perceptions concerning their pre-service teacher education programs regarding:
    a. effectiveness to prepare them for teaching 21st century skills in technology-rich high school classrooms containing a one-to-one laptop to student ratio
    b. facilitating feelings of efficacy and self-confidence for first-year implementation
3. Do relationships exist between teacher preparation models and teacher perceptions of effectiveness and adequacy? If so, what are they? And what are the implications of these findings?

Overview of Methods

This is a mixed method approach study of first-year high school teachers in a school district with technology-rich classrooms and a one-to-one laptop initiative. Subjects are zero-years' experience teachers in core curriculum (math, English, science, social studies, and world languages) who graduated from a SACS-, CAEP-, NCATE- or TEAC-accredited teacher education program in a mid-Atlantic state. The study is based largely on qualitative research methods; however, it includes quantitative data collection to gain numerical and qualifying data on the sample population.

Data collection included a survey with statistical analysis and subject interviews with theme identification. Subjects for the initial survey included all teachers with zero-years' experience in high schools in a single school district with a one-to-one laptop to student ratio. Survey data was collected during the spring of 2015 during the teachers' first year of teaching. Once all survey data was collected, it was analyzed to determine which subjects met the additional criteria for participation in focus groups. The non-descriptive data in the survey for the selected subjects was tabulated and reported.

The quantitative data collection was followed by qualitative focus groups utilizing open-ended questions based on an IRB-approved protocol. The questions were administered in the same order for each focus group. The focus group data was transcribed and entered into Dedoose 6.2.10, using a web-based, Computer Assisted Qualitative Data Analysis Software (CAQDAS) to identify emerging themes.

Definition of Terms

21st century skills. Broad term describing the skills preparing the citizenry for the 21st century workplace. Most working definitions of these skills utilize technology as a tool in the

areas of communication/collaboration, information acquisition/research, productivity/problem solving, creativity/innovation, and human/political/social global impact.

CAEP. Council for the Accreditation of Educator Preparation**.** In 2013, CAEP became fully operational as sole accrediting body for educator preparation providers due to the merger of NCATE and TEAC. Until 2016, they allow accreditation under legacy NCATE and TEAC standards.

***NCATE*.** The National Council for Accreditation of Teacher Education. Founded in 1954, the U.S. Department of Education recognized NCATE as a professional accrediting body for colleges and universities that prepare teachers and other professional personnel for work in elementary and secondary schools. After 2016, schools, programs and departments of education will be accredited by CAEP.

***One-to-one laptop initiative*.** Instructional programs that provide or utilize one laptop computer for each student.

Pre-service teacher. A student enrolled in an education-degree program that is taking courses and/or participating in an internship.

SACS. Southern Association of Colleges and Schools. This is the regional body for the accreditation of degree-granting higher education institutions in the Southern states. It serves as the common denominator of shared values and practices among the diverse institutions approved by the Commission on Colleges that award associate, baccalaureate, master's, or doctoral degrees.

TEAC. Teacher Education Accreditation Council. Founded in 1997, TEAC was a nonprofit organization dedicated to improving academic degree programs for professional educators, those who will teach and lead in schools, pre-K through grade 12. Through 2016,

TEAC is recognized by the Council for Higher Education Accreditation and by the U.S. Department of Education.

Teacher education program. Program of study at the bachelor's degree level or above designed to provide a pathway to teacher preparation and/or licensure. Also may be referred to as a teacher preparation program.

Teacher preparation model. Individual courses or practical experiences, usually part of a broader teacher education program, designed to provide foundational, psychological, technological, pedagogical, or content knowledge in preparation for teaching.

Technology-rich classroom. A classroom equipped with a variety of technology tools. These tools may include personal computers (desktop, laptop, tablet), projection devices (LCD projectors, interactive whiteboards), software, printers, wireless-internet connections, hand-held devices, or other emerging technologies.

TIP-C. Teaching Innovation Progression Chart. This is the standard for teaching and learning in a mid-Atlantic school division with a one-to-one laptop initiative.

TPCK. Technological Pedagogical Content Knowledge. Based on the work of Mishra and Koehler (2006), this instructional delivery method infuses the three types of knowledge rather teaching each component in isolation.

Chapter 2. Literature Review

According to Ravitch and Riggan (2012), the literature review allows the researcher to "(1) understand the conversation already happening; (2) figure out how to add to this conversation; and (3) identify the best means of doing so theoretically and methodologically" (p. 25). The conversation happening in the literature on teacher education programs' incorporation of technology strategies and 21st century teaching and learning skills has grown significantly since the turn of the century. Much of this is due in part to the recent growth in technology-rich classrooms and the discussion of what defines 21st century teaching and learning skills. As that discussion has taken shape, the next step is to address how those strategies are being disseminated into best practices for classroom teachers. To have a greater understanding of teacher education programs' ability to prepare for teaching and learning using 21st century technology and skills, there must be an understanding of the history of the formation of the 21st century skill set. Once the historical setting is established, a review of the literature examines why it is important to teach 21st century skills in the technology-rich environment. The literature review further examines instructional practice and theory, as well as, teacher preparation practices using 21st century skills and instructional technology. The review of the literature concludes with an examination of the level of integration of these skills by the first-year teacher.

Methodology

There were four main foci for identifying the literature relevant to the study. The first focus was the identification of 21st century skills. This search involved a review of government

reports and legislation about the need for 21st century skill sets that, in turn, sparked the need for a change in classroom instruction.

The second focus involved the development of educational theory and best practices for teaching and learning using 21st century skills in the classroom. Beginning with a search for 'teaching with technology,' over 8130 articles were located. However, by limiting the search to scholarly, adolescent studies, only 15 articles met the restricted criteria. Of the 15 articles, only three were found to be useful studies for review. In addition, the credits of a textbook on the subject of technological pedagogical content knowledge (TPCK) yielded several authors of studies to review.

A third focus was on the development of the technology-rich classroom. More specifically, there was a review of implementation practices among schools and within individual schools. The search also included a review of digital equity in education resulting in 59 articles, but only six were relevant to the secondary classroom. An additional search incorporating one-to-one laptops yielded four articles, but only two were peer-reviewed.

The next review of literature was based on pre-service teacher education programs and their incorporation of technology and 21st century skills in the classroom. The results of the search yielded 18 studies with 14 providing scholarly reviews of studies. In order to ensure the usability of the identified studies, each study was vetted by identifying appropriate sample sizes (N), data collection methods, instrumentation reliability and validity, and limitations. If studies had limitations that were not identified by the researchers, those limitations are included in the evaluation and review of the study.

The final review of the literature was based on first-year teachers' use of 21st century skills in the classroom. The number of studies in this category was more limited, but each study was vetted in a similar fashion as the previous two categories of research.

A History of 21st Century Skills

In the late 20th century, there were several major educational reports and legislation that charted the status and future of the American educational system. Most influential and recognizable among those were *A Nation at Risk* (National Commission on Excellence in Education, 1983) and *Goals 2000* (HR 103d, 1994). During the same time period, other governmental agencies began to look at workplace readiness of high school graduates. These studies and reports became the foundation for the development of a 21st century skill set for American students entering the workplace.

In June, 1991, the U. S. Department of Labor issued the report *What Work Requires of Schools*. It was more popularly known as *The Secretary's Commission on Achieving Necessary Skills* (SCANS). The SCANS report compiled information from business owners, public employers, unions and workers and supervisors. Using those resources, in addition to reporting from six panels, the commission recognized that students needed a specific skill set in order to find success in the workplace in the 21st century. The SCANS report provided three major conclusions.

The first conclusion was that "all American high school students must develop a new set of competencies and foundation skills if they are to enjoy a productive, full and satisfying life" (U. S Department of Labor, 1991, p. *i*). The report defined the competencies and foundational skills needed as the workforce moved toward the 21st century. The competencies rest on a three-part foundation of basic skills, thinking skills, and personal qualities. These competencies

included resources, interpersonal, information, systems and technology, likely serving as a foundation for future standards such as ISTE, shown in Table 2.

The second conclusion was that "the qualities that today characterize our most competitive companies must become the standard for the vast majority of our companies, large and small, local and global" (U. S Department of Labor, 1991, p. *ii*). This conclusion focused on the decision-making skills, personal responsibility and the investment made by workers. It also spoke to the use of technology and complex systems as they impact the efficiency of the workplace.

The final conclusion was that "the nation's schools must be transformed into high performance organizations in their own right" (U. S Department of Labor, 1991, p. *ii*). The report noted that reforms initiated after *A Nation at Risk* have been unsuccessful. The report created a framework with characteristics for "schools of tomorrow." The characteristics in schools for tomorrow included instructional strategies (thinking skills and assessment), learning environment (problem solving and contextual skills), management (learner-centered) and outcomes for all students.

Then in 1999, the U. S. Departments of Commerce, Education, and Labor, in conjunction with the National Institute of Literacy and Small Business Administration, developed a review of workplace preparedness in the 21st century. Their report, *21st Century Skills for 21st Century Jobs* (1999), noted that technology skills (21%) and communications / quality (13%) were the job skills most often required for workplace competence. The findings were much like the competencies reflected in the SCANS report. However, in this latter report, technology was emerging as a critical component for workplace readiness.

In 2002, the Partnership for 21st Century Skills (2010) began the development of standards that are now the preeminent working, but evolving definition of a skill set for teaching and learning 21st century skills. This organization is a consortium of partners including the U.S. Department of Education, several technology and communications companies and the National Education Association. In addition to core content competencies, the Partnership for 21st Century Skills promotes four C's: (a) critical thinking and problem solving; (b) communications; (c) collaboration; and (d) creativity and innovation (Table 2).

In 2006, New Directions for Youth Development published a series of articles by leading technology and educational corporations. These articles address the need for workplace readiness from a variety of angles. Much of the information was based on early models by the Partnership for 21st Century Skills. From a business perspective, Levy and Murnane (2006) noted that there were two types of skills needed for workers: expert thinking (the ability to solve new problems that cannot be solved by applying rules) and complex communication (ability to not only transmit information, but to convey a particular interpretation of information to others in jobs like teaching, selling, and negotiation). These skills align with the critical thinking and communication skills described by the Partnership for 21st Century Skills.

From the perspective of the public sector, Sacconaghi (2006) noted that Americans believe "that students today need a 'basics-plus' education: not only competency in the basics of reading, writing and mathematics, but also a package of skills different from those needed ten to twenty years ago to survey in school and in life" (p.40). This mirrors the Partnership for 21st Century Skills foundational model partnered with 21st century competencies.

In 2006, the International Society for Technology in Education (Table 2) established six National Educational Technology Standards (NETS). While the NETS standards, now called

ISTE standards, are focused on technology, they parallel many of the 21st century skills promoted by other entities. The ISTE standards show how technology is a critical tool in development and practice of 21st century skills in the classroom. The ISTE Standards have expanded beyond student learning to include standards for teachers, administrators, coaches and computer science educators. In addition, these standards were incorporated into the accreditation criteria for CAEP, the Council for Accreditation of Educator Preparation (formerly NCATE and TEAC). The standards are used for the preparation of technology directors, tech coaches and computer science educators. They support CAEP's mission "to advance excellence in educator preparation through evidence-based accreditation that assures quality and continuous improvement to strengthen PK-12 student learning" (CAEP, 2015).

In 2007, an urban-suburban school district in the mid-Atlantic finalized a Teaching Innovation Progression-Chart (TIP-Chart) to be used by teachers. The district has technology-rich classrooms with a one-to-one laptop ratio in all secondary schools. This chart (Appendix A) provides guidance for instructional practices and professional development in four areas of 21st century teaching and learning. "The Teaching Innovation Progression Chart helps provide teachers with a structure for self-reflection and growth. It is designed to encourage conversation around 21st Century learning and assess progress to meet the goal of full integration of a 21st Century classroom" (H21, 2014). It was constructed with the Partnership for 21st Century Skills as the core framework. However, the thematic concepts outlined in Table 2 show that the competencies contained in the TIP-Chart overlap many of the competencies from the literature.

In 2009, the Association for Curriculum and Development (ASCD) devoted an entire volume of *Educational Leadership* to "Teaching for the 21st Century" (ASCD, 2009). As the leading professional society for both teachers and school administrators, ASCD brightly shone

the light on strategies and best practices for 21st century teaching learning. The volume was punctuated by an overview of the 21st century skills movement by then chair for the Partnership for 21st Century Skills, Paige Johnson (2009).

Table 2

Thematic Summary of Major 21st Century Skills' Competencies

	SCANS 1991	Partnership for 21st Century Skills 2002	New Directions for Youth Development 2006	ISTE (NETS) 2006	H21 - Teaching Innovation Progression Chart 2007
Core Competencies		Core Subjects Contextual Learning Skills		Basic Operations and Concepts (technology)	
Communication and Collaboration	Interpersonal: Works with Others	Communication skills Collaboration skills	Complex Communication (ability to convey interpretations of information)	Communications Tools	Collaboration and Communication
Information Acquisition and Research	Information: Acquires and uses information Resources: Identifies, organizes, plans, and allocates resources	Information and media literacy skills		Research Tools Problem-solving and Decision-making Tools	Research and Information Fluency
Productivity and Problem Solving	Systems: Understands complex inter-relationships	Critical-thinking and problem-solving skills	Expert thinking (ability to solve problems not by applying rules)	Productivity Tools	Problem Solving and Critical Thinking
Creativity and Innovation	Technology: works with a variety of technologies	Creativity and innovation skills			Creativity and Innovation
Human, Social, Political, Global Impact		Global Awareness Financial, economic, business and entrepreneurial literacy Health and wellness awareness Civic literacy		Social, ethical, and human issues	

Table 2 provides an overview of the major movements for defining 21st century skills and workplace readiness for students. It shows an overlap of competencies that set the standard for

teaching and learning with 21st century skills. These organizations and their frameworks for 21st century skills have established a benchmark that remains current despite significant emerging technologies since 2007.

Rationale for Using Technology for 21st Century Teaching and Learning

There is a base of literature to support the growing use of technology as an educational tool for teaching and learning 21st century skills. These studies show that the use of technology provides a positive effect on student learning, as well as, exposes students to components of the 21st century skill set needed for the workplace.

As early as 2002, Norris, Soloway, and Sullivan conducted a "snapshot survey" in four states with 4000 teachers. The teachers surveyed reported that "computing technology has a positive effect on learning and teaching in the primary and secondary grades." However, the teachers reported several barriers to using technology. From a school district's infrastructure lens, the teachers noted a lack of sufficient access to technology, a lack of adequate teacher preparation, and a lack of support from administration. From an instructional lens, the teachers identified a lack of effective curriculum and relevant assessment as additional barriers. As a result of this snapshot survey, Norris et al. (2002) recommended that institutions look at hand-held technology as a way to provide technology access for all students, thus eliminating the front-line barrier to technology use.

Boon, Burke, Fore and Spencer (2006) examined the effects of using technology-based cognitive organizers versus traditional textbook instruction on social studies learning. The study utilized a quantitative pre-test and post-test study of the interventions in two inclusive classrooms. One classroom used a cognitive organizer using Inspriation6 software. The other

classroom used the materials provided with the adopted textbook. Boon et al. (2006) analyzed the pre-test using ANOVA to determine group equivalence prior to instruction.

After the intervention, Boon et al. (2006) found that "students in the cognitive organizer condition performed significantly better than student in the traditional textbook instruction condition from pretest to posttest" (p.5). These results support the idea that technology as a 21st century teaching and learning tool promotes student learning. However, there was not a discussion of a potential limitation. The software utilized a cognitive organizer. It is unclear if there was a traditional paper cognitive organizer used by the control group using simply textbook ancillary materials. If there was not a similar non-technology based cognitive organizer, it cannot be determined whether the effective intervention was the use of technology or the use of an organizer. In either case, the use of an organizer reflects the use of a 21st century skill (productivity and problem-solving) noted in Table 2.

In their study on transition-planning activities for exceptional education students, Izzo, Yurick, Nagaraja, and Novak (2010) conducted a quantitative study of exceptional education students to understand the effectiveness of using instructional technology (IT) software. In the study, Izzo et al. (2010) used several instruments with 287 students, 119 of which were students with disabilities, from 15 schools. The instruments used were an information technology Literacy Survey (pre-test / post-test), the Ohio State University Career Survey and the AIMSweb Maze Reading Assessment. An experimental group of teachers was trained on the intervention, the IT software's purpose and use. The researchers conducted fidelity observations of the intervention sites to insure adherence to protocol.

After controlling for the covariates, Izzo et al. (2010) found that 42% of the change in the data set could be attributed the independent variable (IT software) and the effect was significant.

Regardless of school setting, "experimental students continue to have greater gains in IT literacy than control students" (Izzo et al., 2010, p. 95). However, the schools selected for the study were identified through participation in technology conferences. There is a limitation, in that the schools already had a predisposition toward the potential for positive effects of technology.

In addition to the positive effects of using technology as for planning transition actives, Izzo et al. (2010) also found that "these 21st century skills (internet organization, use of a website, proficiency in using a course management system, submitting work electronically) are essential in many college and job settings" (p. 102). The students were using a tool that enhanced their learning as well as provided an opportunity to work with the 21st century skill set.

Theoretical Framework for Teaching with Technology

In 1987, Shulman created a framework for effective instructional practice. Prior to Shulman, teachers were trained in content (C), or knowledge about the subject matter to be learned. As teacher preparation evolved, teachers were also trained in pedagogy (P), or "deep knowledge about the processes and practices or methods of teaching and learning and how it encompasses among other things, overall educational purposes, values, and aims" (Mishra & Koehler, 2006, p. 1026). Shulman felt that for the best instruction, teachers needed to combine the two domains of pedagogical knowledge (PK) and content knowledge (CK). Where those two domains overlapped, it created a pedagogical content knowledge (PCK). In Shulman's (1987) view, "pedagogical content knowledge is the category most likely to distinguish the understanding of the content specialist from that of the pedagogue" (p. 8). Shulman's groundbreaking framework for effective instructional practices was further adapted for the 21st century classroom.

In 2006, Mishra and Koehler developed the seminal framework for 21st century teaching and learning by incorporating technology into Shulman's framework (Figure 1). Mishra and Koehler conducted a design experiment based on the understanding that traditional teacher education focused Shulman's (1987) intersection of the content and pedagogy known as PCK. This blends "content and pedagogy into an understanding of how particular aspects of subject matter are organized, adapted, and represented for instruction" (Mishra & Koehler, 2006). In addition, PCK allows teachers to know what teaching strategies best fit the content.

Mishra and Koehler (2006) proposed the new circle, technological knowledge (TK). TK is "knowledge about standard technologies (books, chalk, blackboard) and more advanced technologies (internet and digital video) …and the skills required to operate particular technologies" (p. 1027). In addition, Mishra and Koehler defined how technological knowledge interacted with content knowledge (TCK) and pedagogical knowledge (TPK). TCK is the knowledge of the "manner in which the subject matter can be changed by the application of the technology" (Mishra & Koehler, 2006, p. 1028). Whereas TPK is the "knowledge of the existence, components and capabilities of various technologies as they are used in teaching and learning settings … and how teaching might change as the result of using particular technologies" (Mishra & Koehler, 2006, p. 1028). By combining all three knowledge components -- technology, pedagogy and content -- there is a new framework, TPCK, for instructional practices using 21st century skills (Figure 1).

Effective use of TPCK is not just the knowledge of the three components, but the effective implementation and integration of the three components. According to Mishra and Koehler (2006),

> TPCK is the basis of good teaching with technology and requires an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to lea rn and how technology can help redress some of the problems that students face; knowledge of students' prior knowledge and theories of epistemology; and knowledge of how technologies can be used to build on existing knowledge and to develop new epistemologies or strengthen old ones (p. 1029).

It is this critical connection between the three knowledges that impact 21st century student learning.

There are several ways to define what TPCK looks like in a secondary classroom. According to Silverman's *Handbook of Technological Pedagogical Content Knowledge (TPCK) for Educators* (2008), technology mediated instruction (TMI) must be clearly defined. Due to the rapid rate of change with technology, teachers must be prepared to integrate technology with solid pedagogy for effective instruction of the content. According to Silverman (2008), "teachers with high levels of TPCK possess not only general technology skills, but also knowledge about the types and specific uses of technology that are most likely to facilitate teaching and learning in each subject" (p. 76). There are also some ineffective TPCK strategies such as drill and practice and using technology as a reward in the classroom. In addition, teachers must avoid "defensive teaching and learning" where the teacher controls all parts for the lesson thus stifling a student's inquisitiveness and motivation or the intended learning. Teachers must find the appropriate balance between the three knowledges to provide solid 21st century teaching and learning.

Technology Integration in Schools

In addition to creating a framework for integrating 21st century skills into classroom instruction, schools also needed to create a plan for integrating the technology hardware into schools. This occurred in a variety of ways, including but not limited to computer labs, small computer banks in classrooms, mobile laptop labs, and one-to-one computer initiatives. As much variety also has occurred with the integration of technology within schools, regardless of the hardware provided for instruction. In addition, there is a varied success rate for the integration of technology initiatives. As more and more schools move to a one-to-one computing model, there is increased research and understanding of the impact on student learning.

First, as schools and divisions begin to plan technology integration in their schools, there are a variety of considerations, including historical computer access and computer usage. In Becker's (2006) study, he "focuses on the policy goal of equitable distribution on educational technology resources" (p. 4). The evaluation looked at two components of technology integration: computer access and computer use. He used two data sets for his analysis (NAEP 2000 for national data sets and MEET for individual state data sets). The statistical analysis revealed that "schools in rural areas and schools with higher percentages of African-American students are more likely to have lower level of computer access" (p. 16). However, if students had access, those students on free- or reduced-price lunch and female students were more likely to use computers. Finally, if states had technology as part of their pre-service programs, then computer usage was higher. This study highlights some of the historic inequity in integration so that states and school districts can plan appropriately for technology integration.

Warschauer, Knobel and Stone (2004), in their study of 64 classrooms, found that computer access was relatively equitable between low SES (4.2 students per computer) and high-

SES (5.2 students per computer) populations. However, the integration of the resources varied from classroom to classroom, and from content to content. In this case the access was equitable, but the use was varied based on factors, such as social context, teacher credentials and student attendance rates. While Warschauer found that "every school had some teachers who were creatively making use of technology to help realize the full potential of their students" (p. 586), this was the exception, not the norm.

Second, there is a growing store of research around one-to-one computing. A group evaluating one-to one technology integration in school divisions is ProjectRED. Project Red is an online consortium providing research and solutions for school and districts implementing one-to-one laptop initiatives (Project Red, 2012). According to Project Red, "the recent research has overwhelmingly confirmed the benefits of the one-to-one laptop environment reported on in 2009.

According to Lei and Zhau (2008), "one-to-one computing is one of the fastest growing yet most controversial phenomena in American classrooms" (p. 98). In their study, they set out to determine the impact of one-to-one computing on student learning and school culture. In an evaluation of 231 students and 28 teachers, they found that student GPAs increased (by .05) during the year of the initiative, though it was only marginally statistically significant. However, a teacher noted that "student learning with technology was difficult to measure because much of the kind of learning was hidden …students had the opportunity … to extend and explore much more than they did in traditional classrooms" (p. 114).

Some of those benefits are supported by the research of Inan and Lowther (2010). They noted that "students' achievement scores increased when the laptops are effectively integrated into instruction" (Inan and Lowther, 2010, p. 940). Their path analysis of 379 teachers showed

that teacher readiness (Beta = .40) and beliefs (Beta = .44) had the most significant on teachers' laptop integration. In order for schools to improve student achievement, acquisition of technology hardware must be coupled with teacher readiness and positive teacher beliefs.

There is also concern that one-to-one computing is not the answer. In his article, Goodwin (2011) calls the results of the research on laptop programs "anemic" (p. 78). Goodwin argues that the increase in student achievement while occurring at the same time as one-to-one computing initiative, also is occurring at the same time as schools are implementing "key predictors of effective schools" (p. 79).

In their literature review, New South Wales' Department of Education and Communities (2010) outlines several other studies discussing the next steps for one-to-one computing initiatives. The organization noted that professional learning was critical to the way laptops are used in the classroom. Also, in Maine's one-to-one laptop program, researchers found that the way the laptops are used does have an impact on student learning. The difficulty is in measuring these impacts as they may not be reflected in traditional standardized testing. Because much of the impact may be due to 21st century skill acquisition, this also must be measured. It was also noted that a one-to-one laptop school district in Virginia is "developing an internal assessment tool to measure 21st century skills to establish a more accurate measure of achievement."

New South Wales' Department of Education and Communities (2010) provided studies that show technology by itself does not increase student learning, requiring the need for teacher training and preparation for success in the one-to-one laptop environment. Some of the training and preparation issues to be considered include how teachers use the laptops; the quality and depth of the professional learning teachers; the movement from technological proficiency to pedagogical values; and teacher collegiality and support.

