2017

Virginia's Instructional Technology Resource Teacher Program: Ten Years Later, What We Know, -Where Do We Need to Go?

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

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May, 2017

Acknowledgement

Writing this dissertation was like climbing a mountain, and this climb was Mt. Everest. As such, I had many Sherpas who pushed me every step of the way and helped me get back on track when I lost my way. I would like to thank several Virginia Commonwealth University faculty who were particularly helpful. Dr. Becker thanks for pushing me to see instructional technology from many different angles. Dr. Newcomb thanks for always being supportive during the most stressful times. Dr. Johnson, thanks for sticking with me even after my SNA plans fell apart. Dr. Mansfield, thank you for putting me back on the policy track after the tragic loss of an education legend, Dr. William C. Bosher. Thank you to my friend and classmate Beth Sepelyak, who through personal trials, was still able to get it done and by doing so, pushed me to succeed. To my miracle working computer technician, Hollie Patterson, you supported me, you listened to me, and you made my work life easier so this endeavor was possible while working full-time! Thank you to my friends, Susan Thatcher, Robin McClean, Monica Van Husen, Lindsay Sutton, and Pat Wiedel who always told me I was smart and talented; and always knew when I was not feeling up to the task and gave me the confidence to go on. Thank you to my wonderful children who allowed me to take time (and money) from them to make this dream come true. Thank you to my parents and my brother Chris for their support, but especially for my dad. He did not stay to see me finish, but before he passed, he told me how proud he was of me and all that I have accomplished, especially my children as he felt they were the best thing I have ever done (he was right). And finally, to my husband for giving up much of our retirement nest egg to finance this costly endeavor. Don, you are the best decision I have ever made; you are my rock and my example. I love that you love me, flaws and all.

Table of Contents

List of Figures

List of Tables

List of Illustrations

Abstract

VIRGINIA'S INSTRUCTIONAL TECHNOLOGY RESOURCE TEACHER PROGRAM: TEN YEARS LATER, WHAT WE KNOW, WHERE DO WE NEED TO GO?

By Cherise Ann Hodge, PhD

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

Virginia Commonwealth University, 2017

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In 2004, Virginia's Department of Education (VDOE) identified the need for technology integration in instruction to meet the needs of the 21st century student. For this to happen effectively, Virginia legislators authorized and funded an instructional position, the Instructional Technology Resource Teacher (ITRT), for each 1000 students in Virginia's 132 school divisions (Virginia Standards of Quality [SOQ], 2004). The VDOE established guidelines for this position to direct school division implementation. Primary responsibilities for the position involve activities relating to teacher professional development. Virginia divisions chose varying models for deploying the ITRT to meet this requirement. In 2012, the legislature edited the directive for the position to give localities the option to use the position as an ITRT, as a data coordinator, or as both positions (Virginia Standards of Quality, 2012). This study uses survey data to determine how ITRTs are spending their time, ten years after the implementation of the program.

Survey data was compared to data collected by Hooker (2006) and the guidelines for the position as published by the Virginia Department of Education (Virginia Department of Education [VDOE], 2008). Major findings indicate that ITRTs are still spending time on tasks that are not specified in the published guidelines. This study's data correlate with the data gathered by Hooker (2006) following the first year of the implementation of the SOQ.

I. Overview of the Study

Since the first computer entered the classroom in the early 1980's, there have been questions concerning how to use emerging technologies effectively in the classroom (Veletsianos, 2010, p. 17). The advent of other hardware tools such as student response systems, hand-held tablets, digital pens, and interactive-white boards has altered instructional expectations, and this list continues to grow. Add to this the evolving communication and soft-tools: internet, free web 2.0 tools, cloud applications, smart phones and wireless technologies, and social networking tools and the list of available technologies becomes quite overwhelming. Thomas Friedman (2006), in his book *The World is Flat,* illustrates the dilemma our nation's teachers and children face, as these emerging technologies have changed the landscape of business, communication, and production on a global scale. Friedman argues that the global economic playing field is flat because members of more countries can collaborate and compete for goods, services, and employment opportunities.

Our 21st century classrooms are still home to lessons and learning activities that resemble those of the previous century (Luterbach & Brown, 2011). In 1983, the USDOE published the report, *A Nation at Risk*, which posited that our education system was failing our students (U.S. Department of Education [