Integration of 21st Century Skills and Instructional Technology in Teacher Education Programs

As the need for 21st century skill development and technology integration took the forefront of the education landscape, there became a need to backfill instructional strategies and best practices in our pre-service teacher programs. According to Polly and Moore (2008), "pre-service teachers are not receiving the necessary training on how to use and integrate technology into their instruction" (p. 20). Based on their research, Polly and Moore call for further studies to "determine the 'best practices' in the field of teacher education so that each pre-service teacher will be adequately prepared to infuse technology into their instruction" (p. 23). They note that it is "vital that we follow our graduates into the field to truly understand their prepared ness and actual use of technology as a tool for teaching and learning" (Polly and Moore, 2008, p.30). While they call for more research on teacher education, the current literature contains studies in the areas of methods courses in both content and technology; student teaching/modeling; and ICT courses. There is also research about barriers to technology infusion for both the pre-service and first-year teacher.

Methods courses: content versus technology. Since the mid-1990s, schools, colleges and departments of education (SCDEs) have developed new models for incorporating instructional technology into teacher education programs. The United States Department of Education through the Goals 2000 legislation developed the "Preparing Tomorrow's Teachers to Use Technology (PT3) grant program addressed the growing challenge in modern education that "nearly all elementary and secondary schools are now 'wired' to the Internet, but most teachers still feel uncomfortable using technology in their teaching" (U. S. Department of Education, 2006, para. 1).

This competitive grant program provided over 400 grants and $337.5 million to educational institutions to address the challenge of teacher preparation in the 21st century. The kinds of activities funded include faculty development, course restructuring, certification policy changes, and online teacher preparation. Many of the studies conducted on the integration of instructional technology in SCDE's teacher education programs are a direct result of participation in the PT3 grant program.

With a *Goals2000*-funded grant, SUNY-Oswego created a two-year program for pre-service teachers. The initial program was implemented in year one. During year two, instructors made some adjustments based on lessons learned. The researchers conducted an evaluation of the year two implementation (Vanatta & Beyerbach, 2001). In year two, twelve faculty members participated in the program, forming four teams. The purpose of the program was to develop and implement technology activities within their courses. The treatment also included participation in a three-day workshop to develop and plan activities for their education courses. The education faculty taught 300 pre-service teachers who participated in methods courses during the fall semester.

For the study, pre- and post-treatment surveys were administered to all instructors (n=12) and selected pre-service teachers (n=122). In addition to the surveys, researchers conducted focus groups with pre-service teachers, and observations of technology activities in the education courses and the k-12 classrooms. The study used two instruments -- the Faculty Technology Survey, and the Pre-service Teacher Technology Survey. Surveys focused on technology proficiency and technology integration experiences in the courses.

After an analysis of the pre- and post- treatment surveys, the researchers found a significant increase in faculty's technology proficiencies in instructional methods and overall

efficiency. Specific areas of increase were noted in distance education, content-specific software, webpage development and hypermedia (at $p < 0.01$) and in scanner/digital camera, LCD panel, presentation software (at $p < 0.001$). There was also a significant increase in the faculty use of technology in the areas of their teaching in computer presentations, content-specific software, e-mail, internet, references and overall integration ($p < 0.01$) (Vanatta & Beyerbach, 2001). The pre-service teachers also saw similar gains with one of the largest increases in instructional methods --rising from 15.9% (pre-treatment) with moderate/high proficiency to 68.9% (post-treatment). The program instituted at SUNY-Oswego incorporated a constructivist vision of technology integration in the teacher education program. Vanatta and Beyerbach (2001) noted that "higher education faculty training is a crucial component to developing technology-using pre-service teachers" (p. 133).

Adamy and Boulmetis (2005) studied the PT3 (Preparing Tomorrow's Teachers to Use Technology) grant implementation at a northeastern university. The grant was used to teach the faculty in the school of education several new technologies prior to teaching their courses. The purpose of the study was to "examine the effect that URI's PT3 project had on students' confidence in their ability to use technology in various aspects of the teacher education curriculum and procedures, as well as in their k-12 instruction" (Adamy and Boulmetis, 2005, p. 135). For the study, the sample included two groups of pre-service teachers. These pre-service teachers were part of a teacher education program that "supports an instructional model in which students are introduced to technology through its integration in to their core teacher educations courses as opposed to taking part in a separate technology course" (Adamy and Boulmetis, 2005, p. 143). For data collection, the researchers administered a confidence survey three times during the pre-service experience. The survey rated their level of confidence on a four-point Likert

scale in the areas of technology skills, preparing instructional materials, teaching, student assessment, effective communication and professional development.

The researchers found that the instructional model used for the pre-service teachers increased their confidence in the alignment of teaching materials to standards. However, they also found deficiencies in the area of "using technology with students in the k-12 environment" (Adamy and Boulmetis, 2005). While the teachers' confidence in content and technology alignment increased, teachers were unable to translate into classroom practice.

In 2010 Ozmantar, Akkoc, Bingolbali, Demir and Ergene conducted a mixed methods study of 40 pre-service mathematics teachers (PSMTs). The goal of the study was to analyze the integration of TPCK (technological pedagogical content knowledge) model workshop to influence pre-service teachers' instruction of multiple representations of derivatives. The researchers collected quantitative data through a diagnostic test on derivatives (content knowledge). The qualitative data was collected from lesson plans (pre/post workshop), teaching notes from micro-lessons, video-recordings of micro-lessons, interviews, and pre- and post-workshop questionnaires.

After the TPCK workshop, "75% of the PSMTs aim[ed] to establish interconnections among the three aspects of derivative and they planned to do so with the help of technology" (p. 29). The content (multiple representations of derivatives) provided a venue for the PSMTs to engage in activities where the technology acted as a new learning resource. Ozmantar et al. (2010) concluded that this "not only paves the way for new possibilities of teaching but also serves to deepen the student understanding of the mathematical concepts" (p. 35).

In order to understand better the instructional technology used by math teachers, Hardy (2010) studied 12 pre-service secondary math teachers in a project (X-Tech) during a secondary

methods course that used tablet technology. The pre-service teachers used Blackboard (a learning management system) for course management and communication. The pre-service teachers also used common software programs such as PowerPoint and geometer sketchpad, in addition to evaluating eight pieces of new instructional software. Hardy collected both quantitative and qualitative data. The students (pre-service teachers) reported that participation in X-Tech project enhanced their TPCK. However, the study had several limitations including researcher bias (course instructor), small sample size and an incomplete discussion of methods used in the qualitative data analysis. Hardy did note the limitation of generalizing based on small sample size. Even with its limitations, this study showed the effectiveness of faculty-modeling technology in a pre-service teacher course.

Davis, Hartshorne and Ring (2010) conducted a case study with 51 beginning pre-service teachers. Through the students' introductory education psychology course, researchers tried to identify what the pre-service teachers believed that innovation in education looked like. The sample consisted of third-year students, aged 20 to 25, who had already participated in an introductory educational technology course. The sample was 90% female and 10% male. Using a constant comparative analysis, the researchers identified emergent themes in the students' journaling exercises. Each researcher conducted the iterative process independently as a validity check. As a result, they found three themes, six sub-themes and 131 codes to analyze.

The first theme was *facilitators and inhibitors to technology use*. The students were concerned that the children would be more technology savvy than they. In addition, they were concerned about the availability of resources at both home and school. The second theme was *making curricular decisions*. The researchers found that the group had a varied response to instructional delivery ranging from sticking to the "tried and true" practices to the integrating the

"bells and whistles" of technology in the classroom. The third theme was the *role of technology in promoting learnin*g. Most often the respondents felt that technology would help motivate students and build on prior knowledge. The respondents also noted that technology would have the ability to expose students to diversity unavailable in the traditional classroom.

The researchers assessed the beliefs of pre-service teachers relative to innovation. They found a broad range of responses and pondered how their request for the students to reflect prior to the content methods courses may affect their future innovation and technology integration in the classroom (Davis, Hartshone & Ring, 2010).

Lock and Redmond (2010) conducted a seven-week case study with pre-service teachers on two different continents. Instead of taking a stand-alone Information and Communications Technology (ICT) course, the twenty-six pre-service teachers participated in a cross-institutional online collaborative project. The students were learning about instructional technology while practicing some of the instructional techniques needed to infuse technology into the classroom. The study utilized focus groups and discussion forums as the primary means of communication between the participants. For the researchers, the goal was to incorporate TPCK practices in the project to model TPCK techniques for the pre-service teachers to learn. As a result of their thematic analysis, Lock and Redmond (2010) determined that there must be "a major shift in teacher education programs" in order to make TPCK live within pre-service programs. The researchers identified a limitation as they felt that the data collection instruments "provided a limited insight into the complexity of TPCK" (p. 563).

Lambert and Gong (2010) studied a Midwestern university that was re-vamping its stand-alone technology course for educators to make it more authentic. The course required students to create products using 21st century skills in preparation for classroom instruction. The course had

two goals "(a) technology, when used in appropriate ways inherently promotes higher levels of thinking and (b) technology provides the vehicle necessary for practicing 21st century skills" (p. 66).

Lambert and Gong (2010) worked with 100 subjects (50 male, 50 female), randomly selected from 164 in the pre-service program. The subjects had varied access to computers before entering college. The subjects were drawn from 11 sections of the same course with the same syllabus, taught by different professors. During the study, the researchers conducted four separate evaluations to create a profile of the teachers.

1. A general survey of technology background based on the percentage of their professors who used technology.
2. An ISTE instrument to determine their self-perceived ability to integrate technology into the classroom.
3. A survey about the usefulness of technology in the classroom.
4. A technology skills test designed by the faculty.

Instruments two and three had internal reliability. Instrument four had not been tested for validity and therefore created a limitation for the study. Data were collected both at the beginning and the end of the study.

Lambert and Gong (2010) determined that there were five stages of technology adoption for the pre-service teachers: knowledge, persuasion, decision, implementation, and confirmation. The study found that completing the course made pre-service teachers less anxious about computers, "their belief in the value of using technology … and their self-efficacy toward integrating technology" (p. 54). It also showed that gender and year of college did not make a difference toward their beliefs in the use of technology. However, there was a correlation

between level of prior exposure to technology in previous courses and prior use did have an impact on their self-efficacy and attitudes toward technology in the classroom. "Exposure to K-16 instructor modeling of technology integration and prior educational uses of technology by pre-service teachers correlated to lower levels of computer anxiety and perceived abilities to integrate technology" (p. 67).

Lambert and Gong (2010) noted that further study is necessary to "follow up on the actual long-term use of technology by pre-service teachers after a course such as the one in this study" (p. 68). The researchers also noted the limitations based on one of the instruments used. A further limitation may include the lack of generalizability due to the faculty-created course design and syllabus.

In 2013, Funkhauser and Mouza conducted a qualitative study with entering pre-service teachers. They investigated their beliefs about the role of technology in teaching and learning before and after taking an introductory educational technology courses. They used drawings, blogs and interviews to establish where the teachers felt they were as technology using teachers. They found that after the course was complete that the pre-service teachers' mindset shifted from a teacher-centered approach to more mixed teacher-and student-centered approach. The teachers also saw technology as an opportunity for collaboration between students, parents and teachers.

Barriers to integration. Whereas the sample studied by Lambert and Gong (2010) had varied technology experience, Lei (2009) conducted a study of pre-service teachers who were digital natives born after 1980. The study was designed "to examine the beliefs, attitudes, and technology experiences and expertise of a group of 2007 intake freshmen—digital natives, based on their age—enrolled in teacher education programs in a large northeastern university; identifies the strengths and weakness in their technology knowledge and skills; and explores whether or

not technology preparation is still needed to prepare them to integrate technology in their future classroom" (Lei, 2009, p. 87).

Lei collected data through a technology survey during their first year of the teacher education program. Of the initial sample of 70 students, only 55 had valid responses. Of the sample of 55, nine students were male and 46 students were female. In his mixed methods study, Lei used both Likert-scale questions and open-ended questions. The open-ended questions were piloted on three pre-service teachers and minor revisions were made to the survey.

Lei reported that the students held strong positive beliefs around technology, but moderate confidence and moderate interest in using it. The students reported that 80% used technology for social communication and were proficient with basic technologies. However, the students had very limited use of web 2.0 technology (32.7% had little to no experience with blogging and 40% no experience with wikis). They were also limited in their confidence around teaching-related technologies, and assistive technology. These findings mirrored the reporting of Brush, Glazewski and Hew (2008).

The findings of Lei (2009) indicate that teacher education programs need to "help them make the transition … to digital-native teachers who can use technology in meaningful ways in classrooms." This may be achieved by paying more attention to subject-specific technology, barriers to technology use, exposure to assistive technology and an increase in exposure to a variety of teaching and learning technologies.

Like Lambert and Gong (2010), Brush et al. (2008) studied pre-service teachers' beliefs about technology and barriers to technology integration in the classroom. In their study, Brush et al. (2008) conducted a field test on their questionnaire (Technology Skills, Beliefs and Barriers) to determine reliability and validity. After the field test, they surveyed 176 pre-service teachers

at a major southwestern university. Within the sample, 88% were juniors or seniors, 89% were female, and 59% were 21-25 years old.

The overarching categories of the questionnaire included (a) basic operation, (b) productivity software, (c) communication, (d) electronic references, (e) world-wide web, and (f) multimedia. The questionnaire contained a set of 32 items to represent the technology skills as a subscale of the survey. The questionnaire utilized a four-point Likert scale from "I can't do this" to "I can teach others how to do this" (Brush et al., 2008, p. 115). Another subscale of the survey included a set of 12 items to review beliefs about technology utilizing a four-point Likert scale from "strongly disagree" to "strongly agree." The final subscale for the survey contained a set of 10 items with a three-point Likert scale to measure teachers perceived technology barriers. The survey was given during the first session of a methods course focusing on technology integration (start of junior year). The researchers removed one item due to a correlation below 0.3 based on cronbach alpha coefficients, but deemed that the scale was valid and reliable.

Brush et al (2008) reported that the students' overall technology skills were low, but they were most confident with printing and word processing. They found that students were least comfortable with anti-virus software, graphics, transitions and presentation software. The results around the students' technology beliefs supported the use of technology in the classroom, but did not feel that there was enough time to incorporate technology and that "teaching technology is not my job" (Brush et al., 2008). The students reported that the perceived barriers to technology integration (on a three-point scale) were (a) limited access to technology - μ 2.5, (b) not enough software - μ 2.39, (c) lack of knowledge about technology - μ 2.37, and (d) lack of knowledge about the integration of technology - μ 2.24.

Throughout these studies, Lambert and Gong (2007), Lei (2009), and Brush et al. (2008) identified similar barriers to technology integration emerged with pre-service teachers. Some of the common themes included lack of access to technology, lack of confidence, and lack of training.

Technology integration during student teaching. Koc and Bakir (2010) studied 26 pre-service teachers during their student teaching experience in a Mid-Atlantic university. The student teachers were elementary level (11) and secondary level (15). This mixed methods study utilized a quantitative questionnaire with additional open-ended questions. There were three parts to the questionnaire with the first section gathering demographic data and the student teachers' background information with technology. The second part of the questionnaire dealt with "perceptions and beliefs about participants' knowledge and preparation to various aspects of using available technology for course planning, teaching, assessment and communication" (Koc & Bakir, 2010, p. 16). The final part of the questionnaire assessed the students' "current level of knowledge and skills for using a variety of technological applications" (Koc & Bakir, 2010, p. 16).

At the conclusion, the researchers ran an SPSS qualitative analysis on four aspects of the pre-service teachers' experiences. They also coded the open-ended questions to identify key patterns and themes. The first theme to emerge dealt with the students' prior experiences with technology, both personal and academic. The second theme was their opinion about the role of computers in the classroom and the barriers toward computer integration. When asked "how computer technology should be used to improved teaching and learning, their responses included 'to use the Internet as a research tool' (39%), 'to present information' (31%) and 'to provide time saving programs' (27%)." (Koc & Bakir, 2010) The students identified the largest barriers to

technology integration as lack of knowledge (39%) and lack of equipment (31%) (Koc & Bakir, 2010, p. 17). The third theme to emerge was around students' perceptions about knowledge and preparation for technology use. On a five-point Likert scale, students (at a level of μ 3.77) felt they needed "training to learn how to implement computer technologies into my instruction in order to enhance student learning" and that they were "prepared to regularly use technology to communicate and collaborate with peers in the field of education." However, the fourth theme yielded lower results around the students' comfort level with technological applications. The students' reported the highest comfort level with word processing (μ 2.92), followed by internet research (μ 2.88), and communication (μ 2.81). The students' reported the lowest comfort level with webquests (μ 1.23), simulation tools (μ 1.5) and video editing (μ 1.23).

As a result of their study, Koc and Bakir (2010) concluded that more training was needed for students at this university prior to the student teaching experience. Further, they noted that "teachers still use technologies within the objectivist model of teaching and learning," rather than a more integrated constructivist model of teaching and learning. The researcher also noted that the study was limited by the very small sample and that student teachers were in a variety of settings.

Singer and Maher (2007) conducted a small case study bounded by time and activity in a suburban middle school in the southeast. The study followed two pre-service teachers, and two in-service teachers teaching seventh-grade science. The project goal was to train the incumbent (in-service) teachers in the program alongside the student (pre-service) teacher. For Singer and Maher (2007), the purpose of the study was to "explore the use of the student-teaching experience as an avenue for both pre-service and in-service for teachers' professional development associated with educational technology" (p. 955). The researchers used an

experimental design with a commercial, technology intervention (BioLogica, a software program). The researchers conducted pre- and post-intervention interviews. They, then, analyzed transcripts to identify themes and develop codes. Some of the codes included classroom management, risk and self-efficacy.

Results showed that both in-service and pre-service teachers integrated technology into their lessons, specifically the software. This was a result of three conditions (trust among the pre-service/in-service teachers, perceived capability of the pre-service teacher by in-service teacher and accessibility to resources). The pre-service interns served as "change agents" for the in-service teachers. The researchers reported that "under specified conditions, pre-service teachers are capable of planning and enacting an innovative, student-centered technology-rich curriculum. Furthermore, under specified conditions, pre-service interns can facilitate their in-service mentors' acquisition of these same skills" (Singer & Mayer, 2007). While the results speak to a positive model for 21st century TPCK integration for both pre-service and in-service teachers, there was a significant limitation in the reported results as the researchers created the software intervention used in the study and only measured two teacher-pairs.

First-Year Teachers' Experience with Technology Integration

In 2003, Li and Ngan conducted one of the earliest studies of first-year teachers and technology integration. It was a case study of five first-year teachers in Hong Kong. All had participated in an information and communications technology (ICT) course during their pre-service program. The students also participated in an ICT workshop and created an ICT project during first year of teaching. The students were interviewed after completing the ICT project. Five overarching questions were asked. The three major themes that emerged were related to improvements in classroom learning, gains in ICT knowledge and skills, and beliefs in student-

centered learning. The researchers reported that there were barriers to technology integration, including a lack of professional development time, a lack of support from colleagues, and school culture. Li and Ngan (2003) concluded that the positive "findings validate the need for an induction exercise on the use of ICT in classroom instructions in the initial teaching years" (p. 58). They also felt that "matching a number of beginning teachers with an experienced ICT educator either within a school or in partnership with a teacher education institute is a good measure" (Li & Ngan, 2003, p. 58).

Doppen (2004) conducted a study of four first-year social studies' teachers. The goal was to determine "how beginning social studies teachers actually use technology during their first year in the classroom to help their students grasp" (Doppen, 2004, p. 248) social studies' curriculum and context. All participants had previously taken a course in the integration of technology in the social studies curriculum at a large southeastern university. The data collection included pre- and post-instruction teacher interviews, classroom observations, teacher artifacts, a student technology survey, and school accountability reports. The researchers pulled results based on an interpretive approach using a constant comparative method. Doppen (2004) specifically looked at the impact of teacher preparation on year one teaching. The results of research yielded five assertions about technology.

1. teacher beliefs impact students' appreciation of the subject (p. 256).
2. teachers were well-prepared, but lacked professional development time during year one (p. 258).
3. a school's technology infrastructure and culture impacted student and teacher self-efficacy (p. 260).
4. teachers had difficulty engaging students in historical inquiry (p. 264).

5. as the teachers' pedagogical content knowledge (PCK) developed, their experience in the teacher preparation program impacted their beliefs about integrating technology (p. 267).

As a result, Doppen (2004) concluded that "pre-service programs must provide many structured opportunities integrated throughout their coursework to learn, experiment and reflect on practice" (p. 273), if teachers are to more-fully integrate technology into the classroom.

In a two-year mixed method study, Gao, Wong, Choy, and Wu (2010) looked at the process for developing "leadership potential for technology integration for the perspectives of three beginning teachers in Singapore." Their comprehensive data collection include four iterations of a survey, four interviews per subject, three large group discussions, 14 observations in year one, 56 observations in year two, and a review of artifacts (lesson plans, student work, and ICT projects). Gao et al. (2010) reported three emergent themes: (a) belief systems (teacher beliefs, constructivist theory, passion for teaching), (b) practices (risk taking, discovering strengths, modeling for cooperating teachers) and (c) leadership potential (impact on student learning, school wide tech initiatives and supporting university peers). After an analysis of those themes, the researchers concluded that in most cases, high ICT skill and comfort level do not translate to high ICT integration in the classroom (Gao et al., 2010). Further, they found that "teacher education programs should not only prepare their pre-service teachers in the skills knowledge and attitude about using ICT in classroom teaching and learning, but also in the knowledge of change and supporting others to do so" (Gao et al., 2010, p. 654)

In another evaluation of first-year teachers, Starkey (2010) studied the experiences of six 'digitally able' first-year teachers in New Zealand. The research focused on both barriers and enablers for technology integration in the secondary classroom. This case study worked through

a complex theoretical framework and coded the barriers/enablers into five categories. These categories were based on patterns identified during teacher interviews and included access, experience, support, school structures and beliefs. Starkey (2010) concluded that the major barrier was a lack of resources (teacher and student laptops). Starkey also found that support varied in schools, but teachers stated that they valued the support, particularly in their subject area. Even though there was a lack of resources, the teachers were innovative in overcoming barriers in order to use the technology in the class room. A major finding of this study identified that a "supportive context includes: (a) school policies and structures which encourage and allow access to digital technologies, (b) developing the beginning teacher's sense of agency and (c) the support of a mentor with relevant pedagogical content and expertise" (Starkey, 2010, p. 1437). Starkey did not measure the impact of teacher preparation on the teachers' technology integration.

Conclusion

The literature review revealed several overarching themes. First, during the last quarter of the 20th century and first decade of the 21stcentury, there has been significant analysis and reporting on workplace readiness skills. This includes the need for educational structures to provide students with those skills. Second, the models for student learning that seem to best achieve those goals is an integrated constructivist model, not an objectivist model. And finally, the most common barrier to preparing students with a 21st century skill set is the lack of technology in the classroom.

Chapter 3. Design and Methodology

As the movement toward instructional technology (IT) and 21st century teaching and learning has grown, studies have emerged about the challenges and barriers to using technology in the classroom. These barriers include lack of resources, inadequate curriculum and assessment, the lack of administrative support and infrastructure, and insufficient teacher training. After these barriers were identified, there have been numerous studies on teacher education programs and integration of technology instruction for 21st century and teaching and learning. These studies have identified several methods for preparing teachers including stand-alone courses in IT, faculty modeling of IT methods and more recently, the partnership between the pre-service teacher and supervising teacher during the student teaching experience.

In addition, there is emerging literature about the experiences of first-year teachers as they implement technology and 21st century teaching and learning. However, regardless of the model for preparation, there has been no study on first-year teachers who are working in a district where those barriers to technology integration have been removed. In order to identify the confidence level of first-year teachers and their preparation for the technology-rich classroom, a mixed methods study was employed. This chapter describes the theoretical framework, rationale and description of the methodology for the study.

Purpose and Research Questions

The purpose of the study is to gauge first-year secondary teachers' perceptions of their preparedness for technology-rich classrooms and analyze what relationships may exist between

their perceptions and type of teacher preparation model they experienced. Thus, the following research questions were used to guide this mixed-methods study:

1. What types of teacher preparation models did participants experience in terms of:
    a. technological knowledge
    b. content knowledge
    c. pedagogical knowledge
2. What are participants' perceptions concerning their pre-service teacher education programs regarding:
    a. effectiveness to prepare them for teaching 21st century skills in technology-rich high school classrooms containing a one-to-one laptop to student ratio
    b. facilitating feelings of efficacy and self-confidence for first-year implementation
3. Do relationships exist between teacher preparation models and teacher perceptions of effectiveness and adequacy? If so, what are they? And what are the implications of these findings?

Philosophical Foundations

Ravitch and Riggan (2012) believe that in a good study, researchers must construct a "*conceptual framework."* In essence, the researcher needs to "figure out what you want to study, why it matters (to you and broader audiences), and (arrive) at reasonable conclusions about how to go about studying it (methodology)" (Ravitch and Riggan, 2012, p. 7). Each of these components is addressed in through the literature review and methodology. Determining what to study is a result of the logical progression of the literature over the last two decades; the current condition of teacher preparation for 21st century teaching and learning in the technology-rich classroom, as well as the researcher's positionality. The research matters because of the

importance of merging traditional teacher preparation with emerging technologies. Finally, the way *to go about studying it* is a result of the epistemology and theoretical framework that implores the use of a mixed methods approach to answer adequately the research questions.

Epistemology and Theoretical Framework

Epistemology allows us to look at the nature of knowledge. Expanding on Guba and Lincoln's (1994) paradigms of qualitative research, Merriam (2009) identified four major epistemological perspectives -- positivist/post-positivist, interpretive/constructivist, critical, and postmodern/post-structural.

Positivism "assumes that reality exists 'out there' and it is observable, stable and measurable" (Merriam, 2009, p. 8). Post-positivism recognizes that "knowledge is 'relative rather than absolute' but 'it is possible, using empirical evidence, to distinguish between more and less plausible claims'" (Merriam, 2009, p. 8). These epistemological perspectives lend themselves to qualitative, naturalistic observations rooted in observable, measurable data.

According to Merriam (2009), the purpose of the interpretive/constructivist epistemological perspective is to describe, interpret and understand. The research is "interested in understanding the experience" (p. 19). In order to do that, qualitative research will allow the researcher to "understand the meaning people have constructed, that is, how people make sense of their world and the experiences they have in the world" (p. 19). This perspective lends itself to quantitative research, so there is an ability to get some statistical and deductive data.

Merriam (2009) notes that there is not always a rigid differentiation between these four perspectives, and in fact, they may "intersect in various studies." That intersection leads to the notion of pragmatism. "In practice, the individual using this worldview will use multiple methods of data collection to best answer the research question, will employ multiple sources of

data collection, will focus on the practical implications of the research and will emphasize the importance of conducting research that best addresses the research problem" (Creswell, 2013, p. 28).

Mertens (2010) puts it plainly, "pragmatism allows the researchers to choose the methods (or combination of methods) that work best for answering their research questions" (p. 38). This study looks at two components that "occur in social, historical, political, and other contexts" (Creswell, 2013, p. 28) -- the type of teacher preparation received (quantitative) and the confidence level (qualitative) of teachers entering the classroom. Therefore, the epistemological answer is to utilize the pragmatic approach of a mixed methods study. The "mixed methods research integrates both qualitative and quantitative data and analyses for a more multi-dimensional approach to inquiry" (Miles, Huberman, Saldana, 2014, p. 44). This mixed methods study first uses quantitative survey data to identify methods of teacher preparation and levels of 21st century tools and skills integration. It then uses a qualitative interview process with theme identification to develop a richer understanding of the teachers' confidence level for integration of those 21st century tools and skills.

Data Collection/Methodology

The overall purpose of this study was to determine first-year teachers' level of self-efficacy and confidence for 21st century teaching and learning in a technology-rich classroom. The participants in this study were in their first year of teaching within a technology-rich classroom with a one-to-one laptop ratio. To understand the preparedness of the first-year teachers for the technology-rich classroom, the following research questions were considered.

1. What types of teacher preparation models did participants experience in terms of:
    a. technological knowledge

b. content knowledge

c. pedagogical knowledge

2. What are participants' perceptions concerning their pre-service teacher education programs regarding:

    a. effectiveness to prepare them for teaching 21st century skills in technology-rich high school classrooms containing a one-to-one laptop to student ratio

    b. facilitating feelings of efficacy and self-confidence for first-year implementation

3. Do relationships exist between teacher preparation models and teacher perceptions of effectiveness and adequacy? If so, what are they? And what are the implications of these findings?

Due to the nature of the research questions, the researcher employed a mixed methods approach largely utilizing the research techniques of Mertens (2010) and Creswell (2013). In a mixed methods study, researchers collect both quantitative (numerical) data and qualitative (words, pictures, and artifacts) data (Creswell, 2013). The benefit of the mixed methods approach to the research questions is its "ability to draw conclusions about the problem under study" (Mertens, 2010, p. 298). More specifically, the pragmatic design allowed for "both qualitative and quantitative data (to be) collected to answer the research questions" (Mertens, 2010, p. 298). In the pragmatic sequential mixed methods design,

> one type of data (e.g., quantitative) provides a basis for the collection of another type of data…the final inferences are based on both strands of the study. In some cases, the second strand/phase of the study is used to confirm or disconfirm the inferences of the first strand or to provide further explanation for unexpected findings in the first strand (Mertens, 2010, p. 300).

This pragmatic approach to the research allowed the research questions to be answered within the specific context of the technology-rich classroom utilizing 21st century teaching and learning.

This mixed methods study utilized the pragmatic methodology where the researcher "work(ed) back and forth between various approaches" (Mertens, 2010, p. 298). During the first year of teaching, participants took a survey and participated in focus groups reflecting on their experience with technology integration. The focus group further explored the use the tenets of the Teaching Innovation Progression Chart (TIP-C) as the model for 21st century skills integration. There were two major components to the focus group: effectiveness of the teacher preparation in the area of 21st century teaching and learning and instructional confidence in the technology-rich classroom.

Site Selection and Entrée

The first step was to complete an application to the Virginia Commonwealth University Institutional Review Board (IRB). The application requested consideration of expedited review of the proposal because the study design met all guidelines established by the IRB for exempt status. The application included specific steps outlined in this chapter which comprised the data collection portion of the study. After several adjustments to address subject confidentiality, audio recordings and data retention concerns, the proposal was approved with exempt status.

The school district was chosen for this study based on its unique combination of a long-standing one-to-one laptop to student ratio and its codified approach to 21st century teaching and learning (H21). Over the last decade, the district invested in the technology infrastructure and professional development to maximize the use of a variety of instructional tools in the classroom. Prior to beginning the study, the researcher conducted a preliminary review of the research with the district's research and planning department. A formal application was submitted to the

Director of Research and Planning following institutional IRB approval. The researcher gained formal approval from the school division in order to conduct research with school division employees.

Setting

The study took place in an urban, suburban school district serving a community with a total population of 306,935 (U.S. Census Bureau, 2014). During the 2014-2015 school year, the district served 50,971 students in a total of 72 schools and facilities. The high school population was 15,318 students at nine comprehensive high schools (Virginia Department of Education, 2015). In the fall of 2013, high school students received new laptop computers as part of the Teaching and Learning Initiative. This initiative, started in 2001, created a one-to-one laptop-to-student ratio. In addition to the hardware provided to the students, in 2005, the district launched a professional development initiative to support the use of instructional technology for 21st century teaching and learning.

Overview of Population and Sampling Procedures

The purpose of this study was to understand the preparation of first-year high school teachers with zero-years' experience in a district with a one-to-one laptop initiative. The research and planning department of the district identified the participants for the quantitative survey. In the initial phase, the research and planning department contacted via email 104 unique teachers who were classified as first-year teachers within the district. This provided a convenience sample, that in the next phase yielded nested sample, as a "subset of those in one (phase) of the study (was) chosen to be in the other part of the study" (Mertens, 2010, p. 330).

The sample for the qualitative focus group interviews was narrowed based on the participant survey. Of the 104 identified participants, 29 (or 27.8%) of the district's first-year

teachers completed the email survey. Of those 29 teachers, 13 teachers indicated that they would be interested in a follow-up focus group. Understanding that Mertens (2013) recommends "six to nine people for a focus group" (p. 332), the researcher contacted all 13 of the first-year teachers who responded regardless of the type or location of their teacher education program. The 13 teachers were all located in the middle to eastern part of the district, so the researcher offered two locations and two dates for the focus group to provide flexibility and a better chance for teacher participation. Six teachers (three for each date) responded to the request to participate in the focus group. This created a nested sample of six participants for the qualitative focus group phase of the study from the original 104 eligible participants in the convenience sample provided by the district.

Mixed Method Approach to the Research Question

In order to adequately answer the research questions, both quantitative and qualitative data was collected with little lag time, utilizing a pragmatic sequential mixed methods approach. Table 3 provides an overview of the methodology followed by a more detailed description of each phase of the research.

Phase One: Quantitative Research

The first component of data collection was an online participant survey (Appendix D) via Survey Monkey. The descriptive qualitative and quantitative data captured in the survey established participant demographics, the type of teacher preparation the participant received, the instructional technology available to the participant, and the rate of use of instructional technology. By collecting descriptive data in the participant survey, the researcher was able to establish focus group participants. It also allowed the researcher to understand better the

qualitative data in the interview component that "elucidate(d), elaborate(d) on or explain(ed) the quantitative findings (McMillan, 2004).

Table 3

Overview of Methodology to Address Individual Research Questions

Research Question	Quantitative Data	Qualitative Data	Data Source and Sample	Analysis
1. What types of teacher preparation models did participants experience in terms of: a. technological knowledge? b. content knowledge? c. pedagogical knowledge?	Descriptive statistics		Survey of convenience sample	Statistical description through tables and graphs
2. What are participants' perceptions concerning their pre-service teacher education programs regarding: a. effectiveness to prepare them for teaching 21st century skills in technology-rich high school classrooms containing a one-to-one laptop to student ratio? b. facilitating feelings of efficacy and self-confidence for first-year implementation?	Survey responses	Audio recording Video recording Researcher transcription Member checking	Survey of convenience sample Focus Group of nested sample	Categorical data analysis Code and theme analysis
3. Do relationships exist between teacher preparation models and teacher perceptions of effectiveness and adequacy? If so, what are they? And what are the implications of these findings?	Descriptive statistics	Audio recording Video recording Researcher transcription Member checking	Survey of convenience sample Focus Group of nested sample	Categorical data analysis Code and theme analysis

Data analysis. Survey responses were tabulated and reported utilizing Microsoft Excel 2010 and SPSS Statistics 23. Much of the data in the survey provided qualitative descriptive statistics. Analysis of qualitative descriptive statistics was analyzed in Microsoft Excel in

multiple representations to determine the best method of presentation. The final data was presented in tables, frequency distributions, bar graphs and pie charts. All data relevant to technology training, teacher preparation, and technology usage during the first year was loaded into SPSS Statistics 23. .

Table 4

Summary of variables used in SPSS analysis

Variable Short Form	Relevant Survey Question	Type of Variable	Coding for Analysis
Participant	N/A	Ordinal	N/A
StdaloneITcrse Methcontcrse Studtchcrse Practcrse Onlinecrse	What courses and/or experiences did you have in Instructional Technology prior to your first year of teaching?	Qualitative, nominal	0=No 1=Yes
ISTE TPCK	Standards Standards	Qualitative, nominal	0=No 1=Yes
OneToOneAvail IntActWhtBdAvail LMSAvail BYODAvail ProjDevAvail	What instructional technology tools were available in your classroom during the 2014-15 school year?	Qualitative, nominal	0=No 1=Yes
OneToOneFreq IntActWhtBdFreq LMSFreq BYODFreq ProjDevFreq	How often did you use the following instructional technology tools during the 2014-15 school year?	Quantitative, ordinal	0=Never 1=Quarterly 2=Monthly 3=Weekly 4=Daily
OneToOnePrep IntActWhtBdPrep LMSPrep BYODPrep ProjDevPrep	I received adequate preparation through my teacher preparation program for using the following instructional technology tools in the classroom	Quantitative, ordinal	0=Disagree 1=Somewhat disagree 2=Somewhat agree 3=Agree

This included five variables about courses, two variables on instructional standards, five tools available in the classroom, frequency of use for the five tools, and the confidence level of

preparedness to use the five tools. They were converted to nominal variables and coded according to the data in Table 4.

Validity. The items within the survey instrument (Appendix B) were developed with guidance from Converse and Presser (1986), including the length of survey questions; and the format for the questions using the agree/disagree construction. The questions were based on the major themes that emerged in the literature around teacher preparation for technology integration and the identification of 21st century skills. The instrument was approved by the Institutional Review Board and the district's department of research and planning. The responses provided data to inform the focus group interviews as recommended by Mertens (2013) in a pragmatic sequential mixed methods design – "one type of data (e.g., quantitative) provides a basis for the collection of another type of data…the final inferences are based on both strands of the study" (p.309).

Limitations. The limitations of this study are due to the sampling population. Because the population came from a single district with specific contexts about the availability of technology and expectations for use of 21st century teaching and learning, it is not generalizable to other school districts. In addition, there is not an ability to provide a cause and effect relationship analysis between teacher preparation and teacher efficacy as no classroom observations were part of the research.

Phase Two: Qualitative Research

According to Creswell (2013), "we conduct qualitative research because a problem or issue needs to be explored" (p. 43). It allows the subjects to "tell the stories unencumbered by what we expect to find or what we have read in the literature" (Creswell, 2013, p. 44). The qualitative research component of this study was relevant to provide rich understanding of the

first-year teachers' confidence level and their perceptions of efficacy. While the statistical data from the survey instrument provided framework for the analysis of the teachers, the focus group interviews provided an in-depth understanding of the experience.

Research positionality. As a pre-service teacher, my technology training was based on modern technologies like laminators, film strips and overhead projectors. I began my educational career as a teacher with one computer in my classroom. As a classroom teacher, I incorporated emerging technology as a tool in my classroom, utilized our school-based computer labs and provided training for colleagues in that area. When the district introduced five computers into every secondary classroom, our district provided teachers with significant training (three days) during the school year.

As I transitioned to administration, our district adopted a one-to-one student to laptop initiative, as well as, a 21st century teaching and learning initiative. Training for these initiatives was largely school-based or during the summer months. Teachers who successfully integrated technology and 21st century teaching and learning in their classrooms participated in those formal trainings or conducted their own self-study.

For over a decade, I served as a high school principal. The majority of that time was spent in a school district with a one-to-one student to laptop ratio. In addition, I was at a hard-to-staff school that resulted in significant hiring each year.

During the teacher interview process, I asked always asked candidates the question, "What role do you see instructional technology playing in the classroom? What is your comfort level with various technology applications?" This allowed for a broad range of responses, but leant itself to candidates discussing 21st century teaching and learning, as well as the use of 21st century teaching and learning tools. I often had the opportunity to interview teachers from five

major universities within 120 miles of our school district. I rarely heard more than textbook answers about technology integration, and even more rarely heard about technology as a component of an overall teaching model including pedagogy and content knowledge.

During one interview, I received a response that felt like the teacher was trained using the processes and initiatives of our school district. Her responses were not textbook responses, but responses based on a rich experience in the university classroom and in her internship. However, she was trained at a private university in another state with a student teaching experience in that state.

This experience made me realize that in order to prepare first-year teachers for the technology-rich environment of our district, that teacher education programs needed the commitment to training that our district had as they placed new technologies in our classrooms. I was concerned that teacher education programs, likely administered and taught by staff not privy to the experience of emerging technologies in the classroom, may not have the breadth and depth of coursework to prepare teachers for the 21st century teaching and learning in technology-rich classrooms. As school districts continue to embrace a variety of policies from one-to-one initiatives, BYOD, and 21st century teaching and learning paradigms, it is critical that our teacher education programs keep pace.

Participants. Using a convenience sample, the district's research and planning department distributed an online survey via Survey Monkey to all (104) first-year high school teachers with zero-years' experience. After a second request to complete the survey, 29 teachers completed the survey. As part of the survey, respondents were asked if they would be willing to participate in a follow-up focus group interview. This narrowed the participant list for the focus groups to 13 potential candidates. The focus group interview sample was initially limited to

first-year teachers who completed education programs in CAEP-, SACS-, NCATE- or TEAC-accredited schools, colleges or departments of education in the Commonwealth of Virginia (Table 5).

Table 5

Virginia Four-Year Public and Private Institutions, Accreditation, Teacher Education Program

Colleges and Universities	Accreditation of Education Program*	School, College or Department of Education or Preparation Program
Bluefield College	TEAC	Teacher Education
Christopher Newport University	N/A	Teacher Preparation Program
College of William and Mary	NCATE	School of Education
Eastern Mennonite University	NCATE	Special Education
Emory and Henry College	TEAC	Teacher Education Program
George Mason University	NCATE	Educator Preparation
Hampton University	NCATE	Educator Preparation
James Madison University	NCATE	College of Education
Liberty University	NCATE	Educator Preparation
Longwood University	NCATE	School of Education and Human Services
Mary Baldwin College	TEAC	Teacher Education
Marymount University	CAEP/NCATE	Educator Preparation
Norfolk State University	NCATE	School of Education
Old Dominion University	NCATE	Darden College of Education
Radford University	NCATE	College of Education and Human Development
Randolph College	TEAC	Teacher Education Program
Randolph-Macon College	TEAC	Teacher Preparation Program
Regent University	TEAC	Teacher Education Licensure Program
Roanoke College	TEAC	Teacher Licensure Program
Shenandoah University	TEAC	Teacher Education
The University of Virginia's College at Wise	TEAC	Teacher Education
University of Mary Washington	N/A	Teacher Education Program
University of Virginia	TEAC	Teacher Education Program
Virginia Commonwealth University	NCATE	School of Education
Virginia State University	NCATE	School of Liberal Arts and Education
Virginia Tech	NCATE	School of Education
Virginia Union University	NCATE	Educator Preparation
Washington and Lee University	TEAC	Teacher Education

Note. Adapted from "Council for the Accreditation of Educator Preparation" accessed January 20, 2015 at http://caepnet.org/; and from" Public Colleges & Universities Authorized to Operate in Virginia" accessed April 18, 2011 at http://www.schev.edu/students/PublicCollegeList.asp.

To meet Mertens (2013) recommendation of "six to nine people for a focus group" (p. 332), the sample was expanded to include participants in Virginia Department of Education-approved career switcher and provisional licensure programs. The final sample included six teachers.

Informed consent. Each respondent was provided a Participant Letter (Appendix C) and an Informed Consent Agreement (Appendix D) in accordance with the IRB protocol. All appropriate documents were submitted as noted in the *Submission Checklist* of the Initial Review Submission Form for the IRB protocol.

Instrumentation. The qualitative instrument, the Focus Group Protocol (Appendix E) contained a set of questions that were tailored to the specific setting of the suburban district with a one-to-one laptop initiative, technology-rich classrooms, and a professional development and evaluation plan centered on 21st century teaching and learning. The questions were designed to explore instructional technology integration during (a) the teacher education program, (b) student teaching experience, (c) professional development activities, and (d) first year of teaching. The Focus Group Protocol (Appendix E) was grounded in the review of the literature for technology integration in teacher education programs and first-year teacher experiences.

Data collection. Data collection was via focus groups because they allow the "explor(ation) of a topic in depth through group discussion" (Mertens, 2013, p. 370). They are designed to elicit more of the participants' points of view than would be evidenced in a more researcher-dominated interview (Mertens, 2013). The qualitative data expanded upon the quantitative survey and explored the confidence of the participant to implement 21st century skills within the technology-rich classroom based on the teacher preparation received. For each focus group, there was a video recording and two audio recordings. The video recordings were

conducted with a JVC Everio camcorder GZ-E200BU with a SanDisk 16GB /4hour video card. The audio recordings were conducted using Audacity 2.0.5 from a Dell Latitude E5540 and a TASCAM Linear PCM DR-05 Recorder with a 2GB micro SD card. Unbeknownst to the researcher, the video card did not extend beyond 30 minutes, so audio recordings solely were used for the transcription beyond the 30 minute point of the focus group. The video and audio recordings were transcribed to Microsoft Word by watching and listening via Windows Media Player. The video and audio recordings were transcribed to Microsoft Word by watching and listening via Windows Media Player. During the transcription, open coding was used to do "what one does that the beginning of any data analysis (by) tagging any unit of data that might be relevant to the study" (Merriam, 2009, p.200).

In order to prevent possible misrepresentation, the study included member checking. "After gathering data and drafting a report, the researcher will ask the participants to read it for accuracy and possible misrepresentation" (Stake, 2006, p. 172). Member checking also provides a method for increasing validity (Mertens, 2013). Participants received the transcription to ensure that there were no misrepresentations of their remarks. The focus group participants did not provide any concerns with the representation of their interviews.

Data analysis. Creswell (2009) identifies several steps for data analysis and representation. The data must be organized, classified into codes and themes, interpreted and presented. Bogdan and Biklen (2003) recommended utilization of several types of codes – coding categories, situation codes and setting/context codes. As noted earlier, the researcher transcribed the video and audio recordings of each focus group into Microsoft Word documents. During the transcription, open coding was used to do "what one does that the beginning of any data analysis (by) tagging any unit of data that might be relevant to the study" (Merriam, 2009,

p.200). Key quotes or statements were highlighted for later reference. Also, any themes or codes that began to emerge were placed in a text box at the beginning of each transcription document. The primary documents containing the transcriptions were named based on the location of the focus group.

Following the initial transcription and open coding, the transcribed focus group documents were entered into Dedoose 6.2.10 creating the two records, called media, used for analysis and further coding. This CAQDAS, web-based software was chosen because of its ability to incorporate qualitative and quantitative data for mixed methods research. Survey statistical data as well as the transcriptions of both focus groups were entered. In fact, much of the data analysis done in Microsoft Excel was also available in Dedoose. Once the statistical data was uploaded, descriptor sets were developed for the survey data that could be used to cross reference with transcription coding Bogdan and Biklen (2003) recommend "a limited number of codes, say thirty to fifty" (p. 173).

The coding process began with the creation of a large number of codes based on survey questions, the initial open-coding during transcription, and the literature review. For example, codes related to *barriers to technology integration* were added as that theme (also identified in the literature review) emerged early from the first focus group. Similarly, the term *confidence* was used as a primary code because of its relevance to Research Question 2, but sub-codes (practicum experience, other teachers, content methods course) were included to indicate the source of the participants' confidence. Also during the first round of coding, memos were attached to excerpts that may have more to offer than a code value. The first round of coding yielded 122 excerpts from focus group one and 61 excerpts from focus group two.

Once the first round of review and coding was complete, a peer reviewer evaluated the coding for consistency in code application. Following the peer review, the researcher conducted a second review of the coding which allowed for the combination of some codes and clarity for other codes.

Trustworthiness / validity. In order to maximize the trustworthiness of the study, it is important to triangulate the data. "Triangulation involves checking information that has been collected from different sources or methods for consistency of evidence across sources of data" (Mertens, 2013, p. 258). In the study, the survey responses for the focus group members were reviewed along with their focus group responses allowing for a triangulation of their responses from two different sources. This comparison of responses from the survey with responses from the focus group ensured consistency within the respondents' reporting of their experience. There were also two opportunities for the focus group participants to interact with the data. In addition to the member checking mentioned previously, they also provided feedback on the findings. Miles et al. (p. 310, 2014) recommend feedback "at a higher level of inference … on interpretive conclusions." Once the findings of the study were identified, each of the focus group participants had an opportunity to review them and provide feedback. This increased credibility in the presentation of the results.

Limitations. There are several considerations that must be transparent as the results of the study are reported. They are specific to the expectations that the school district has for its teachers. As described by Hew and Brush (2007), first order barriers to technology and 21st century skills integration have been removed by this school district through the one-to-one laptop program and technology-rich classrooms. In practice, the teachers did not have equitable technology-rich classrooms as noted in chapter four. Second, the district was human resource

rich with site-based instructional technology support and instructional coaches to support first-year teachers. This allowed for additional professional growth during the first-year of teaching. Third, the CAEP-, NCATE-, SACS-, and TEAC- accreditation o`f the colleges and universities created an expectation of quality teacher preparation for these first-year teachers. Because the study used a convenience sample, there were teachers who did not attend an accredited institution for teacher preparation, but instead attained provisional licensure prior to their first-year of teaching.

There were also delimitations with regard to the sample. Delimitations are elements within the study that the researcher can control, but has chosen in order to narrow the scope of the study. In order to restrict the scope of the study, the researcher made some decisions to narrow the sample. The school district had 104 first-year teachers at the high school level. However, the sample for the focus group was narrowed to a minimum of four, maximum of ten teachers to comply with the recommendation for focus groups from Mertens (2013). This was accomplished organically as only six respondents agreed to focus group participation.

Another delimitation is that the teachers do not all teach the same subject. While the researcher could control for this, in order to collect data more broadly in other areas, this was not feasible. Different content areas have differing levels of ability to integrate technology into the curriculum and different approaches to 21st century skills' integration.

Finally, there were some limitations in the study. The generalizability of the study is limited to school districts with the very specific programming of the study district. In addition, the use of the perceptions of the participants about their pre-service training at the conclusion of the first-year creates a time lapse that was noted. The researcher's previous experience with

hiring and supervising first-year teachers in the district required continued attention to the objective collection and reporting of data.

Summary

Incorporating both survey and focus group interviews in this mixed method study provided a basic framework for the study, as well as an in-depth understanding of the participants experience and perceptions. The study was designed to identify the methods of teacher preparation in the areas of technology integration and 21st century teaching and learning, and their impact on the confidence level and perceived efficacy of the first-year teacher. The mixed method study is a pragmatic approach to answering the identified research questions.

Chapter 4. Presentation of Findings

As stated in Chapter 1, the purpose of the study was to understand the effectiveness of teacher pre-service programs for preparing teachers to teach 21st century skills in technology-rich public high school classrooms containing a one-to-one laptop to student ratio. Surveys were conducted with 29 first-year high school teachers, followed by focus groups with six teachers who completed the survey at the end of their first-year of teaching. The survey and focus group questions were guided by these questions:

1. What types of teacher preparation models did participants experience?
2. What are participants' perceptions of their preparedness and confidence based on their pre-service teacher education?
3. Do relationships exist between teacher preparation models and teacher perceptions of effectiveness and adequacy?

This chapter presents the findings of the survey and focus group interviews. The findings were developed by analyzing the survey using Microsoft Excel 2010 and SPSS Statistics 23, and the focus group interviews using a CAQDAS web-based software, Dedoose 6.2.10, that allowed for themes to emerge naturally based on the teachers' comments. The first part of the chapter includes the data collection process and analysis from the survey. Results of the survey are presented in text and tabular form. The second part of the chapter includes the coding and analysis of the focus group interviews. And because the researcher is the ultimate instrument for a qualitative study -- understanding the process for creating a coding system, identifying

emerging themes, and delineating relationships among those themes – the chapter concludes with an understanding of the connection between the survey and focus group data, as well as a summary of the findings of the study.

Phase One: Survey

Data collection. The first component of the study was a survey of first-year high school teachers in technology-rich classrooms. The school division chosen for the study had a one-to-one laptop initiative and a professional development program committed to 21st century skill development. The division's research and planning department distributed via email the study protocol, participant letter and online survey to 104 first-year teachers. Of the initial 104 teachers emailed, 19 teachers completed the online survey via Survey Monkey within the first week. In order to get a more robust sample, the researcher requested, and the research and planning department sent, a follow-up email one week later. An additional 10 teachers responded, for a total of 29 survey participants.

Data analysis. The online survey (Appendix B) was divided into five components, each on an individual page. The first page (introduction) provided an overview of the study. The second page contained three questions about teacher demographics. The third page contained five questions about their teacher education program. The fourth page contained three questions about technology in the first-year classroom. The fifth page discussed next steps, including their interest in participating in a follow-up focus group.

The 29 respondents were identified, when necessary, based on their order of response to the survey. Respondents 12 and 28 provided incomplete data and were removed from the sample of survey participants. While, the survey contained yielded statistics on the 27 complete

responses, there were no statistics available on the overall convenience sample by research and planning, so the first point of measurement is at the survey participant level.

Teacher demographics. The survey allowed for the collection of some demographic information about the respondents. Survey questions two and three asked for information about their gender and age. Of the 27 complete survey respondents, 59.3% were female and 40.7% were male.

Their age range was reported using the digital native standard coined by Prensky in 2001. By that standard, 77.8% of the survey respondents were digital natives born after 1980, while 22.2% of the respondents were digital immigrants born prior to 1980.

The 27 respondents were all high school teachers; however, their content area varied. Survey question one asked "what was the primary subject area that you taught during the 2014-2015 school year (ex. Algebra 1, World History 1)?" This was converted to broad curriculum areas as shown in Table 6. The largest group (22.2%) of teachers taught science and the smallest groups (7.4%) of teachers taught exceptional education and health/PE.

Table 6

Frequency of Content Areas Taught by Survey Respondents

Content Area	No. Teachers	Percentage
Science	6	22.2%
Math	5	18.5%
English	4	14.8%
Social Studies	4	14.8%
World Languages	4	14.8%
Exceptional Education	2	7.4%
Health/PE	2	7.4%

Teacher education programs. The next set of survey questions delved into the specifics of their teacher education programs. Question 4 asked "at what college / university did you

receive your primary teacher education preparation?" Table 7 shows the number of teachers from each of the college and university teacher education programs. Of the programs represented, eight were NCATE-accredited, three were TEAC-accredited and two were SACS-accredited. There were 13 unique institutions from the Commonwealth of Virginia represented. Four of the institutions represented were not located in Virginia.

Table 7

Colleges Attended by Survey Participants

College / University	No. Teachers
College of William and Mary	1
George Mason University	1
James Madison University	3
Mary Baldwin College	1
Old Dominion University	1
Radford University	1
Regent University	2
University of Richmond	2
University of Virginia	1
VCU	5
Virginia Community College System - Career Switchers	2
Virginia State University	1
Virginia Tech	1
Non – Virginia	4

There was also diversity in the road to teacher licensure for the survey respondents. Survey question five asked "What route did you use to attain teacher licensure?"

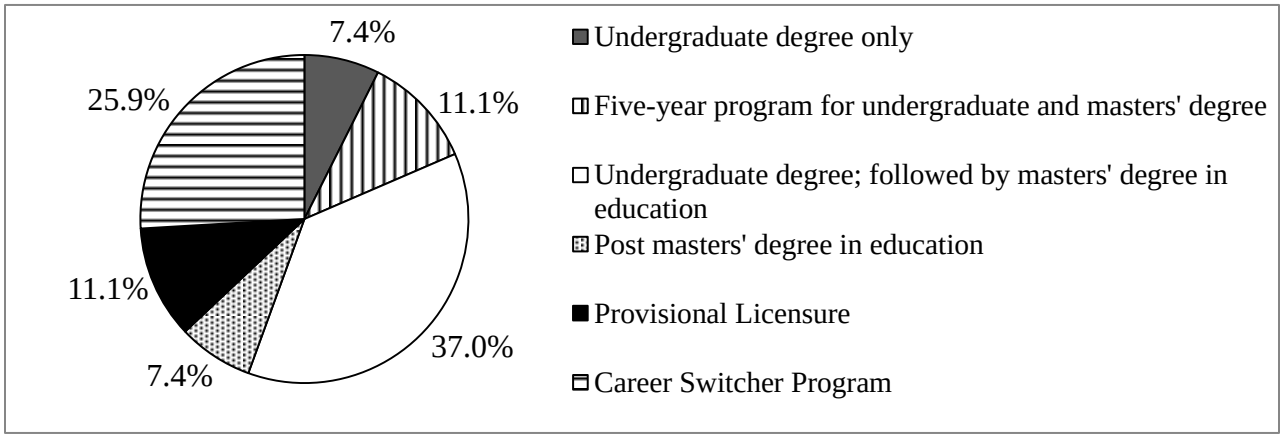

Figure 2. Type of teacher education program for survey respondents.

Figure 2 displays the type of teacher education programs experienced by the survey respondents. Of the 27 respondents, 48.1% earned a masters' degree in education. Of this group, three teachers completed a five-year program for undergraduate and masters' degrees and ten teachers completed a separate undergraduate degree followed by a masters' degree in education. Two of the respondents only had an undergraduate degree. Three of the respondents were provisionally licensed, having not yet completed a full, accredited licensure program. Finally, 25.9% of the first-year teachers completed a formal career switcher program to gain licensure.

Research question one addresses the types of teacher preparation models that participants experienced in terms of technological, content and pedagogical knowledge. In the survey, questions six through eight asked questions about the types of courses pre-service teachers experienced and about specific industry standards (ISTE and TPCK) that deal with technology and 21st century skills integration.

Based on the survey responses to question six represented in Table 8, sixteen teachers took a content methods course that included technology strategies. This type of course would address the three knowledge components (technological, pedagogical, and content) for instruction described in Mishra and Koehler's TPCK framework (Figure 1).

Table 8

Type of Teacher Preparation Models for Survey Participants

Type of Teacher Preparation Models	No. Teachers
Content methods course that included instructional technology strategies	16
Stand-alone instructional technology course	14
Practicum placement in a technology-rich classroom	11
Online course during my undergraduate or graduate program	7
Student teaching placement in a technology-rich classroom	6
Other	2

The stand-alone instructional technology course that 14 teachers reported taking would address the instructional technology and 21st century skills based on the ISTE standards (Table 1).

The teachers were also asked about their exposure to two industry standards related to instructional technology – ISTE standards and the TPCK framework. While 59.3% of the teachers surveyed took pre-service courses that were designed to present the ideas related to the TPCK construct, when asked if they had been exposed to TPCK standards, only 40.7% of the teacher reported learning about the TPCK framework. Additionally, 23 teachers took either the stand-alone instructional technology course (14 teachers) or the content methods course with technology (16 teachers). Yet, only five teachers reported learning about the ISTE standards that are the benchmark for technology integration for education.

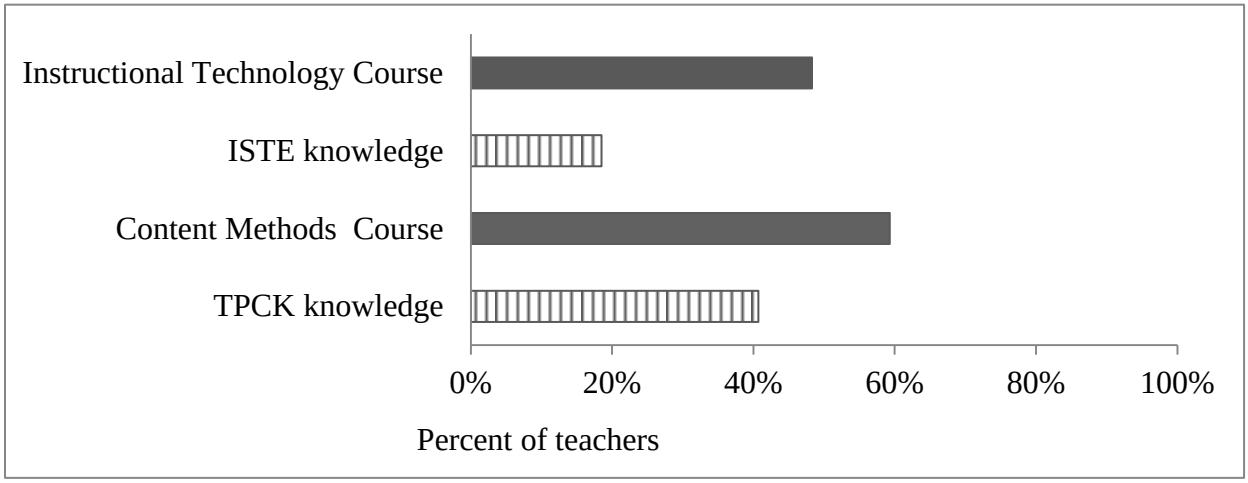

Figure 3. Preservice teachers' exposure to ISTE Standards and TPCK framework while taking stand-alone instructional technology and content methods courses.

Figure 3 shows that the first-year high school teachers had a greater exposure to the broad TPCK framework (40.7%) for technology integration than the specific standards developed by ISTE (18.5%). However 16 teachers reported exposure to neither TPCK, nor ISTE. This indicates that despite the fact that 85.2% of the teachers had teacher preparation models that

focused on technology, pedagogy and content, 59.3% of teachers had no direct exposure to technology integration based on the ISTE standards or TPCK framework.

Because research question one asked about the types of teacher preparation models that participants experienced in terms of technological, content and pedagogical knowledge, the survey allowed for a comparison of types of courses and relevant technology and 21st century skills instruction. In the sample of teachers taking related course work, only 7 of 23 (30.4%) received training on the industry standards (ISTE, TPCK) for technology and 21st century skills integration. For the full sample, 11 of 27 (40.4%) received on the industry standards (ISTE, TPCK). This indicates that four of the pre-service teachers were exposed to ISTE and TPCK outside of the stand-alone technology and content methods courses.

Technology in the first-year classroom. Teachers were also asked about the availability and their use of specific tools in their technology-rich-classrooms. Figure 4 shows the availability of technology in the full sample of first-year teachers. All teachers reported having the one-to-one student laptop ratio. While a division-wide learning management system (LMS) was available, only 26 teachers reported having it available. The other pervasive tool was some type of projection device for 25 of the teachers. More than half (15 teachers) reported the availability of an interactive whiteboard and almost half (13 teachers) utilized a BYOD policy in their classrooms. The survey asked about clickers and responders. Data collected in the focus groups indicated that this was a dated product supplanted by web-based applications. The results of this question in the survey provided sufficient information to deem the classrooms as technology-rich.

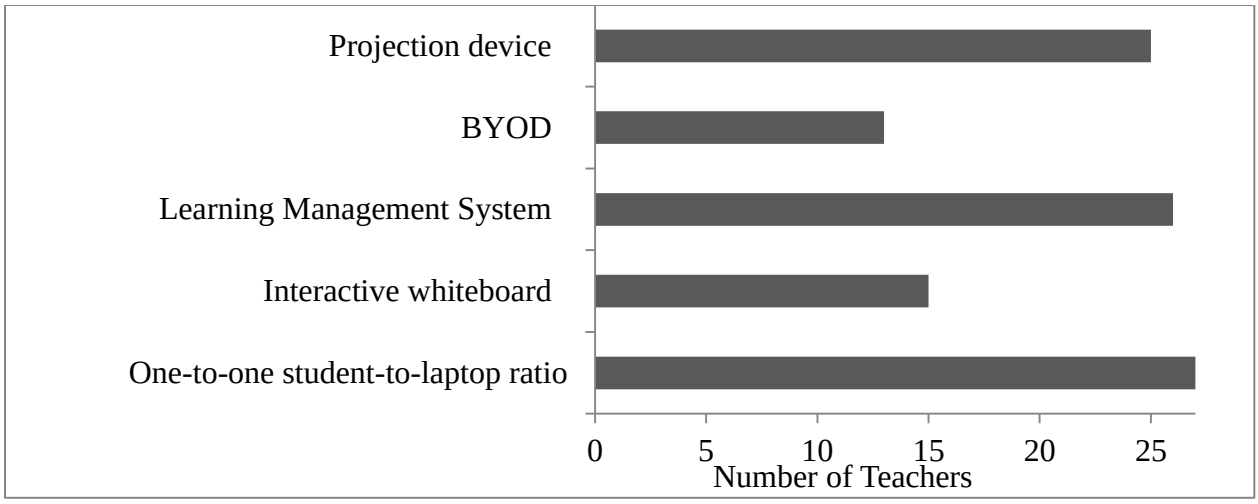

Figure 4. Types of technology available in first-year teachers' classrooms (n=27).

The next set of data (Figure 5) shows the frequency of use of the tools in the technology-rich classroom Learning management systems are use the most by the first-year teachers (daily – 23, weekly – 3, monthly – 1). The interactive whiteboard is never used by 13 teachers. However, 12 teachers reported that they did not even have access to them. A closer examination of the individual responses indicated that in fact, one teacher had an interactive whiteboard, but reported never using it.

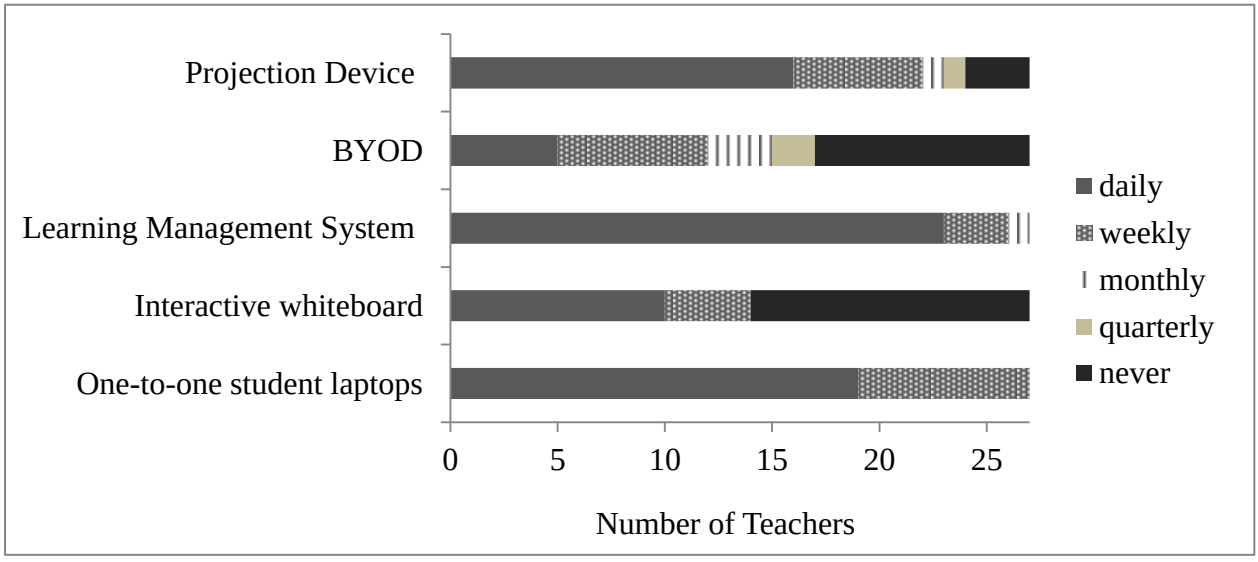

Figure 5. Frequency of use of available technology in first-year teachers' classrooms (n=27).

The final item about technology in the first-year teacher's classroom focused on their confidence for using specific tools in the classroom. It stated "I received adequate preparation through my teacher preparation program for using the following instructional technology tools in the classroom" and asked teachers to respond using a Likert scale. Figure 6 shows the results of this survey item.

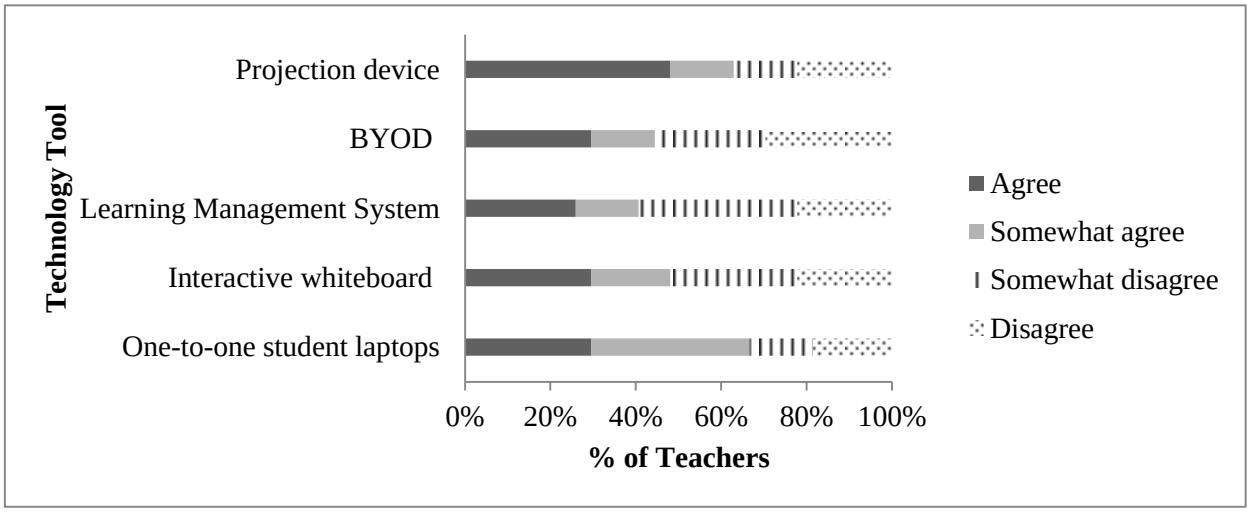

Figure 6. Teachers' perception of their preparedness to use available technology in the first-year teachers' classrooms.

The first-year teachers indicated the greatest level of preparation for the usage of student laptops (18 teachers strongly agreed or agreed) and projection devices (17 teachers strongly agreed or agreed). They felt the least prepared to use the learning management system with only 11 teachers strongly agreeing or agreeing.

Survey findings. The data collected in the initial survey were intended primarily to inform the analysis of the focus groups in phase two. Findings were largely noted in the previous data analysis. However, survey items 6-11 allowed for a deeper analysis of the type of preparation pre-service teachers received and their perceptions of preparedness to use technology in the technology-rich classroom. Specifically, there was one component of the survey that directly informed the research questions. Research question two asked about teachers'

perceptions concerning their pre-service teacher education program and its impact on their preparedness to teach effectively in the technology-rich classroom. Based on their responses, 66.7% of teachers felt prepared to use student laptops; 63.0% of teachers felt prepared to use projection devices; 48.1% of teachers felt prepared to use interactive whiteboards; 44.4% of teachers felt prepared to use projection devices; and 40.7% felt prepared to use a learning management system. While this does not get at the deeper understanding of their preparedness to use these tools to teach 21st century skills, the focus group protocol provides an opportunity for a more in depth investigation of the research questions.

Phase Two: Focus Group

Data collection process. Respondents were asked in question 12 of the survey from phase one if they would be willing to participate in a follow-up focus group about the topic of teacher preparation for the technology-rich classroom. These respondents were identified for the focus groups, reporting to one of two sessions that worked based on their schedule and location. Both focus groups were held after a full day of instruction and lasted 70 minutes and 44 minutes respectively.

At the beginning of each focus group, three recording devices were set up – two audio and one video. Prior to each focus group, the researcher provided a copy of the Teacher Innovation Progression-Chart (Appendix A) and the Focus Group Protocol (Appendix E) for their reference. Each of the participants signed and submitted a Consent Agreement (Appendix D). The researcher read to the participants the Focus Group Protocol (Appendix E) which included information about keeping their information anonymous. During each of the focus groups, the participants had a good rapport with each other and respected each other's time on the floor. In the first focus group, all recipients provided substantial responses. In the second

focus group, one of the participants had a stronger command of the group dynamic which will be noted in the analysis. At the end of the focus group, the recordings were immediately downloaded from the Audacity software on the laptop and the SD cards of the other audio and video recorders to prepare for transcription.

Participant make-up. Each of the focus group participants participated in an online survey (Appendix B) prior to their interviews. Thirteen survey respondents indicated that they were interested in participating in a follow-up focus group. The teachers from this group were from across the district. While thirteen survey participants were invited to focus groups, seven teachers initially accepted, but one bowed out for a professional conflict. Six first-year teachers, representing three of the nine high schools in the district, participated in focus groups. All six of the teachers were from schools with significant populations of at-risk students. The teachers were provided two dates and sites for the focus groups. There were two focus groups with three teachers each. The participants were assigned a pseudonym and a number based on their response order from the initial survey. That survey also provided the data for the following descriptions of each of the participants.

Focus group one. The first participant, Walt, was an English 12 and Theater Arts teacher who attended a four-year private university and completed an accredited career switcher program. He reported that his program included a content methods course with IT strategies, a practicum placement in a technology-rich classroom, and exposure to both ISTE and TPCK standards. During his first year of teaching, he had access to student laptops, a learning management system and a projection device. He reported that he used student laptops, BYOD and the learning management system daily. He used the projection device weekly. He felt that

his teacher education program adequately prepared him to use the student laptops, but none of the other tools.

The second participant, Vera, was an English teacher who attended a four-year public university and was provisionally licensed. Born after 1980, she had taken an online course, but had not received other preparation in the areas of instructional technology, ISTE standards or TPCK methods. During her first year of teaching, her classroom was equipped with student laptops, an interactive whiteboard, a learning management system, BYOD processes and a projection device. She reported using the laptops, learning management system, projection device and BYOD processes daily, but the interactive whiteboard only weekly. She felt that her teacher education program somewhat prepared her to use the student laptops, learning management system, BYOD, projection device and interactive whiteboard.

The third participant, Abby, was a Spanish teacher born after 1980 who attended a four-year public university. She attained a bachelor's degree in education. In her teacher education program, she took a content methods course that included instructional technology, and had student teaching and practicum placements in technology-rich classrooms. She reported that she learned about the TPCK model, but not the ISTE standards. In her first-year classroom, she had access to the one-to-one student laptop program, a learning management system, a projection device and BYOD. She reported using the student laptops, projection devices and learning management system daily. She used BYOD weekly, but never used an interactive whiteboard. She believed that she was prepared for using an interactive whiteboard, projection devices and BYOD. She believed that her teacher education program somewhat prepared her to use a one-to-one laptop program and learning management system.

Focus group two. The first participant, Jack, was an earth science teacher in exceptional education born after 1980 who attended a public four-year university and was provisionally licensed based on his undergraduate course work and initial course-work in exceptional education. He took a stand-alone technology course but was not exposed to ISTE standards or the TPCK model of technology integration. In his first year, he had access to student laptops, an interactive whiteboard, a learning management system, and a projection device. He reported using those items daily, but never used clickers or a BYOD system. He agreed that he had adequate training to use student laptops, the learning management system and the projection device, but did not have adequate training to use the interactive whiteboard, clickers, or a BYOD system.

The second participant Erica was a biology teacher born after 1980 who attended a public four-year university and received a master's degree in education. Her teacher education program included a stand-alone instructional technology course, a content methods course that included instructional technology strategies, a practicum placement in a technology-rich classroom, and an online course. However, she did not report learning about ISTE standards or the TPCK model of technology integration. She reported having access to the one-to-one student-to-laptop initiative, a Learning Management System and a Projection device (LCD projector, document camera, etc.). She also reported that she utilized a BYOD system in her classroom. During her first year, she used laptops, the learning management system, a projection device, and BYOD system daily. She never used an interactive whiteboard or clickers. She believed that she received adequate training during her teacher education program to implement the use of student laptops, the learning management system, and projection devices. She did not feel prepared to use an interactive whiteboard or a responder/clicker system.

The third participant, Molly, was an English exceptional education teacher born after 1980 who attended a four-year public university and received a master's degree in education. Her teacher education program included a stand-alone instructional technology course and an online course. Her student teaching was in a Montessori classroom with no technology. She was not exposed to ISTE standards or the TPCK model of technology integration during her teacher education program. In her first-year classroom, she had access to student laptops, an interactive whiteboard, a learning management system, projection device, clickers and a BYOD system. She felt that her teacher education program prepared her to use student laptops, an interactive whiteboard, a learning management system, projection device, and a BYOD system, but not the clicker.

Table 9 provides a side by side comparison of the focus group participants' survey responses. A quick review shows that the focus groups contained representation from core curriculum, elective, and exceptional education teachers. They had a diverse range of teacher education from traditional undergraduate work with or without masters' programs to the alternative path of a career switcher program. Two teachers (Erica and Abby) noted the greatest number of teacher preparation courses geared toward 21st century teaching and learning based on the information from the literature review. All of the teachers indicated that if a specific technology tool was available in their classroom, they used it daily or weekly. Ninety percent (27/30) of the time, the teachers reported that they were prepared to use those tools in the classroom. The following analysis of their focus group responses further shows how their teacher preparation translated into their first-year classroom.

Table 9

Summary of Survey Responses of Focus Group Participants

Participant		**Walt**	**Vera**	**Abby**	**Jack**	**Erica**	**Molly**
Focus Group		1	1	1	2	2	2
Content Taught		English	English	World Languages	Science	Science, Exceptional Education	English, Exceptional Education
Teacher Education Program		Career Switcher Program	Career Switcher Program	Bachelor's degree in education	Undergraduate degree; followed by masters' degree in education	Undergraduate degree; followed by masters' degree in education	Undergraduate degree; followed by masters' degree in education
Preservice Instructional Technology Experience	Stand-alone Instructional Technology Course				Yes	Yes	Yes
	Content Methods course	Yes		Yes		Yes	
	Student Teaching			Yes		Yes	
	Practicum	Yes		Yes		Yes	
	Online course		Yes			Yes	Yes
	TPCK			Yes		Yes	
	ISTE					Yes	
Technology tool • **Available?** • **Frequency of Use?** • **Prepared for Use?**	One-to-one student-to-laptop ratio	• Yes • Daily • Somewhat agree	• Yes • Daily • Somewhat agree	• Yes • Daily • Somewhat Agree	• Yes • Daily • Agree	• Yes • Daily • Somewhat agree	• Yes • Daily • Agree
	Interactive whiteboard	• No • Never • Somewhat disagree	• Yes • Weekly • Somewhat agree	• No • Never • Agree	• Yes • Daily • Somewhat disagree	• No • Never • Somewhat disagree	• Yes • Daily • Agree
	Learning Management System	• Yes • Daily • Somewhat agree	• Yes • Daily • Somewhat agree	• Yes • Daily • Somewhat agree	• Yes • Daily • Somewhat agree	• Yes • Daily • Agree	• Yes • Daily • Agree
	BYOD	• Yes • Daily • Somewhat agree	• Yes • Daily • Somewhat agree	• Yes • Weekly • Agree	• No • Never • Disagree	• Yes • Daily • Agree	• Yes • Weekly • Agree
	Projection device	• Yes • Weekly • Somewhat disagree	• Yes • Daily • Somewhat agree	• Yes • Daily • Agree	• Yes • Daily • Somewhat agree	• Yes • Daily • Agree	• Yes • Daily • Agree

Data analysis. The focus group protocol contained two major components. Part one addressed instruction related to technology as a tool in their teacher education program and its impact on their confidence in their first year of teaching. Part two addressed instruction related to 21st century skills in their teacher education program and its impact on their confidence in their first year of teaching.

After reviewing the focus group responses, teachers in this study highlighted several issues or themes that were best categorized by using themes from the literature, such as TPCK, 21st century skills, and barriers to technology integration, but also that dovetail nicely with focus areas within the research questions, such as confidence and efficacy. For this reason, the results from the analysis of the transcripts are presented in both tabular and written form, and organized according to the research questions.

Identifying quotations. Using the CAQDAS, Dedoose 6.2.10, the researcher entered and re-read both transcripts of both focus groups. The researcher then identified quotations (or excerpts) that matched the initial set of codes established. As the researcher progressed through both pieces of media, additional codes were identified that also provided insight on the research questions. The first piece of media, focus group one, yielded 121 excerpts and the second, focus group two, yielded 66 excerpts. These excerpts were coded using the codes in Table 10.

Analyzing codes for consistency and accuracy. Once the codes were assigned, the researcher exported all excerpts sorted by each of the 35 unique codes. "Whether codes are prespecified or developed along the way, clear operational definition are dispensable so they can be applied consistently by a single researcher over time" (Miles et al., 2014, p. 84). This additional review ensured that all of the codes had a defined, consistent, and accurate application to each of the excerpts within the coding group. Finally, a peer reviewer checked the excerpts and codes for consistent application throughout the transcription.

Table 10

Codes Used to Analyze the Transcription of the Focus Group Interviews

Code assigned to participant quotation	Description and relevance to literature review, participant survey and research questions
21st C - Communication / collaboration 21st C - Critical Thinking / Problem Solving 21st C - Research / info fluency 21st C - Creativity / innovation	Addressed the components of the TIP-Chart (Appendix A) that guided 21st century skill integration in the district.
Barrier - Lack of / limited access to technology Barrier - Lack of time for implementation Barrier - Lack of training	Addressed barriers to the integration of technology in the classroom identified in the literature review.
Confidence - Content methods course Confidence - Online class Confidence - Other teachers/on the job training/professional support Confidence - Practicum placement Confidence - Stand-alone IT course Confidence - Student teaching	Complemented the participant survey questions about preparedness for the technology-rich classroom.
Confidence – Undergrad Lack of confidence Lack of knowledge about the integration of technology	Addressed the confidence component of research question two.
Google suite H21 - professional development Improved during 1st year of teaching ITRT - professional development Lit review Prepped for technology-rich classroom Student engagement Tech-rich classroom Tech rich pre-service classroom	Emerged during the course of reviewing the transcript and were tangential to codes developed based on literature review, research questions and participant survey.
TPCK – Content TPCK – Pedagogy TPCK – Technology	Addressed the TPCK model (Figure 1) of instructional technology developed by Mishra and Koehler.
Use/Availability – BYOD Use/Availability - Interactive whiteboard Use/Availability – Laptops Use/Availability – LMS Use/Availability - Software / apps Use/Availability – Tablets Use/Availability – Projector	Complemented the participant survey questions about preparedness for the technology-rich classroom.

Teacher Preparation Models and TPCK

Research question one asked "what types of teacher preparation models did participants experience in terms of technological knowledge, content knowledge and pedagogical knowledge?" This question was based on the TPCK model that informs technology integration in the classroom. In the initial participant survey, 40.7% of the full sample reported experience with the TPCK model or ISTE standards. Within the focus group, 2 of 6 (33.3%) reported training with respect to either the TPCK model or the ISTE standards.

Table 11

Frequency of TPCK Knowledges Reported During Teacher Preparation Models

Type of knowledge	No. of references to teacher preparation experiences
Technology (T)	8
Pedagogy (P)	8
Content (C)	1
TP (Technology / Pedagogy)	8
PC (Pedagogy /Content)	2
TC (Technology / Content)	8
TPCK	4
Lack of Technology	*9*

The focus group responses allowed for a closer examination of the teachers' experiences with these two items. The researcher conducted a cross analysis of codes. The researcher looked for any excerpts that contained any codes related to Table 8's teacher preparation models (the confidence subgroup of codes in Table 10) or the TPCK knowledges (the TPCK subgroup of codes in Table 10). This yielded 55 excerpts. The excerpts were further examined to determine if the excerpts provided a clear indication that the teachers received experience in their teacher education programs in terms of each of the TPCK knowledges. They were then coded by individual knowledges (T, P, and C), dual knowledges (TP, TC, PC) or the full range of TPCK knowledges. After that closer examination of the excerpts, only 39 examples of any combination

of TPCK knowledges surfaced. Table 11 shows the breakdown of experiences the teachers had related to the three knowledges – technology, pedagogy and content—that are part of research question one.

This showed that the teachers had a representative experience in the TPCK knowledges, noting that content was the least represented of the knowledges. This would be expected as the teachers received their content training via undergraduate coursework, not as a part of the teacher preparation models. This analysis did not show the teacher preparation model that provided the specific source of the knowledge. Table 12 breaks down the teacher preparation models by teacher and TPCK knowledge.

Table 12

Teacher Preparation Models by Teacher Producing Experiences within the TPCK Model

		Teacher Preparation Model				
TPCK Knowledge	Teacher	Content Methods	Student Teaching	Practicum	Stand Alone IT	Online
Technology (T)	Abby	✓	✓			
	Erica	✓		✓		
	Vera				✓	
Pedagogy (P)	Erica	✓				
	Vera	✓				
	Walt	✓				
Content (C)	Molly	✓				
TP	Abby	✓				✓
	Molly	✓				
	Vera	✓				
	Walt			✓		
TC	Abby	✓				
	Erica			✓		
	Molly	✓				
	Vera	✓				
	Walt	✓				
PC	Abby	✓		✓		
TPCK	Abby		✓	✓		
	Erica					

Based on the results in Table 12, it appeared that each of the teacher preparation models contributed in some way to teachers' experience. Five of the six teachers linked one or more of the TPCK knowledges to their teacher education programs. The only teacher who did not provide a specific response that linked TPCK knowledge and teacher preparation models was Jack. However, Jack was only provisionally licensed with a single course in trends in special education.

Summary. In response to research question one, "what types of teacher preparation models did participants experience in terms of technological knowledge, content knowledge, and pedagogical knowledge?" the 39 excerpts revealed the following, as represented in Table 13. Technology knowledge was part of all models; pedagogical knowledge was present in all models except online courses; and content knowledge was found in content methods courses and practical experiences of practicums and student teaching.

Table 13

Summary of Teacher Preparation Models Linked to Technology, Pedagogy and Content Knowledge

	Teacher Preparation Model				
TPCK Knowledge	Content Methods	Student Teaching	Practicum	Stand Alone IT	Online
Technology (T)	✓	✓	✓	✓	✓
Pedagogy (P)	✓	✓	✓		✓
Content (C)	✓	✓	✓		

Participants' Perceptions of Pre-service Teacher Education Programs

One of the goals of the study was to determine teachers' perceptions of their pre-service teacher education program (research question two). The initial survey of the full sample (Figure 6) indicated that first-year teachers felt the greatest level of preparedness for the usage of student laptops (66.7%) and projection devices (63.0%). They felt the least prepared to use the learning

management system (40.7%). As noted in Table 9 and summarized in Table 14, the participants of the focus group responded at a different rate than the full sample.

Table 14

Teachers Agree / Somewhat Agree That They Were Prepared to Use Technology in the First-Year Classroom

	Teachers – Agree, Somewhat Agree	
Technology Tool	Full Sample *(n=27)*	Focus Group *(n=6)*
Projection device	63.0%	83.3%
BYOD	44.4%	66.7%
Learning Management System	40.7%	83.3%
Interactive whiteboard	48.1%	50.0%
One-to-one student laptops	66.7%	100.0%

In every category, the focus group reported that they felt a greater level of preparation than the full sample. The focus groups responses allowed for a more in-depth review of teacher perceptions of their preparedness for their first year of teaching.

Research question two asked "what are participants' perceptions concerning their pre-service teacher education programs regarding (a) effectiveness to prepare them for teaching 21st century skills in technology-rich high school classrooms containing a one-to-one laptop to student ratio; and (b) facilitating feelings of efficacy and self-confidence for first-year implementation?" In order to answer research question two, there were three separate reviews of the focus group transcripts. First, to address preparedness, there was a review of codes related to teacher preparation experiences crossed with TPCK use. To further analyze their preparedness, there was a review of codes related to teacher preparation experiences crossed with codes related to 21st century skills. Finally, to determine if their programs facilitated feelings of efficacy, codes related to the use of technology were crossed with codes related to TPCK knowledge and 21st century skills. This final review provided information about how their use was informed by TPCK and 21st century skill concepts acquired prior to the first year of teaching.

Teacher education programs and TPCK use. The participant survey from phase one provided an overview of teacher preparation models and their exposure to learning around 21st century skills and technology integration. The results of the survey were intended to inform the focus group analysis. The responses for the survey indicated that only Abby and Erica were exposed to formal training related to the ISTE standards or the TPCK model. However, the focus group process allowed for a deeper discussion around their preparedness in these areas.

To identify themes about teachers' perceptions of their preparedness for teaching in the technology-rich classroom, the researcher conducted a cross analysis of codes. The TPCK model (Figure 1) is the standard for the successful integration of technological knowledge, pedagogical knowledge and content knowledge in the classroom. In the previous section, a numerical representation (Table 12) of the TPCK-related codes informed research question one. By reviewing the narrative within the codes containing both the TPCK-related codes and the teacher preparation codes, a picture of the teachers' perceptions of their preparedness to teach in the technology-rich classroom began to emerge.

By taking the data from Table 12 and the online survey, an initial picture of the relationship between the preservice teachers' exposure to formal ISTE and TPCK instruction, as well as examples of the TPCK knowledges within their teacher preparation models developed. Table 15 shows whether teachers had formal ISTE or TPCK learning in their teacher education program. It also shows if their focus group discussion yielded any information about experiences with the three TPCK knowledges during their teacher education program.

Table 15

Comparison of Survey Responses and Focus Group Experiences Based on TPCK

Type of experience reported	Walt	Abby	Vera	Molly	Jack	Erica
ISTE or TPCK learning		✓				✓
Technological (T)	✓	✓	✓			✓
Pedagogical (P)	✓		✓			✓
Content (C)				✓		
TP	✓	✓	✓	✓		
TC	✓	✓	✓			✓
PC		✓				
TPCK		✓				✓

Erica and Abby both reported knowledge of TPCK or ISTE in their initial survey. Their focus group responses reflected that they had broad exposure to the integration of technology, pedagogy and content knowledge. While Walt and Vera did not report direct knowledge of TPCK or ISTE, both shared experiences in their teacher education program that reflected the merging of technology, pedagogy and content knowledge. Molly and Jack reported the least amount of teacher preparation and lack of / limited responses in the focus group around TPCK knowledge reflects that.

So despite only 33.3% of focus group participants reporting an exposure to TPCK or ISTE in their teacher education program, the focus group responses indicated a deeper understanding of the three TPCK knowledges in practice than the participants noted in their response to the TPCK question on the survey. In fact, with the exception of Jack, their programs showed a clear incorporation of the three knowledges.

As noted in the previous section the initial cross analysis of the codes yielded 55 excerpts. Once the excerpts were further examined to determine their relevance, they were sorted by their individual knowledges (T, P, and C), dual knowledges (TP, TC, and PC), or the full TPCK model. Of the 48 relevant excerpts, nine examples also indicated a lack of confidence

based on the teacher preparation experience. Each of the excerpt narratives for the individual, dual and full TPCK knowledges was reviewed to identify any emerging themes.

Technology. Based on the focus group responses, there were seventeen experiences in the individual TPCK knowledges. In the area of technology knowledges, the participants reported using a wide variety of technology in their teacher preparation courses. They used Microsoft PowerPoint and Movie Maker with Molly noting that "the movie maker lesson was for us to prepare one as if you were a student." Erica stated that at one point in her program, "QR codes … were definitely stressed." (Quick Response codes are black and white codes that contain URL links and are readable on smart-phones. They are often used in education to spark research). In addition to these technologies, the participants also found that their teacher education programs introduced them to some organizational tools using technology. The teachers reported using Learning Management Systems -- Blackboard *as* students, Edmodo *for* students. (Blackboard is an industry leader in LMS at the university level, while Edmodo is a free web-based LMS designed for education and modeled after popular social media content). They also learned about technology-based communication programs. Abby commented that her professors utilized "different strategies like Remind 101, Google, Google docs … we used a lot of Google docs even for submitting our own work into our professors and our program director." Abby was the only participant who reported having access to interactive whiteboards, "in my school, we actually had a room that had smart boards in it."

The teachers also had experience with technology in their practical experiences (student teaching or practicums) during their teacher education program. During Walt's practical experience, he worked with a teacher who allowed students to use smart phones in class. The teacher pointed out a student using her phone, "')h this girl over here, she's typing her paper on

her phone,' and I was like 'no, she's not,' and I went and looked and that was what she was doing." While this was an independent example of technology in the practical experience, more often the technology was paired with one or more of the other TPCK knowledges.

Pedagogy. The teachers also indicated that their teacher education programs had a focus on pedagogy with eight references to individual pedagogical knowledge. One of the pedagogies centered on collaboration. Walt shared that he learned about collaboration *for* students, noting "a full module was pretty focused on collaboration and group work different ways to structure groups, grouping them – letting them pick." While Vera discussed that her collaboration *as* a student prepared her for working with students in collaborative activities.

> We definitely worked as a group in classes. We all did a big group presentation, so the teachers did some modeling for us. For me in my grad program, 95% of what we did was group work … it taught me how to deal with it for my students. Some of my students have issues with it, so I can tell them that in the real world that is how things are done. You are going to know how to deal with it because it is a skill that you are going to need.

They also reported that they worked on the pedagogy of lesson and unit planning. Walt shared that this was the biggest component of his program with "three concurrent modules on this and circled back and did three more. One was always on instruction and on backwards instructional design." And as part of the process, the program focused on the pedagogy of "using critical thinking and Bloom's taxonomy in lesson planning. They were always focused on questioning. Having students ask questions, how to ask them questions, pushing them toward the critical thinking." Other teachers noted that assessment and student choice were parts of their program. Erica noted that giving students choices was a part of her content methods course.

And Walt shared that he received instruction about "how to assess a project, giving them choice menus. It's about letting them be creative, giving them choice, creating something. It's not something they can just go and find and memorize. It's always like you're creating something."

Content. Not surprisingly, there were the fewest references (1) to content knowledge as part of the teacher education programs as that type of coursework was likely part of an undergraduate program. Instead, the focus group participants provided information about content knowledge experiences within the contexts of pedagogy/content (PC), technology/content (TC), or technology/pedagogy/content (TPC) knowledge.

Technology and pedagogy. The focus group responses also showed that the teacher education programs provided experiences (18) in two knowledges. In the area of technology and pedagogy, these experiences showed technology integration with pedagogical knowledge in the areas of classroom management, lesson planning, collaboration, LMSs, and reading. Walt liked the approach that his supervising teacher during student teaching took with cell phone usage as it was also a classroom management concern he encountered in the first-year classroom.

> The teacher who I worked with was great. She … didn't police cell phone usage all that much in her classroom. Yes, some of them were texting, some of them are whatever, but it's a distraction that you have to learn to deal with at some point.

He noted that her modeling flexibility helped him as he transitioned to the first-year classroom.

Abby discussed how her program incorporated technology with lesson planning. They had a dedicated classroom in their program that had a variety of technology tools so they could practice as they prepared their lessons. She said "you could go into this room and play with the smart board and make your lessons there. We were expected to do that, too. Smart board

obviously, taking notes on your computer, Google classroom, all those kind of things." She was very animated during her discussion of this opportunity.

Molly, who reported that her student teaching experience had a significant lack of TPCK experiences because it was in a Montessori school, shared that her course work allowed for some integration. "We used several different methods to submit assignments. They recommended different things for us to use with students." Similarly, Vera and Walt also reported that their instructors modeled technological and pedagogical integration through online work. Vera reported that she used "something like a blackboard (learning management system)" in her program. Walt discussed having an online component to many of his classes, "online classes for submitting stuff and online assignments for submitting different works for different professors, different papers, and projects."

Vera noted that she had an experience that helped her greater understand her students as they are almost solely used to reading online. When taking an online course, she stated that "I had a computer at home, but not a printer. I was obsessed with printing all the articles out so I could highlight them. And print out my paper so I could proofread it before I turned it in, but it just wasn't going to happen. So having to make that adjustment and see that everything could be done like that helped me jump more full into Google classroom." This allowed her to understand the importance of using a learning management system to organize her lessons and activities.

Technology and content. Because several of the teachers came from similar content areas, there was the ability to have a deeper discussion around technology and content. The English teachers spoke about the integration of technology and English, but also about the integration of technology and research. It was placed in the technology and content discussion

because while research may be considered a pedagogical knowledge, in the English curriculum, it is also a content knowledge.

Walt shared that he went through a career switcher program, with six different modules. "One of the modules, the methods module, the English one, I think they would encourage us to look for ways to incorporate technology." Beyond just English content, there was instruction about how to use online databases. Molly noted that "mainly because of my English content, we are naturally going to do a lot of research. Databases. I learned more about them in my teacher prep program." Whereas Vera noted that she had training in databases, but it was during her undergraduate work. She described her experience with a course in "research methods and statistics. Because of that I wrote an article that was published." Abby noted that her program provided significant training for online research. "We did a lot of work in the library within our program. They would show us this is how you get to this, this is how you access that / get to the web. We learned how to do an extended Google search." Abby also discussed how technology was integrated into her content area through apps like Duolingo. One of her courses was "solely focused pretty much on technology, implications for technology and tying it into foreign language. There was a big push for it." Erica experienced the integration of technology and content during her practicum experience. "The school system had a training at the beginning of the year so you could download the apps you needed. They had a list just for science."

Pedagogy and content. As noted above, the pedagogical knowledge around research was placed with content in the previous discussion. Because of that, there was only one additional example of pedagogical and content knowledge within the excerpts. Abby discussed how there was a great deal of collaborative learning within her program.

> For my curriculum, there were only six of us, so we were constantly working together. Outside of just my methods classes, most of my classes were collaborative – working on assignments, creating lessons, acting them out, teaching other students, modeling. There was a lot of collaboration.

Similar to the collaboration *as* students and collaboration *for* students mentioned in the section on pedagogy, Abby experienced that in her graduate program within her content classes.

Technology, pedagogy, and content. The ultimate experience during teacher preparation would show teachers how to integrate technological, pedagogical and content knowledge. The teachers shared three examples of this full integration. During Erica's practicum experience, she had an extremely positive experience in a classroom that had a grant for iPads.

> She did a lot of station activities. It was brilliant with middle schoolers, moving from one place to another using iPads effectively. She came up with a criteria for one of the best thought out projects I've ever seen about weather phenomena. They used the iPads to make movies; they had a digital bulletin board. All apps that the teacher had downloaded and prepped in advance.

The teacher used iPads and a digital bulletin board (technology), station work (pedagogy) and weather phenomena (content) to create a full and effective lesson. Similarly, Abby created a full TPCK lesson in her student teaching placement.

> We did this project where kids had to draw out a map and they had to include different features from different cities. They had to do the research about different famous buildings. Find different famous buildings and talk about them in the language, in Spanish. That was cool implementing that -- different technologies, having them do the research, finding sources other than Wikipedia.

This used online research (technology and pedagogy) in a world languages (content) lesson. Erica also shared another lesson with iPads during her student teaching experience. While she noted that they didn't use the iPad too often, "the students had a BYOD policy, so they could bring their own technology and they often did. We did a tissues (biology) lab and they were able to use their phones to take pictures. It was actually the hardest part of the lab, but they did pretty well with it." This allowed for the use of technology (iPads and BYOD), content (tissue) and pedagogy (lab experience).

Summary. The comparison of codes related to teacher preparation and TPCK knowledges provided richer insight about participants' preparedness for the technology-rich classroom. While only two of the teachers reported experience with ISTE and TPCK in the initial survey, five of the teachers provided examples in their teacher education programs that indicated they were prepared for the technology-rich classroom. In the area of technology, they reported exposure to a wide variety of software especially around communication (Google docs, remind 101, blackboard). In terms of pedagogical knowledge, the teachers noted that their programs allowed them to use collaboration skills *as* a student and *for* students. They also learned about how to use choices for assessment. Because of the nature of teacher education programs, there was any individual content instruction.

Their teacher education programs also allowed them to combine some of the knowledges. They shared experiences about classroom management, collaboration and learning management systems that integrated technological and pedagogical knowledges. There was also an 'aha moment' when one of the teachers was able to understand the how and why of integrating reading online. In the areas of technology and content, there was discussion of online research and content-related apps. Pedagogical and content knowledge were integrated through

collaboration *as* a student and *for* students. Finally, the teachers shared three examples of full TPCK integration through their student teaching and practicum experiences.

Teacher education programs and 21st century skills. Participants' perceptions of their pre-service teacher education program regarding the effectiveness to prepare them for teaching 21st century skills was also a focus of research question two. The 21st century skills used for this analysis were the four threads within the Teacher Innovation Progression Chart (Appendix A). The threads were communication and collaboration, creativity and innovation, research and information fluency, and critical thinking and problem solving. Because there was not a survey question directly related to 21st century skills' integration, the focus group interviews provided the only data for this component of the research question.

The researcher conducted a cross analysis of codes to include any excerpts with codes related to 21st century skills or the confidence subgroup noted in Table 8. This yielded 122 excerpts. The excerpts were further examined to determine if the excerpts provided a clear indication that the teachers received experience in their teacher education programs in terms of

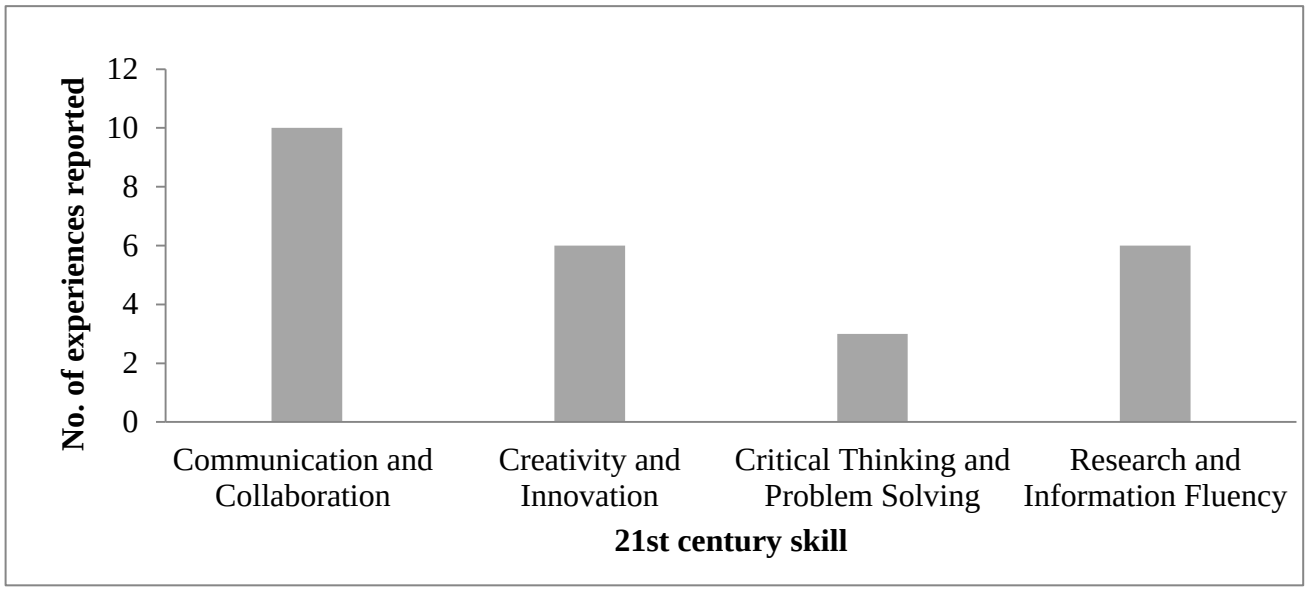

Figure 7. 21st century skill experiences reported during teacher education programs.

21st century skills. They were then coded by individual 21st century skills. After that closer

examination of the excerpts, only 25 examples surfaced of any combination of 21st century skills and confidence based on teacher preparation. Figure 7 shows the breakdown of experiences the teachers had related to the 21st century skills outlined in the TIP-Chart.

This showed that the teachers reported the most experiences related to Communication and Collaboration and the fewest experiences related to critical thinking and problem solving. This analysis did not show the teacher preparation model that provided the specific source of the knowledge. Table 16 breaks down the teacher preparation models by teacher and 21st century skill.

Table 16

Teacher Preparation Models by Teacher Producing Experiences with 21st Century Skills

		Teacher Preparation Model				
21st Century Skill	Teacher	Content Methods	Student Teaching	Practicum	Stand Alone IT	Online
Communication and Collaboration	Abby	✓	✓			✓
	Erica	✓				
	Molly		✓			
	Vera	✓				
	Walt	✓				
Creativity and Innovation	Abby	✓				
	Erica	✓		✓		
	Walt	✓				
Critical Thinking and Problem Solving	Erica	✓				
	Molly			✓		
	Walt	✓				
Research and Information Fluency	Abby	✓	✓	✓		✓
	Erica			✓		
	Molly	✓				

Table 16 shows that each of the teacher preparation models, except the stand-alone IT course, contributed to experiences with 21st century skills. Five of the six teachers linked one or more of the 21st century skills to their teacher education programs. The only teacher who did not provide a specific response that linked 21st century skills and teacher preparation models was

Jack. However, Jack was only provisionally licensed with a single course in trends in special education. The content methods courses provided the broadest range of experiences with five teachers experiencing one or more of the 21st skills. The practical experiences (student teaching and practicum) allowed three teachers (Abby, Erica and Molly) to experience 21st century skill integration. It should also be noted that only four teachers had practical experiences. Walt was the only teacher with a practical experience that did not report 21st century skill instruction. The focus group responses allowed for elaboration on the specific experiences that the participants had in relation to 21st century skill integration.

Communication and collaboration. According to the TIP-chart (Appendix A), "students should communicate and collaborate ethically and effectively to reach a common goal or create a product. The teacher uses a variety of communication methods, structures student interaction in groups, and engages students in collaborative projects." The teachers shared ten examples of communication and collaboration in the focus group interviews. Both Vera and Abby pointed to experiences of communication and collaboration in their online courses. Vera's experience was as a student using effective communication and proofreading, while Abby's experience was related to using online tools to collaborate with colleagues and professors. Abby also shared an experience from her methods class using collaboration with peers. "Most of my classes were collaborative – working on assignments, creating lessons, acting them out, teaching other students, modeling. Walt had a "full module (that) was pretty focused on collaboration and group work, different ways to structure groups, grouping them – letting them pick." Vera also said, "in my grad program, 95% of what we did was group work … so it taught me how to deal with it for my students." Molly cited an example from student teaching where she conducted a Socratic seminar. This allowed for structured student interaction in groups that engaged students.

> We did a Socratic seminar. They all brought a topic, or a clip, or book or a story that they want to talk about. One student opens the floor and asks a question that makes them think. Everyone gets an opportunity to take a stand on it. It just turns into this fluid conversation.

In each of these experiences they were either modeling communication and collaboration through their teacher preparation coursework, or they were applying it with students in their practical experiences.

Creativity and innovation. The TIP-chart states that "in the 21st Century classroom, students develop original ideas and create products by applying critical thinking, research methods, communication tools, and collaborative processes. Teachers provide experiences that allow students to create unique ideas and products." In the focus groups, this concept provided an animated point of discussion for participants as they described projects from their teacher education program or later implemented in the first-year classroom. The teachers shared six experiences reflecting two general themes: creating a unique product and allowing for student choice. Abby discussed an experience based in knowledge gained in her content methods course and applied in her first-year classroom where students were able to be creative and have choices.

> I always give projects because I want to see kids succeed. I want students to see and use language with a creative eye. The art and stuff. The project we just did for Spanish 3, they had to give advice on something, create a project and present it. They created physical models (posters, paintings, I had a kid do a video game). They had to show that they did it on their own and it was authentic and I could tell that they didn't use Google translate. I had a kid make a spaceship. One kid did a sketch book. Giving them the leeway to do whatever method they wanted.

Walt shared a similar experience, noting that he "got a lot of instruction about it. How to assess project, giving them choice menus. I always try to do choices." This translated directly to his first-year classroom. He taught seniors, but wanted to use some alternate assessments, noting that "I've only given like two tests and two quizzes. It's about letting them be creative, giving them choice, creating something. It's not something they can just go and find and memorize. It's always like you're creating something." Also, Walt created a project based on the Canterbury Tales renamed for his school. The students needed to create a character that would navigate the social groups and experiences of his high school. "Even the (School) Tales which is the least "choicy" one, because they just had to write … that was still allowing them to pick the character. They couldn't go out and find it. Everything I do is geared toward that." This exemplified the 21st century skill as it allowed students to create a unique product using collaboration, communication and research.

Erica had exposure to this 21st century skill in both her content methods courses and her practicum experience. She received instruction on differentiation that taught her how to show students to "to apply what they know about real world situations and create something that they could show off. By creating they are proving that they know the information, they aren't just regurgitating the information." As noted earlier, she had a positive experience with a station activity in her practicum placement. In this activity, the supervising teacher created a project where students could chose a station to create a product around weather phenomena. The teacher created station where the students used "iPads to make movies, they had a digital bulletin board. All apps that the teacher had downloaded and prepped in advance." Erica felt strongly about the influence of her practicum placement noting "I got a lot of ideas from my practicum teacher." The choices, unique product, and real world applications described by Erica indicated that she

had exposure to this 21st century skill during her teacher education program.

Critical thinking and problem solving. For this 21st century skill, "students will extend knowledge and skills in practical ways to solve real world problems. The teacher provides the activities, experiences, and feedback needed for students to develop questioning, critical thinking and problem solving skills." Erica noted that "we did inquiry training in my teacher prep program, so I was pretty confident coming in" to incorporate critical thinking and problem solving skills. Two teachers shared three experiences directly related to this 21st century skill. As noted earlier, Molly utilized a Socratic seminar that she learned about in her practicum experience. She allowed a student to open "the floor and asks a question that makes them think. Everyone gets an opportunity to take a stand on it. It just turns into this fluid conversation. That's definitely a critical thinking skill."

Walt experienced this on the most foundational level with instruction on "critical thinking and Bloom's taxonomy in lesson planning." He noted that his "program did a great job" as "they were always focused on questioning. Having students ask questions, how to ask them questions, pushing them toward the critical thinking." Walt was very animated about how this translated into his classroom. He was beginning Canterbury Tales and his discussion with his students morphed into a project that allowed for real world applications.

> The students were very critical of the characters and one of them said "that sounds like (our School)," so I had them write their own version of the (School) Tales. They were all stuck in Saturday ALC together, kind of like the Breakfast Club. They all had to pick a character type – the jock, the nerd, whatever –write a description and what kind of story would this tell. What kind of view would they have of (our School), the way they did in Canterbury tales. It made it real life to

> them instead of a slice of life in Old England. We are doing the same thing now with Jane Austen's Emma and Clueless. Don't you see how it's the same, how we are no different from them?

Both Walt and Molly took information from their teacher education programs and translated it into actual lessons in their first-year classroom.

Research and information fluency. Participants in the focus groups shared six experiences, where "students find, navigate through, and evaluate large amounts of information. Teachers provide guided and independent research opportunities for students to make informed, ethical decisions and create products." Vera, Molly and Abby all noted that they learned about this skill in their content methods courses. Vera "took a course in research methods and statistics." Those skills translated directly into her senior English class where they were "working on research now and the different technology." The students used a free bibliography website called EasyBib that allowed for research and citations in multiple formats including MLA and APA. While she was not exposed to the specific website during her preparation program, the concepts were similar, but on a student level. She noted that "using that program to help them with research makes that so much easier for them and for us because the research can all be done within the EasyBib format."

Molly also used citations for MLA format. "It's a lot easier because I teach exceptional education. It's better for them to enter something and then to go back and check it." While these experiences were not directly linked by codes to a specific teacher preparation model, the participants clearly had developed a knowledge base on research and information fluency that they applied to the first-year classroom.

As noted during the earlier *pedagogy and content* discussion, several teachers learned research skills in their content methods courses. Molly was exposed to databases in her teacher education program "mainly because of (her) English content. Abby learned about extended Google searches and library skills even though she has not "used it that much because (her) class isn't that research-based." And Abby had a project during her practicum where students researched famous buildings.

> Kids had to draw out a map and they had to include different features from different cities. They had to do the research about different famous buildings. Find different famous buildings and talk about them in the language, in Spanish. That was cool implementing that -- different technologies, having them do the research, finding sources other than Wikipedia.

There was also a lively discussion about information fluency and appropriate sources with the second focus group. Jack shared that in his science classroom he "makes sure they only use two to three websites. We discourage Wikipedia. We try to stay on top of that." Erica countered that she wants her students to make informed decisions.

> Wikipedia is not the devil. They can find other links. It's a great tool for finding better sources because they often have citations. I used it more in AP (Environmental Science) because they had to cite everything APA style. We had a discussion about scientific literature vs. stuff coming from government vs. stuff coming from somebody's homepage. We used Purdue OWL, not Citation Machine. I taught them to do it themselves.

Summary. The focus group participants did not provide any information in the survey or in the subsequent interviews to indicate that they had received formal training during their

teacher education programs on 21st century skills as defined by the Teacher Innovation Progression-Chart. However, their discussions indicated that not only did they have training related to 21st century skills, but it translated to their first-year classrooms. In the area of collaboration and communication, the teachers noted that their learning about collaboration *as* students and *for* students informed their use of collaborative groups in the classroom. The projects that the teachers described using creativity and innovation were directly sourced from methods classes that taught them how to differentiate instruction and provide choices for students. They also took lessons from their supervising teachers in practicum and student teaching about how to design projects that allow students to create unique products. In the area of critical thinking and problem solving, the participants pointed to how they pushed students to think about real world issues. Finally, only three of six teachers provided a direct link (Table 16) between research and information fluency and their preparation program. However, all six participants pointed to application of that 21st century skill in their first-year classroom.

Teacher education programs and first-year implementation. The final component of research question two asked about teacher perceptions of their preservice teacher education and feelings of efficacy and confidence in the first-year classroom. The earlier discussions about TPCK and 21st century skills provided a glimpse at their teacher education programs' impact on implementation in the first-year classroom. There were also items in the initial survey and codes from the focus groups that provided insight.

Figure 5 showed that 100% of teachers in the initial survey sample used student laptops daily or weekly; and 96.3 % of teachers used a learning management system daily weekly. From there, usage varied based on the availability of the tool in the classroom. Table 14 analyzed how prepared the full sample and focus group were to use technology in the first-year classroom. For

the full sample, 40.7% to 66.7% of the teachers felt ready to use specific tools in the classroom. For the focus group, 50% to 100% of the teacher felt ready to use specific tools. There were not appropriate variables that allowed for any correlation between teacher preparation models and their preparedness to use technology in the first-year classroom.

And while technology tools not are the sole indicator of TPCK and 21st century skill implementation in the first-year classroom, the focus group coding related to technology tools allowed for a better picture of first-year implementation. As such, the researcher crossed codes related to teacher confidence with those related to the availability and use of tools in the first-year classroom. There were 55 instances of technology use in the first-year classroom (Table 17) from the 41 excerpts that showed a cross coding between technology use and teacher preparation models. Also included in the analysis were nine stand-alone excerpts related to confidence and preparedness for the first-year classroom.

Table 17

Technology Use in the First-Year Classroom by Type of Technology

Type of Technology	No. of references to teacher preparation experiences
Laptops	11
Interactive whiteboards	6
Learning management system	8
BYOD	4
Projection devices	3
Software / applications	13
Tablets	2
Lack of training / confidence	*8*

The cross analysis also allowed for a review of teacher preparation models that may have had an impact on technology use in the first-year classroom. Table 18 breaks down the models and usage by teacher. Four of the six teachers directly linked their usage of technology in the first-year classroom to one of their teacher preparation models. In earlier discussions about TPCK

and 21st century skills, the content methods courses were most frequently linked to confidence for teachers. In this case the practical experiences of student teaching and practicum also provided opportunities for implementation in the first-year classroom.

Table 18

Technology Use in the First-Year Classroom Linked to Teacher Preparation Models

		Teacher Preparation Model				
Technology Tool	Teacher	Content Methods	Student Teaching	Practicum	Stand Alone IT	Online Course
Laptops						
Interactive white boards	Abby	✓				
Learning management system	Erica	✓				
	Molly	✓				
	Vera					✓
BYOD	Erica			✓		
Projection devices						
Software applications	Abby			✓		
	Erica			✓	✓	
	Vera	✓				
Tablets	Abby		✓			
	Erica			✓		

Because the participants worked in a district with a one-to-one laptop program, it was not surprising that software applications (13 instances) and laptop usage (11 instances) were the most frequent usages reported in focus groups. Each of the focus group participants, except Jack, provided concrete examples of activities during their first year that reflected learning from their teacher education program. Abby, Erica, Vera and Walt provided examples where they were confident because of their teacher education, but Molly noted two examples where she was not confident in her preparation for the first-year classroom.

Abby. Abby had practicum placements each semester that were often in technology-rich classrooms. In one placement, the classes had iPads, about which she said, "I think that kind of prepared me for coming into a school with all of the kids having the available technology."

Abby described an activity during her first year that built upon a similar project about famous buildings in her practicum course. In the project, she used Google docs for student collaboration, the internet for research and student laptops to create presentations.

> One of the first projects that I gave to my Spanish 3 class was to create an art gallery for a specific artist they were studying. They had to use a Google doc and go in and type about the lives of the artist and research information about them. They had to create a gallery, talk to the other students about the gallery and present their gallery. Using different research methods, applying them, presenting.

Abby also noted that she was extremely confident in the use of the interactive whiteboard because of her teacher education program. "We did a lot of work through smart board which kind of makes me sad because I wish I had a smartboard."

Erica. Erica talked about laptop and software use during her first year in the context of student choice. She stated that her supervising teacher was "brilliant" in her development of a project using student choice during her practicum experience. This translated to her first-year classroom as Erica developed her own projects.

> I usually give them choice for their projects. I give them a list of things and there is generally a creative option. A graph, a PowerPoint, they can make a movie. But the person who is making the movie gets more points because it is more challenging than writing a poem. They can write a short story. But that's a classic component of almost all of my projects that they have to do something creative.

While this showed a general philosophy gleaned from her practicum experience, she also shared a project during her first year that utilized a 4D software app and products that students had to create after the initial research. Erica also noted in her practicum course that the school district provided a list of content related apps for teachers at the beginning of the year that were pre-loaded for their use. As Erica recounted specific examples of first-year instruction, she continued to come back to the foundation she received in her practicum class.

Molly. Despite going through a traditional education program, Molly did not feel prepared for technology in her first-year classroom. She was one of the few focus group participants to take a stand-alone instructional technology classes.

> It was called digital-something in the classroom. I'm not a tech-y person, so it was a challenge. I didn't know what I was supposed to do. We used Movie Maker. It was expected that we would already know that stuff. We did have a course, but I didn't do well because I wasn't prepared.

Her English methods course also did not prepare her. She worked with a supervisor who was very "old school. I just remember papers and hand-outs and hand-outs, never used technology. It wasn't even hand-outs as PDFs, it was stuff that he kept and copied from 1975." After that experience, her student teaching placement was in a Montessori program that did not have materials for the modern technology-rich classroom. "I didn't expect to come to a school with a one-to-one laptop ratio. We didn't focus on that."

Walt. Walt was a career switcher with multiple modules and practicum experiences. Walt discussed a project during his first year utilizing the student laptops, research tools and PowerPoint software. In his discussions, he noted that he learned about research through content methods modules.

> For our Beowulf activity, we did a research paper, as well. And because we did small, pre-research activities, like finding out about Anglo Saxons – instead of lecturing about the Anglo Saxons or doing a PowerPoint, when we got to the research paper, we were there. They already knew how to do it and to cite a source because we had practiced it.

This type of lesson planning with small pre-research activities was attributed to planning constructs from his content methods course. "I learned how important it was to have structure to the unit so that students would think critically throughout it. I knew it going in, but it doesn't always happen that way." He also pointed to his practicum teacher for his understanding of classroom management in a technology-rich classroom. "She didn't police cell phone usage all that much in her classroom … it's a distraction that you have to learn to deal with at some point."

Vera. Because she was a career switcher with a provisional license, much of what she brought to the classroom was based on her undergraduate and graduate programs. She noted that she was very comfortable using data and conducting research. "I was comfortable with it because of my prior work experience --planning and development at (graduate school). They take a lot of data from (graduate school) and spread it around the university. Because of that I felt comfortable coming in with it." That translated to projects in her first-year classroom, such as building resumés with seniors.

> Teaching them about resumés was a little difficult because they didn't feel that it was something that was necessary to have. Because right now, they are all working small jobs – fast food, car wash – something that doesn't need a resumé. Understanding they need to be successful later on in life.

She pulled on her preservice experiences as she developed activities for her first-year classroom.

Other measures of confidence. A final analysis of the transcripts from the focus groups showed that the participants used the words *confident* or *confidence* 13 times during the course of the focus groups with nine positive references and four negative references. Abby used one positive reference to confidence. Jack used the term three times (one positive, two negative). Molly used one negative reference to confidence. Vera used three positive references to confidence. Walt used the term twice (once positively, once negatively). These specific references by the participants are similar to the narratives above about their first-year implementation of 21st century skills in a technology-rich classroom.

Relationships between teacher preparation models and teacher perceptions of effectiveness and adequacy.

The first two research questions allowed for a review of teacher preparation models within teacher education programs and their impact on first-year teachers in technology-rich classrooms. Question one asked about the types of technological, content and pedagogical knowledges that participants experienced in their teacher preparation models. Five of the six teachers in the focus group linked one or more of the TPCK knowledges to their teacher education programs. Question two took a broader look at the overall pre-service teacher education programs and participants' perceptions of their preparedness for the technology-rich classroom. While only two of the teachers reported experience with ISTE and TPCK in the initial survey, five of the teachers provided examples in their teacher education programs that indicated they were prepared for the technology-rich classroom. The focus group discussion revealed that not only did they receive training, in 21st century skills, but it also translated to their classrooms. They noted that their content methods courses and practical experiences of practicums and student teaching supported learning around creativity and innovation. Three teachers also

identified a link between research and information fluency and their preparation program. Table 18 provides a summative representation of each of the teachers' experiences with TPCK and 21st century skills in their teacher education programs, along with technology used in their first-year classroom. The table also indicates if there was a link between those experiences and specific teacher preparation models. This review of participants' experiences and perceptions provided a foundation for research question three.

Question three asked if relationships exist between teacher preparation models and teacher perceptions of effectiveness and adequacy. Erica and Abby had the most traditional teacher education programs. They both shared experiences from their content methods courses and practical experiences that created self-confidence for first-year implementation of 21st century skills in a technology-rich classroom. Walt's career switcher program featured abbreviated modules of the traditional teacher education program. He, too, pointed to his content methods courses and practical experiences as the source of his confidence for first-year teaching. All three of these teachers cited specific activities in the first-year classroom that were linked to their preservice program. Molly also had a traditional teacher education program with content methods courses and practical experiences. However, the nature of those experiences led her to a lack of confidence in the first-year classroom. She noted that her English methods professor was "old school," regurgitating old lessons. This was in direct opposition to Erica who discussed one of her cooperating teachers as "brilliant" in her use of station work and student choice. Molly also shared that her student teaching placement had no technology. Vera and Jack both were provisionally licensed, but Vera's preservice experiences yielded greater preparation than Jack's experiences.

Table 19

Reported Experiences in TPCK, 21st C. Skills, and Technology Tool Integration by Teacher Based on Teacher Preparation Models

	Teacher Education Program	Teacher Preparation Models				
		Content Methods Course	Practicum in Technology-Rich Classroom	Student Teaching in Technology-Rich Classroom	Stand Alone IT Course	Online Course
Abby	Bachelor's degree in education	Communication/Collaboration Creativity/Innovation Research/Information Fluency Technology Technology/Pedagogy Technology/Content Pedagogy/Content Interactive Whiteboards	Research/Information Fluency TPCK Software Applications	Technology TPCK		Communication/ Collaboration Technology/Pedagogy
Erica	Undergraduate degree; followed by masters' degree in education	Creativity/Innovation Critical Thinking/Problem Solving Technology Pedagogy Learning Management System	Creativity/ Innovation Research/ Information Fluency Technology Technology/Content TPCK BYOD Tablets Software Applications		Software Applications	
Jack	Undergraduate degree; followed by masters' degree in education					
Molly	Undergraduate degree; followed by masters' degree in education	Communication/ Collaboration Research/ Information Fluency Content Technology/ Pedagogy Technology/ Content Learning Management Systems		Communication/ Collaboration		
Vera	Career Switcher Program	Communication/Collaboration Pedagogy Technology/Pedagogy Technology /Content Software Applications			Technology	Communication/ Collaboration Learning Management System
Walt	Career Switcher Program	Communication/Collaboration Creativity/ Innovation Critical Thinking/Problem Solving Research/ Information Fluency Technology/ Content Pedagogy	Technology/Pedagogy			

Based on the overview of participants' experiences and the data provided in Table 18, a relationship was established between teachers' perceptions of effectiveness and specific teacher education models. The table clearly shows that the majority of instruction around 21st century skills, while not overtly described to the teachers, was found in their content methods courses. The table also shows that the application of those ideas occurred within the student teaching and practicum experiences. The translation of that to the first-year classroom as described in the last section also came largely from the practical experiences of the practicum and student teaching placements. In the cases of Abby, Walt and Erin, their positive experiences in their content methods courses and practical experiences led to feelings of efficacy and self-confidence as they implemented lessons and activities in the first year. Conversely, when those models were not applied appropriately, as in the case of Molly, there was a lack of confidence for the first-year classroom. The teacher preparation models that have the greatest impact on teacher perceptions of effectiveness and adequacy were content methods courses and practical experiences.

A closer look at those two models (content methods and practical experiences) throughout the study would also show that the practical experiences of student teaching and practicum placements had a more direct impact on first-year implementation. As such, there are some implications for teacher education programs. If teachers are to be prepared for teaching 21st century skills in the technology-rich classrooms, their content methods courses must provide a framework for technology and 21st century skills integration such as ISTE, TPCK or TIPC. Similarly, their practical experiences must be in technology-rich classrooms with supervising teachers who utilize similar frameworks as they develop lessons.

Summary of Findings

This study considered first-year teachers in technology-rich classrooms. The purpose of the study was to understand the effectiveness of teacher pre-service programs for preparing teachers to teach 21st century skills in technology-rich public high school classrooms containing a one-to-one laptop to student ratio. The study further considered the types of preparation models that the participants had in terms of technological, content, and pedagogical knowledge. The study gauged the participants' perceptions of the effectiveness teacher education program. Finally, it determined whether there was a relationship between teacher preparation models and teachers' perceptions of effectiveness and adequacy. Table 20 provides a final summary of the findings of the research questions.

After a review of data from the initial participant survey and subsequent focus group interviews, the five teacher preparation models (content methods courses, student teaching, practicum placement, instructional technology class, and online class) contributed in some way to teachers' experience in the areas of technological, pedagogical, or content knowledge. Five of the six teachers linked one or more of the TPCK knowledges to their teacher education programs. Technological knowledge was part of all models, pedagogical knowledge was present in all models except online courses, and content knowledge was found in content methods courses and practical experiences of practicums and student teaching.

A further review of the TPCK knowledges gauged participants' perceptions of their teacher education programs' effectiveness for first-year implementation. While only two of the teachers reported experience with ISTE and TPCK in the initial survey, five of the teachers provided examples in their teacher education programs that indicated they were prepared for the technology-rich classroom. In the area of technology, they reported exposure to a wide variety

of software (Google docs, remind 101, blackboard). In terms of pedagogical knowledge, the teachers noted that their programs allowed them to use collaboration skills *as* a student and *for* students. They gave examples of how they used choices for assessment. Their teacher education programs also allowed them to combine some of the TPCK knowledges. They shared experiences about classroom management, collaboration and learning management systems that integrated technological and pedagogical knowledges. In the areas of technology and content, there was discussion of online research and content-related apps. Pedagogical and content knowledge were integrated through collaboration *as* a student and *for* students. Finally, the teachers shared three examples of full TPCK integration through their student teaching and practicum experiences. While the teachers did not have direct knowledge of the ISTE or TPCK frameworks, their experiences within the education programs readied them for teaching in the technology-rich classroom.

The Teaching Innovation Progression-Chart was used as the framework to understand teachers' perceptions of their teacher education programs' effectiveness to prepare them for teaching 21st century skills. Those skills included *c*ollaboration and communication, creativity and innovation, critical thinking and problem solving, and research and information fluency. The focus group discussions revealed that, not only did they have training related to 21st century skills, but it translated to their first-year classrooms. In the area of collaboration and communication, the teacher education used collaboration *as* students and *for* students to inform their later use of collaborative groups in the classroom. The participants' content methods courses provided instruction on differentiation and student choice that were used for creativity and innovation in the first-year classroom. They also took lessons from their supervising teachers in practicums and student teaching about how to design projects that allow students to create

unique products. In the areas of critical thinking and problem solving, the participants referenced inquiry-based learning and Bloom's taxonomy in their methods courses. All six participants pointed to application of research and information fluency in their first-year classroom. The fact that there were concrete examples of integration in the first-year classroom indicated a level of efficacy and self-confidence for first-year implementation.

The final purpose of the study was to understand if there was a relationship between teacher preparation models and effectiveness and adequacy. For three of the participants, their strong experiences in the content methods courses and practical experiences translated directly to strong first-year classroom experiences. Conversely, one of the participant's poor experiences in the same courses created a lack of confidence for first-year implementation. These findings indicate that the content methods courses and practical experiences are related to teachers' perceptions of effectiveness and adequacy.

Table 20

Summary of Findings for Research Questions 1, 2, 3

Research Question	Findings
1. What types of teacher preparation models did participants experience in terms of: a. technological knowledge? b. content knowledge? c. pedagogical knowledge?	Technological knowledge was part of all teacher preparation models; pedagogical knowledge was present in all models except online courses; and content knowledge was found in content methods courses and the practical experiences of practicums and student teaching.
2. What are participants' perceptions concerning their pre-service teacher education programs regarding: a. effectiveness to prepare them for teaching 21st century skills in technology-rich high school classrooms containing a one-to-one laptop to student ratio? b. facilitating feelings of efficacy and self-confidence for first-year implementation?	While the teachers did not have direct knowledge of the ISTE or TPCK frameworks, their experiences within the teacher education programs readied them for teaching in the technology-rich classroom The concrete examples of technology and 21st century skill integration in the first-year classroom indicated a level of efficacy and self-confidence for first-year implementation.
3. Do relationships exist between teacher preparation models and teacher perceptions of effectiveness and adequacy? If so, what are they? And what are the implications of these findings?	Two teacher preparation models, content methods courses and practical experiences, and the quality of those models, are most related to teachers' perceptions of effectiveness and adequacy.

Chapter 5. Discussion

The purpose of this study was to understand the perceptions of first-year teachers' preparedness to integrate 21st century skills into the technology-rich classroom. An initial survey was disseminated to all first-year teachers with zero-years' experience in a technology-rich school district with a one-to-one laptop program. It was followed by two focus group interviews with first-year teachers. The survey and the focus group interviews were guided by the research questions below:

1. What types of teacher preparation models did participants experience in terms of technological knowledge? content knowledge? pedagogical knowledge?
2. What are participants' perceptions concerning their pre-service teacher education programs regarding:
    a. effectiveness to prepare them for teaching 21st century skills in technology-rich high school classrooms containing a one-to-one laptop to student ratio?
    b. facilitating feelings of efficacy and self-confidence for first-year implementation
3. Do relationships exist between teacher preparation models and teacher perceptions of effectiveness and adequacy? If so, what are they? And what are the implications of these findings?

Researchers have not previously conducted interviews with first-year teachers at the conclusion of their first year of instruction. This study gave teachers the ability to reflect on their pre-service experience as it related to their preparedness for their first year of instruction in the technology-rich classroom.

Rationale of the Study and Methodology

"The challenge for our education system is to leverage technology to create relevant learning experiences that mirror students' daily lives and the reality of their futures" (National Education Technology Plan, 2010). This statement by the US Department of Education provides a backdrop for the importance of this study. The study examined first-year teachers in a technology-rich school district, so the teachers had the infrastructure "to leverage technology." The district also had a model for 21st century skills integration "to create relevant learning experiences." Ravitch and Riggan (2012) noted that the researcher needs to "figure out what you want to study, why it matters (to you and broader audiences), and (arrive) at reasonable conclusions about how to go about studying it (methodology)" (p.7). This research matters because of the importance of merging traditional teacher preparation with emerging technologies to provide desired 21st century skills outcomes.

In this final chapter, the rationale for the study and the methodology used to the complete the study are reviewed. Implications of the findings are summarized in the context of the research questions and current research is discussed in relation to these themes. The implications for teacher education of teachers who are entering technology-rich classrooms with 21st century skills are addressed and recommendations are made. Finally, suggested areas for future research are detailed.

Rationale.

In 1983, when *A Nation at Risk* was released by the National Commission on Excellence in Education, a national conversation began about the condition of the American educational system. It was followed in 1994 by *Goals 2000* that began to address student outcomes for the 21st century. Over the following two decades, a variety of governmental and educational

organizations began to create definitions (as outlined in Table 2) of 21st century skills and workplace readiness requirements for high school graduates.

At the same time, new technologies emerged and were integrated into the classroom. This precipitated the need for educators to adapt their traditional methods to meet the changing structures of the classrooms and needs of the workplace. The literature review showed that the models for student learning that best achieved those goals were grounded in an integrated constructivist model, not an objectivist model. Several frameworks (TPCK, ISTE, TIP-C) for teaching and student learning emerged to address those needs. In addition, there were varying degrees of technology available in classrooms where these frameworks were implemented. In order to isolate first-year teachers' perceptions of their preparedness to teach 21st century skills, that barrier (a lack of technology) had to be eliminated. This study allowed for an understanding of first-year teachers' perceptions of their preparedness to teach 21st century skills because they were teaching in a technology-rich school district.

Methodology.

The study analyzed first-year teachers' perceptions of their preparedness for the technology-rich classroom. The teachers worked in a district whose one-to-one laptop computing initiative was one of the first large scale implementations in the nation. In addition to the laptop initiative, the district had a framework for 21st century skill integration that was central to its professional development. There were two teacher participant groups in the study. The first group was a convenience sample of all first-year teachers with zero-years' experience who were invited to take an online survey. The second group volunteered during the survey to be a part of a follow-up focus group. The goal of the study was to document the perceptions of the

teachers' readiness for the technology-rich classroom based on their pre-service education programs.

The researcher provided an initial online survey via Survey Monkey to 104 first-year teachers within the district. Twenty-nine teachers completed the initial survey. Results were tabulated and reported utilizing Microsoft Excel 2010 and SPSS Statistics 23. Of the 29 initial respondents, 13 teachers volunteered to participate in follow-up focus groups. Of those 13, six teachers actually participated in two focus groups of three teachers each. The focus group interviews were transcribed by the researcher and entered into Dedoose 6.2.10, a web based CAQDAS (Computer Assisted Qualitative Data Analysis Software), for excerpt identification, coding, and analysis. Once the codes were analyzed for consistency and accuracy, the researcher organized the excerpts into similar units of meaning using Microsoft Excel. This allowed themes to emerge from the excerpts for each of the research questions.

Limitations of the Study

There were several limitations of the study identified in advance of the research, but several others emerged during the course of the study. The final sample size of the focus groups was small with three teachers participating in traditional teacher preparation programs, two teachers participating in career switcher programs and one teacher provisionally licensed with minimal teacher education coursework. The focus group questions teased out some comparisons between the types of programs, but they did not allow for the full development of a cause and effect relationship between specific teacher education programs and efficacy in the classroom.

Another consideration that must be transparent as the results are reported is specific to the expectations that the school district has for its teachers. As described by Hew and Brush (2007), first order barriers to technology and 21st century skills integration have been removed by this

school district through the one-to-one laptop program and technology-rich classrooms. Despite the understanding that this was a technology-rich school district, the technology available in the teachers' individual classrooms varied greatly. One of the starkest examples of this was in focus group one. Abby, who had received instruction on the use of interactive whiteboards in her teacher education program, was limited to laptops and a projector in her room. Abby stated

> we did a lot of work through smart board (in my teacher education program) which kind of makes me sad because I wish I had a smart board. I learned all these really cool tools. And how to get the kids involved. And sometimes I'm like 'mmm' with my projector.

At the same time, Molly, who had no interactive white board training, noted

> I have a smartboard (glares from others who want one). Sorry, I don't use it that often, except for projecting. Just because not everyone has a computer which does make it hard to use a smartboard for lessons where you want to be interactive and not everyone can do it. And I do have very few students who don't have cell phones either so they can't even participate when we do those (activities).

Molly had not received instruction on how to navigate the shifts in technology within the classroom and was not able to maximize the use of the interactive whiteboard the way that she needed. The variability of available technology was a limitation for the study, while the mismatch of technology to teacher qualifications has implications for the district that will be discussed further.

The CAEP-, NCATE-, SACS-, and TEAC- accreditation of the colleges and universities created an expectation of quality teacher preparation for these first-year teachers. Because the

study used a convenience sample, there were teachers who did not attend an accredited institution for teacher preparation, but instead attained provisional licensure prior to their first-year of teaching.

Also, the district was human resource rich with site-based instructional technology support and instructional coaches to support first-year teachers. This allowed for additional professional growth during the first-year of teaching.

Table 21

First-Year Teachers' Comments about Collegial Support during Year One

Focus Group Participant	Source of Support	Comment
Erica	ITRT	Our ITRT is brilliant. He provides suggestions about ways to expand beyond Edmodo, so he showed me how to use Google sites.
Molly	ITRT	We have our ITRT and the Help Desk. So when I'm having a computer crisis, they help me out. They really advocate for you to use technology in the classroom. We have H21 that they want you to use (for instructional planning).
Vera	Librarian	The librarians here are amazing and as they would go through a lesson, I would learn along with the students. It makes it easy when you have people who teach you how to do it.
Abby	Veteran Teacher	He does a lot with technology which I thought that I hope that I can bring some of the stuff and advice that he gives, but essentially it's trying to find the time to do all these things.
Erica	Veteran Teacher	We share with other teachers a lot. One of the Spanish teachers is using Classroom Dojo for behavior management and I have adopted it.
Vera	New Teachers	It has come through talking with teachers about what they've used. As a new teacher, the nine new teachers talk a lot and discuss how things worked in other subject areas. (That) has really helped…what different methods worked for other teachers…trying it in your own class and seeing if it worked or not.

The first-year teachers in the focus group reported a very positive experience with colleagues, ITRTs (instructional technology resource teachers), librarians and instructional

coaches. This fell in line with recommendation from a study by Li and Ngan (2003). They reported in their study that there were barriers to technology integration, including a lack of professional development time, a lack of support from colleagues, and school culture. Li and Ngan (2003) concluded that the positive "findings validate the need for an induction exercise on the use of ICT in classroom instructions in the initial teaching years" (p. 58). The participants of the focus groups described several instances where they had support during the first year of teaching. Table 21 provides some of their comments and the source of the support they received during the first year of teaching. This informal professional development during the first year may have had an impact on the types of lessons reported during the focus groups.

There were some final limitations in the study. The generalizability of the study is limited to school districts with the very specific programming of the study district. In addition, the use of the perceptions of the participants about their pre-service training at the conclusion of the first-year created a time lapse that was noted. The researcher's previous experience with hiring and supervising first-year teachers in the district required continued attention to the objective collection and reporting of data.

In reviewing the limitations, there are some opportunities to improve a study of first-year teachers in the technology-rich classroom. There are several opportunities for improvement in the sample and setting. While the sample size for the focus groups met the suggested size, the make-up did not allow for an understanding of individual or specific teacher education programs. To allow for this, the sample would need to be targeted to first-year teachers who were graduates of specific programs. Also, the technology varied from school to school and from classroom to classroom. The study could have identified specific schools that had more uniformity in their classroom technology. There were several new schools or newly renovated schools in the

district that may have had that uniformity. This would allow the participants to discuss their experiences during the first year from a more consistent platform.

During the focus group analysis, the influence of professional development, both formal and informal, became apparent. The initial survey and the focus group protocols could include information that would tease out the influence of professional development in the first year as opposed to instruction and experiences from the teacher education programs. And while the sample and setting provided some limitations, some of the limitations (like the variety of teacher education experience) allowed for a rich discussion about what teacher preparation models provided stronger feelings of effectiveness and self-confidence in the first-year of teaching.

Connections to the Literature Review

Finding 1.

Technological knowledge was part of all teacher preparation models; pedagogical knowledge was present in all models except online courses; and content knowledge was found in content methods courses and the practical experiences of practicums and student teaching.

The literature review showed that in the early 21st century, a new framework emerged for instruction. It was built upon the pedagogy (P) and content (C) framework developed by Shulman (1987) where he demonstrated that merging the two is essential for teachers to know what teaching strategies best fit the content. As new technologies emerged, Mishra and Koehler (2006) took this one step further integrating a third component, technology (T), to create TPCK as represented in Figure 1.

TPCK is the basis of good teaching with technology and requires an understanding of the representation of concepts using technologies; pedagogical

> techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face; knowledge of students' prior knowledge and theories of epistemology; and knowledge of how technologies can be used to build on existing knowledge and to develop new epistemologies or strengthen old ones (p. 1029).

Just as Shulman's original framework informed professional development and teacher education in the latter part of the 20th century, the TPCK model became part of professional development and teacher education programs.

The first finding showed that the pre-service teachers had exposure to technology and pedagogy in their teacher education programs. Content was part of their undergraduate experience. The integration of those strands occurred in the practical experiences of the teacher preparation program. The lesson described by Abby during her practicum integrated those strands.

> With iPads … we implemented Google Earth using it to give instructions about cities and places in the cities. We did this project where kids had to draw out a map and they had to include different features from different cities. They had to do the research about different famous buildings. Find different famous buildings and talk about them in the language, in Spanish. Different technologies, having them do the research, finding sources.

This practicum lesson included technology (iPads, Google Earth), pedagogy (research, finding sources), and content (draw out a map, in Spanish), thus merging the three knowledges.

For teacher education programs to prepare teachers "to leverage technology to create relevant learning experiences," they should note that the full marriage of technology, pedagogy, and content best happened in the practical experiences of practicums and student teaching. And while there is merit in universities providing direct instruction prior to the student teaching experience as noted by Koc and Bakir (2010), the practical experiences were the areas where the first-year teachers could best describe their understanding of this instructional framework.

Finding 2.

While the teachers did not have direct knowledge of the ISTE or TPCK frameworks, their experiences within the teacher education programs readied them for teaching in the technology-rich classroom. The concrete examples of technology and 21st century skill integration in the first-year classroom indicated a level of efficacy and self-confidence for first-year implementation.

Polly and Moore (2008) noted that it is "vital that we follow our graduates into the field to truly understand their preparedness and actual use of technology as a tool for teaching and learning" (p.30). The study utilized three frameworks – ISTE, TPCK, TIP-C – to understand first-year teachers' preparedness to teach 21st century for the technology-rich classroom. The initial survey revealed limited knowledge of the frameworks, while the focus groups provided information that the teachers were putting the content of the frameworks into practice during their first year. Molly described her use of webquests in her exceptional education classroom. "I like the webquests. The kids are independent…I like them being independent and looking for information on their own." This allowed for technology and pedagogy to be merged for research at a basic level. Whereas Erica implemented a bit more advanced lesson using Google docs for collaboration and communication.

> We've done Google docs because it's collaborative. That worked. They were supposed to comment on each other's work. We also communicated across blocks because there was a huge hallway project. They had one Google doc for each biome. They had different people in different classes working on the same biome, so they had to collaborate. It worked pretty well.

And Vera was comfortable sharing that she felt confident teaching seniors using a pedagogical technique (collaborative groups), but it didn't work as initially planned.

> Since I have seniors, I thought oh, you've got this, just work together and figure it out. They still aren't quite there yet, so it's a matter of figuring out how much direction and structuring they need without being restrictive. At the beginning I thought I could just put them in groups and tell them to go. They still need a little framework. And very specific about what you are looking for. I tend to let them pick their own groups which doesn't always work out. I feel like I have a better sense of the amount of structuring that needs to be in place.

These three examples showed that the teachers had confidence in the implementation of 21st century skills in the technology-rich classroom, but met with varied success when it was applied in practice.

Both Molly and Erica had traditional teacher education experiences, whereas Vera had coursework without practical experience. It was not enough for Vera to be a digital native and to move into the classroom with basic educational coursework. She needed more direct instruction or specific experiences that not only allowed her to be confident, but also to be effective in the classroom.

Finding 3.

Two teacher preparation models, content methods courses and practical experiences, and the quality of those models are most related to teachers' perceptions of effectiveness and adequacy.

The initial research showed that there were several studies of individual teacher preparation models and their effectiveness in preparing pre-service teachers. Doppen (2004) noted that if teachers are to more-fully integrate technology into the classroom, "pre-service programs must provide many structured opportunities integrated throughout their coursework to learn, experiment and reflect on practice" (p. 273). However, Gao, et al. (2010) looked at instructional technology courses in teacher education programs and found that high ICT skill and comfort level do not translate to high ICT integration in the classroom. Koc and Bakir (2010) noted that after their preservice training, teachers felt they needed "training to learn how to implement computer technologies into my instruction in order to enhance student learning," but that they were "prepared to regularly use technology to communicate and collaborate with peers in the field of education" (p.17). And the findings of Lei (2009) indicated that teacher education programs need to "help them make the transition … to digital-native teachers who can use technology in meaningful ways in classrooms." All of these studies provided a background for the final research question which addressed teachers' feelings of efficacy for implementation in the technology-rich classroom.

The study showed that the four teachers (Abby, Erin, Molly, and Walt) who had full practicum and/or student teaching experiences expressed how the quality of those programs impacted their feelings of efficacy and confidence in the first year of teaching. This reinforced the findings of the research in the literature review that indicated coursework needed to be more

than stand-alone IT work and more reflective practice. Abby, Erin, and Walt described practical experiences that complemented their coursework, while Molly described a weak practical experience that compounded a weak content methods course experience. And by their absence, the lack of practical teacher experiences for two teachers (Jack and Vera) impacted perceptions of efficacy and confidence. Vera was able to compensate through other graduate work and professional development.

A final connection to the literature came from the interview with focus group one. Abby was a product of the teacher education program that was evaluated by the research of Vanatta and Beyerback (2001). After receiving a PT3 grant, the faculty of her institution participated in a two year professional development program. The purpose of the program was to develop and implement technology activities within their courses. The treatment also included participation in a three-day workshop to develop and plan activities for their education courses. The education faculty taught 300 pre-service teachers who participated in methods courses during the fall semester. Abby entered that program a full decade after the implementation of the grant, but her positive perceptions of confidence and efficacy for implementation in the 21st century classroom were clearly impacted by a teacher education program that had a targeted approach to implementing technology activities in the classroom.

Implications of the Findings

The impetus for this study grew out of hiring experiences and practices in technology-rich school district with a framework for 21st century skill integration. As such, the findings of the study have implications for stakeholders at multiple levels – school-based administrators, district-level administrators, and leaders of teacher education programs.

School-based administrators. Depending on the school district, school-based administrators have a varying degree of involvement with the initial screening of potential teacher candidates. They may be able to provide feedback about the kind of teacher preparation or experience level that their candidates have. They may have previous hiring experience that help guide their decision-making when hiring teachers. They definitely have an idea of the technology available within their buildings, as well as the philosophy they have around 21st century skill integration. Armed with all of that information, the findings of this study provide additional information for their hiring practices.

The teachers who showed the greatest perceptions about their efficacy and confidence during the first year of teaching were those who had positive experiences in content methods courses and practical experiences. School-based administrators should delve into those experiences during the hiring process to determine if the teacher will be a good fit for their school's level of technology and 21st century skill integration. However, principals may require training to accurately uncover key indicators during the hiring process that show a candidate's skill level in the areas of technology and 21st century skill integration.

As the hiring and induction process continues, school-based administrators should note the teacher's level of perceived efficacy and confidence when assigning technology in the classroom. This already naturally takes place when the principal assigns the teacher to a content area, but needs to expand to the areas of technology and pedagogy to provide the best possible setting for the successful implementation of those three knowledges in the first-year classroom.

District-level administrators. Again, depending on the school district, district-level administrators have a variety of roles pertaining to hiring. Some district-level administrators may have natural partnerships with local and regional teacher education programs. Some hire

strictly locally and some hire out-of-state /out-of-region. Districts have varying degrees of technology available in their classrooms based on educational philosophy and funding availability. All of those factors will determine the implications of the study for district-level administrators.

Professional development is a key role of school district administration. As such, they play a role in the mentorship programs for new teachers; teacher training; and professional development. During the focus groups, the teachers discussed the flurry of training received during the two weeks prior to the start of school. While they found the training helpful, they felt overwhelmed by the amount of content. They noted that on-going training during the year would be beneficial. If the school district uses a formal mentoring program, they should infuse some follow-up training during the school year to reinforce skills from the initial training.

If school districts have partnerships with teacher education programs, they should provide feedback to the programs about their level of technology available and their philosophy of 21st century skill integration. They should note the relationship between content methods courses and practical experiences with teachers' perceptions of efficacy for first-year implementation. This also would imply the need for the school district to define their philosophy for 21st century skill integration so that could be incorporated into content methods courses, as well as provide opportunities to host preservice teachers for those practical experiences.

Teacher education programs. The implications of the study are greatest for teacher education programs, assuming that the teacher education programs support the frameworks (TPCK, ISTE, TIP-C) that were the foundation of the study. In the areas of technology, pedagogy and content knowledge, two-thirds of the focus group participants were not able to recall any of the specific instructional frameworks. However, their preservice and first-year

experiences reflected the integration of the three knowledges. Teacher education programs need to identify ways to spiral those knowledges through the entire program so that they become the foundation for instructional planning for their graduates.

The other major implication for teacher education programs is in the quality of their content methods courses and their practical experiences. Preservice teachers are learning about teaching in every component of the teacher education program. While Erin, Will and Vera took content methods courses that provided feelings of efficacy in the first-year classroom, Molly's content methods course was taught "old school." There was strong modeling for the first three teachers, but weak instructional modeling for Molly in the methods course. There must be philosophical consistency along all course work and practical experiences for preservice teachers to maximize their feelings of preparedness for first-year implementation.

Likewise, the practical courses – practicum and student teaching – must allow for rich experiences that reflect the same philosophy of technology and 21st century skill integration. The teacher education programs that Abby (undergraduate education), Erin (master's in education) and Walt (career-switcher) attended showed evidence of a pervasive philosophy of technology and 21st century skill integration throughout all courses, but specifically in practical experiences. They had placements in classrooms that not only had available technology, but supervising teachers who were versed in appropriate integration of technology for 21st century skills teaching and learning. Teacher education programs must identify supervising teachers and classrooms that match the frameworks that support technology and 21st century skill integration.

Contribution to the Literature

The literature review examined instructional practice and theory around 21st century skills and technology integration, as well as, teacher preparation programs and models in those

areas. The review of the literature also included an examination of the level of integration of these skills by the first-year teacher. However, researchers have not previously conducted interviews with first-year teachers at the conclusion of their first year of instruction to better understand the connection between the teacher preparation and first-year integration in the areas of technology and 21st century skills. There was not a study that examines the instructional needs and expectations of technology-infused secondary public schools and the preparation of pre-service teachers.

This study was important because it allowed for reflection on the *preparation for* and the *implementation of* 21st century skills and technology integration during the first year of teaching. The teachers were able to reflect on their pre-service experience as it related to their preparedness for their first year of instruction using 21st century skills in the technology-rich classroom. This study also gave first-year teachers the ability to reflect on their first year of instruction in a school district with a framework for 21st century skills integration in a technology-rich environment. The mixed methods approach allowed for a richer understanding of the data collected within the quantitative component of the study.

Suggestions for Future Research

The section on limitations discussed how the research might be revised to provide a more complete picture of specific teacher preparation programs. However, there are still some areas for further research. Career switcher programs have emerged to allow for quick licensure to address the growing teacher shortage. Walt, the career switcher focus group participant, shared some experiences that created perceptions of efficacy and preparedness. As those programs grow, there will be a need to further understand their efficacy in relationship to traditional teacher education programs.

While this study chose instructional frameworks of technology and 21st century skill integration, there is a need to understand how those frameworks are used by school districts and by teacher education programs. If school districts are adopting them, but teacher education programs are not, it will not allow for efficacy in implementation in the first year of teaching.

There is also an opportunity to study the impact of teacher preparedness has on student performance. There have been studies on the impact of technology integration on student performance in the school district. Further study could help to understand how teacher preparation and teachers' confidence in the areas of technology and 21st century skill integration impact student performance.

Finally, while not part of the study, information emerged about the impact of professional development during the first year on teachers' perceptions of efficacy. A study of the types of induction programs would allow school districts to take teachers who come from a variety of teacher education programs and allow them to implement the philosophy of technology and 21st century skill integration supported by the district.

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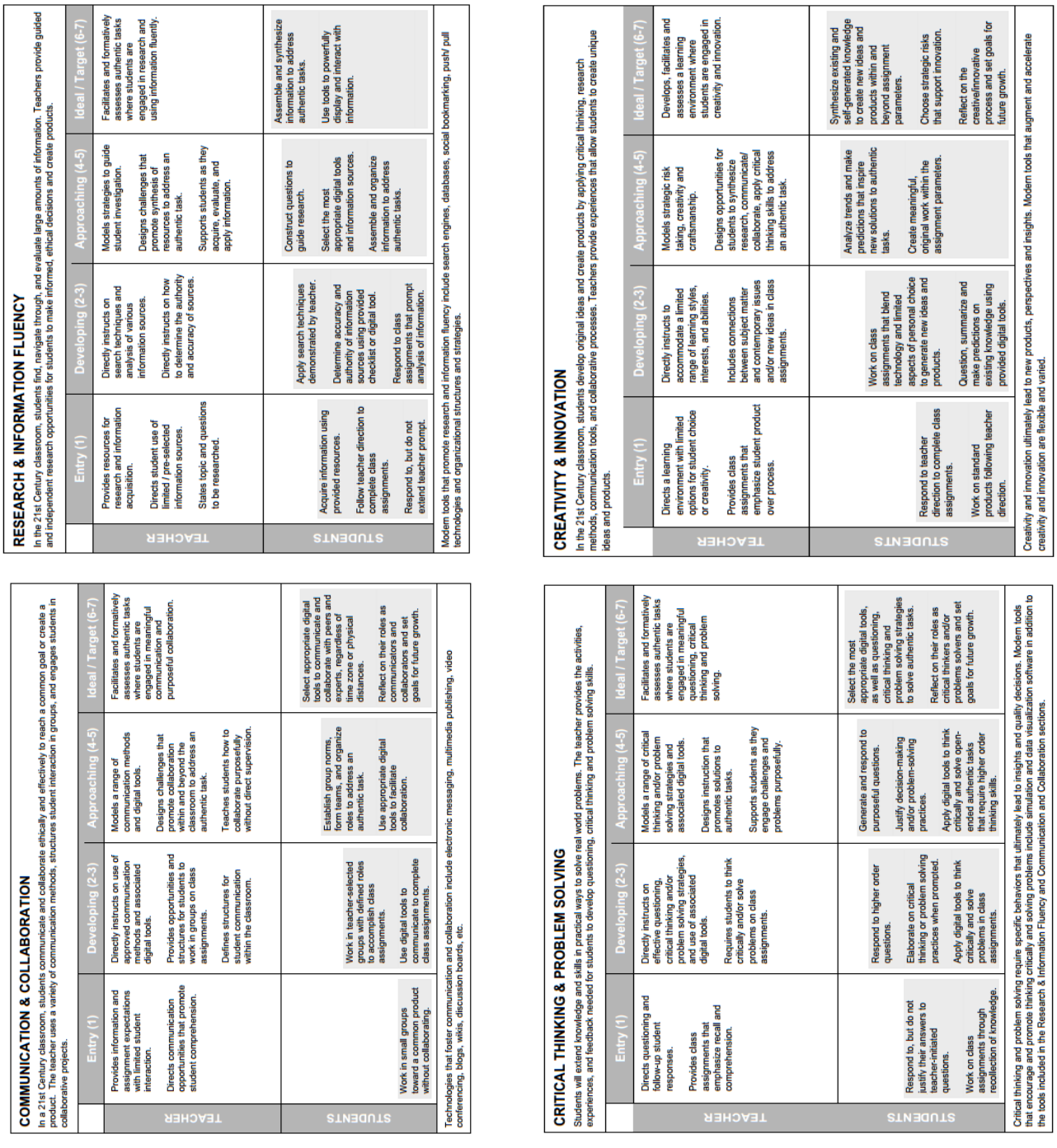
Appendix A



RESEARCH & INFORMATION FLUENCY

In the 21st Century classroom, students find, navigate through, and evaluate large amounts of information. Teachers provide guided and independent research opportunities for students to make informed, ethical decisions and create products.

	Entry (1)	Developing (2-3)	Approaching (4-5)	Ideal / Target (6-7)
TEACHER	Provides resources for research and information acquisition. Directs student use of limited / pre-selected information sources. States topic and questions to be researched.	Directly instructs on search techniques and analysis of various information sources. Directly instructs on how to determine the authority and accuracy of sources.	Models strategies to guide student investigation. Designs challenges that promote synthesis of resources to address an authentic task. Supports students as they acquire, evaluate, and apply information.	Facilitates and formatively assesses authentic tasks where students are engaged in research and using information fluently.
STUDENTS	Acquire information using provided resources. Follow teacher direction to complete class assignments. Respond to, but do not extend teacher prompt.	Apply search techniques demonstrated by teacher. Determine accuracy and authority of information sources using provided checklist or digital tool. Respond to class assignments that prompt analysis of information.	Construct questions to guide research. Select the most appropriate digital tools and information sources. Assemble and organize information to address authentic tasks.	Assemble and synthesize information to address authentic tasks. Use tools to powerfully display and interact with information.

Modern tools that promote research and information fluency include search engines, databases, social bookmarking, push/ pull technologies and organizational structures and strategies.

CREATIVITY & INNOVATION

In the 21st Century classroom, students develop original ideas and create products by applying critical thinking, research methods, communication tools, and collaborative processes. Teachers provide experiences that allow students to create unique ideas and products.

	Entry (1)	Developing (2-3)	Approaching (4-5)	Ideal / Target (6-7)
TEACHER	Directs a learning environment with limited options for student choice or creativity. Provides class assignments that emphasize student product over process.	Directly instructs to accommodate a limited range of learning styles, interests, and abilities. Includes connections between subject matter and contemporary issues and/or new ideas in class assignments.	Models strategic risk taking, creativity and craftsmanship. Designs opportunities for students to synthesize research, communicate/ collaborate, apply critical thinking skills to address an authentic task.	Develops, facilitates and assesses a learning environment where students are engaged in creativity and innovation.
STUDENTS	Respond to teacher direction to complete class assignments. Work on standard products following teacher direction.	Work on class assignments that blend technology and limited aspects of personal choice to generate new ideas and products. Question, summarize and make predictions on existing knowledge using provided digital tools.	Analyze trends and make predictions that inspire new solutions to authentic tasks. Create meaningful, original work within the assignment parameters.	Synthesize existing and self-generated knowledge to create new ideas and products within and beyond assignment parameters. Choose strategic risks that support innovation. Reflect on the creative/innovative process and set goals for future growth.

Creativity and innovation ultimately lead to new products, perspectives and insights. Modern tools that augment and accelerate creativity and innovation are flexible and varied.

COMMUNICATION & COLLABORATION

In a 21st Century classroom, students communicate and collaborate ethically and effectively to reach a common goal or create a product. The teacher uses a variety of communication methods, structures student interaction in groups, and engages students in collaborative projects.

	Entry (1)	Developing (2-3)	Approaching (4-5)	Ideal / Target (6-7)
TEACHER	Provides information and assignment expectations with limited student interaction. Directs communication opportunities that promote student comprehension.	Directly instructs on use of approved communication methods and associated digital tools. Provides opportunities and structures for students to work in groups on class assignments. Defines structures for student communication within the classroom.	Models a range of communication methods and digital tools. Designs challenges that promote collaboration within and beyond the classroom to address an authentic task. Teaches students how to collaborate purposefully without direct supervision.	Facilitates and formatively assesses authentic tasks where students are engaged in meaningful communication and purposeful collaboration.
STUDENTS	Work in small groups toward a common product without collaborating.	Work in teacher-selected groups with defined roles to accomplish class assignments. Use digital tools to communicate to complete class assignments.	Establish group norms, form teams, and organize roles to address an authentic task. Use appropriate digital tools to facilitate collaboration.	Select appropriate digital tools to communicate and collaborate with peers and experts, regardless of time zone or physical distances. Reflect on their roles as communicators and collaborators and set goals for future growth.

Technologies that foster communication and collaboration include electronic messaging, multimedia publishing, video conferencing, blogs, wikis, discussion boards, etc.

CRITICAL THINKING & PROBLEM SOLVING

Students will extend knowledge and skills in practical ways to solve real world problems. The teacher provides the activities, experiences, and feedback needed for students to develop questioning, critical thinking and problem solving skills.

	Entry (1)	Developing (2-3)	Approaching (4-5)	Ideal / Target (6-7)
TEACHER	Directs questioning and follow-up student responses. Provides class assignments that emphasize recall and comprehension.	Directly instructs on effective questioning, critical thinking and/or problem solving strategies, and use of associated digital tools. Requires students to think critically and/or solve problems on class assignments.	Models a range of critical thinking and/or problem solving strategies and associated digital tools. Designs instruction that promotes solutions to authentic tasks. Supports students as they engage challenges and problems purposefully.	Facilitates and formatively assesses authentic tasks where students are engaged in meaningful questioning, critical thinking and problem solving.
STUDENTS	Respond to, but do not justify their answers to teacher-initiated questions. Work on class assignments through recollection of knowledge.	Respond to higher order questions. Elaborate on critical thinking or problem solving practices when prompted. Apply digital tools to think critically and solve problems in class assignments.	Generate and respond to purposeful questions. Justify decision-making and/or problem-solving practices. Apply digital tools to think critically and solve open-ended authentic tasks that require higher order thinking skills.	Select the most appropriate digital tools, as well as questioning, critical thinking and problem solving strategies to solve authentic tasks. Reflect on their roles as critical thinkers and/or problems solvers and set goals for future growth.

Critical thinking and problem solving require specific behaviors that ultimately lead to insights and quality decisions. Modern tools that encourage and promote thinking critically and solving problems include simulation and data visualization software in addition to the tools included in the Research & Information Fluency and Communication and Collaboration sections.

Note. Adapted from "TIP Chart" accessed April 29, 2014 at http://blogs.henrico.k12.va.us/21/tip-chart/

Appendix B

Participant Survey

First-Year Teacher Survey

Page 1. Introduction

I am a doctoral candidate working on my dissertation at Virginia Commonwealth University. My dissertation research has two components. Phase one involves an online, introductory survey; phase two will be small follow-up focus groups. Your participation in either phase is voluntary and confidential.

The guiding premise for this study is the preparedness of first-year teachers to teach 21st century skills in a technology-rich classroom with a one-to-one laptop initiative.

Please review the Participant Letter and Consent Agreement provided in the email prior to taking this survey.

Thank you for your participation.

Tracie Omohundro
tracie_omohundro@verizon.net

Page 2. Teacher Demographics

1. What was the primary subject area that you taught during the 2014-2015 school year? (ex. Algebra 1, World History 1)

2. What is your gender
   a. Female
   b. Male

3. When were you born
   a. Prior to 1980
   b. 1980 or after
   c. N/A

Page 3. Teacher Preparation Program

4. At what college / university did you receive your primary teacher education preparation?

5. What route did you use to attain teacher licensure?
   a. Career Switcher Program
   b. Undergraduate degree; followed by masters' degree in education
   c. Five-year program for undergraduate and masters' degree
   d. Post masters' degree in education
   e. Other (please specify)

6. What courses and/or experiences did you have in Instructional Technology prior to your first year of teaching? (check all that apply)
   a. Stand-alone Instructional Technology Course
   b. Content Methods Course that included instructional technology strategies
   c. Student teaching placement in a technology-rich classroom
   d. Practicum placement in a technology-rich classroom
   e. Online course during my undergraduate or graduate program
   f. Other (please specify)

7. I learned about ISTE (International Society for Technology in Education) standards during my teacher preparation program.
   a. Yes
   b. No

8. I learned about TPCK (Technological Pedagogical Content Knowledge) standards during my teacher preparation program.
   a. Yes
   b. No

Page 4. Technology in the First-Year Classroom

9. What instructional technology tools were available in your classroom during the 2014-15 school year? (check all that apply)
   a. One-to-one student-to-laptop ratio
   b. Interactive whiteboard (SMART board, Promethean board, Brightlink, etc.).
   c. Learning Management System (School Space, Blackboard, Google classroom, Edmodo, etc.)
   d. BYOD (bring your own device)
   e. Projection device (LCD projector, document camera, etc.) Responders / Clickers
   f. Other (please specify)

10. How often did you use the following instructional technology tools during the 2015-15 school year? (Daily, Weekly, Monthly, Quarterly, Never)
   a. One-to-one student laptops

b. Interactive whiteboard (SMART board, Promethean board, Brightlink, etc.)Learning Management System (School Space, Blackboard, Google Classroom, Edmodo, etc.)
c. BYOD (bring your own device)
d. Projection Device (LCD projector, document camera, etc.)
e. Responders / Clickers
f. Other (please specify)

11. I received adequate preparation through my teacher preparation program for using the following instructional technology tools in the classroom. (Disagree, Somewhat Disagree, Somewhat Agree, Agree)
    a. One-to-one student laptops
    b. Interactive whiteboard (SMART board, Promethean board, Brightlink, etc.)Learning Management System (School Space, Blackboard, Google Classroom, Edmodo, etc.)
    c. BYOD (bring your own device)
    d. Projection Device (LCD projector, document camera, etc.)
    e. Responders / Clickers
    f. Other (please specify)

Page 5. Next Steps

12. Would you be willing to participate in a small focus group on the topic of teacher preparation for the technology-rich classroom?
    a. Yes
    b. No

13. If you answered "Yes" to question 12, please provide the following information.
    a. Name
    b. Email Address

14. If you answered "No" to question 12, your responses to questions 1-11 will be used in the study.
    a. You may use my responses for this study.
    b. You may NOT use my responses for this study.
    c. Please provide your email address to receive a consent agreement form.

Thank you for your participation in this survey! Tracie Omohundro

Appendix C

Participant Letters

Phase One - Survey

Dear_____,

My name is Tracie Omohundro and I am a doctoral candidate working on my dissertation at Virginia Commonwealth University. My dissertation research has two components. Phase one involves an online, introductory survey; phase two will be small follow-up focus groups.

I invite you to take part in my research study by answering an online survey and participating in a 60 minute focus group.

The guiding premise for this study is the preparedness of first-year teachers to teach 21st century skills in a technology-rich classroom with a one-to-one laptop initiative. The primary research questions are:

1. What types of teacher preparation models did participants experience in terms of:
    a. technological knowledge?
    b. content knowledge?
    c. pedagogical knowledge?
2. What are participants' perceptions concerning their pre-service teacher education programs regarding:
    a. effectiveness to prepare them for teaching 21st century skills in technology-rich high school classrooms containing a one-to-one laptop to student ratio?
    b. facilitating feelings of efficacy and self-confidence for first-year implementation?
3. Do relationships exist between teacher preparation models and teacher perceptions of effectiveness and adequacy? If so, what are they? And what are the implications of these findings?

The results of this survey will be used as part of my dissertation.

For phase one, you are asked to complete an anonymous online survey. The survey will take approximately 7 – 10 minutes to complete. Participation is completely voluntary.

Participants who indicate on the survey that they are interested in the focus group will be contacted to participate in phase two.

To take the survey type the following link into your browser‘s address bar: https://www.surveymonkey.com/s/G265NY6.

Thank you for your consideration to participate in this research. Please e-mail me with any questions or concerns at tracie_omohundro@verizon.net

Sincerely,

Tracie Omohundro
Doctoral Candidate, Virginia Commonwealth University, School of Education
Telephone: 804-248-1971
Email: tracie_omohundro@verizon.net

Phase Two – Focus Group

Dear_____,

My name is Tracie Omohundro and I am a doctoral candidate working on my dissertation at Virginia Commonwealth University. My dissertation research has two components. Phase one involves an online, introductory survey; phase two will be small follow-up focus groups.

In your survey responses, you indicated an interest in participating in a follow-up focus group. The 60-minute focus group will be audio- and video-taped. You will be assigned a pseudonym during the interview to allow for anonymity. All identifiers will be removed once the data has been analyzed. The published results will be anonymous. The results will be used as part of my dissertation and provided to HCPS.

The guiding premise for this study is the preparedness of first-year teachers to teach 21st century skills in a technology-rich classroom with a one-to-one laptop initiative. The primary research questions are:

1. What types of teacher preparation models did participants experience in terms of:
    a. technological knowledge?
    b. content knowledge?
    c. pedagogical knowledge?
2. What are participants' perceptions concerning their pre-service teacher education programs regarding:
    a. effectiveness to prepare them for teaching 21st century skills in technology-rich high school classrooms containing a one-to-one laptop to student ratio?
    b. facilitating feelings of efficacy and self-confidence for first-year implementation?
3. Do relationships exist between teacher preparation models and teacher perceptions of effectiveness and adequacy? If so, what are they? And what are the implications of these findings?

The focus group will meet at Hermitage High School on DATE at TIME. Please RSVP to tracie_omohundrdo@verizon.net by DATE

Thank you for your consideration to participate in this research. Please e-mail me with any questions or concerns.

Sincerely,

Tracie Omohundro
Doctoral Candidate, Virginia Commonwealth University, School of Education
Telephone: 804-248-1971
Email: tracie_omohundro@verizon.net

Appendix D

Participant Informed Consent Agreement

Please read and sign this consent agreement before you decide to participate in the study.

Study Title: First-year secondary teachers' perceptions of their preparedness for the technology-rich classroom.

Purpose of the research: The purpose of this study is to gauge first-year secondary teachers' perceptions of their preparedness for technology-rich classrooms, as well as determine relationships between their perceptions and type of preparation programs**.**

Your responsibility as part of the study: Each participant will complete an on-line survey; and participate in a 60-minute focus group. The focus group discussion will be recorded and transcribed.

Risks: There is no apparent risk associated with this study.

Benefits: There are no direct benefits to the participants. The analysis may show colleges and universities which types of teacher preparation activities are meeting the needs of school districts that are working to infuse 21st century teaching and learning skills into their technology-rich classrooms. It may also show school districts which types of teacher preparation programs best align with their hiring needs.

Confidentiality: The information gathered will remain confidential. The on-line survey (phase one) will be submitted with email addresses. The email addresses will be used to assign pseudonyms for use in the focus group (phase two). The observational data will be coded to maintain confidentiality and the focus group participants use pseudonyms for anonymity. The focus group sessions will be digitally recorded and transcribed without identifying references to the participants. Once the data is verified by the participants, the digital recordings will be destroyed. Analysis of the transcribed data will be done solely by the researcher. This study is being conducted as part of a dissertation project and it is not being conducted for the school district; however, the results of the study will be shared with division staff to inform best practice.

Voluntary participation: Teachers' participation is completely voluntary.

Right to withdraw from study: Teachers may withdraw from the study at any time.

How to withdraw from study: Teachers may withdraw at any time by contacting the researcher. If the teacher withdraws after completing the initial survey (phase one), but does not want to participate in the focus group (phase two), the teacher will indicate whether the survey data may be used in the research.

Remuneration: The teacher will not be compensated for participating in the study.

Who to contact with questions:
Tracie Omohundro
Doctoral Candidate, Virginia Commonwealth University, School of Education
2901 Calcutt Drive
Midlothian, VA 23113
Telephone: 804-248-1971
Email: tracie_omohundro@verizon.net

Agreement: I agree to participate in the research study described above.
Name (Print)_____Date_____
Signature: _____Date_____
You will receive a copy of this form for your records. Focus group protocols are attached

Appendix E

Focus Group Protocol

Provide participants with a brief background of study and interview protocol.

My name is Tracie Omohundro and I am a doctoral candidate working on my dissertation at Virginia Commonwealth University. My dissertation research has two components. Phase one involves an online, introductory survey; phase two will be small follow-up focus groups.

In your survey responses, you indicated an interest in participating in a follow-up focus group. The 60-minute focus group will be audio- and video-taped. You will be assigned a pseudonym during the interview to allow for anonymity. All identifiers will be removed once the data has been analyzed. The published results will be anonymous. The results will be used as part of my dissertation and provided to HCPS.

The guiding premise for this study is the preparedness of first-year teachers to teach 21st century skills in a technology-rich classroom with a one-to-one laptop initiative. The primary research questions are:

1. What types of teacher preparation models did participants experience in terms of:
   a. technological knowledge?
   b. content knowledge?
   c. pedagogical knowledge?

2. What are participants' perceptions concerning their pre-service teacher education programs regarding:
   a. effectiveness to prepare them for teaching 21st century skills in technology-rich high school classrooms containing a one-to-one laptop to student ratio?
   b. facilitating feelings of efficacy and self-confidence for first-year implementation?

3. Do relationships exist between teacher preparation models and teacher perceptions of effectiveness and adequacy? If so, what are they? And what are the implications of these findings?

Focus Group Questions

Part One

1. How was technology used as a 21st century tool in your teacher preparation program in the following areas:
   a. A stand-alone instructional technology course?

b. Instructional technology strategies in a methods or content course?
c. Technology modeled by professors?
d. Technology used in the student teaching experience?

2. How has technology been available for you as:
   a. A pre-service teacher?
   b. A student teacher?
   c. A first-year teacher?

3. Describe your confidence in using instructional technology after you completed your teacher preparation program.

4. How has your confidence in using instructional technology changed during your first year of teaching?

Part Two

The researcher will provide a written copy of the description for each of the four TIP-C categories to the participants. The researcher will read the summative statement for each of the TIP-C categories.\

RESEARCH & INFORMATION FLUENCY

In the 21st Century classroom, students find, navigate through, and evaluate large amounts of information. Teachers provide guided and independent research opportunities for students to make informed, ethical decisions and create products.

COMMUNICATION & COLLABORATION

In a 21st Century classroom, students communicate and collaborate ethically and effectively to reach a common goal or create a product. The teacher uses a variety of communication methods, structures student interaction in groups, and engages students in collaborative projects.'

CRITICAL THINKING & PROBLEM SOLVING

Students will extend knowledge and skills in practical ways to solve real world problems. The teacher provides the activities, experiences, and feedback needed for students to develop questioning, critical thinking and problem solving skills.

CREATIVITY & INNOVATION

In the 21st Century classroom, students develop original ideas and create products by applying critical thinking, research methods, communication tools, and collaborative processes. Teachers provide experiences that allow students to create unique ideas and products.

After the reading of each of the TIP-C categories, the following questions will be read.

1. Was this 21st century skill part of your teacher preparation program? If so, how?
2. Describe a specific activity or strategy used in your classroom this year that addresses this 21st century skill.
   Describe your confidence in teaching 21st century skills after you completed your teacher preparation program.

3. How has your confidence in teaching 21st century skills changed during your first year of instruction?

Vita

Tracie Quinn Omohundro was born on August 17, 1969 in Outagamie County, Wisconsin and is American citizen. She graduated from Xavier High School in Appleton, Wisconsin in 1987. She received her Bachelor of Arts in Religious Studies from the University of Virginia, Charlottesville, Virginia in 1991. After receiving her Master of Teaching with a concentration in secondary social studies from Virginia Commonwealth University in 1994, she taught high school religion and geography in private school, then middle school social studies in Henrico County for six years. She received a Post-Master's Certificate in Administration and Supervision from Virginia Commonwealth University in 2004. She began service in high school administration as an assistant principal (2001) and later principal (2004) in Henrico County. She is currently principal at Powhatan High School in Powhatan County, Virginia.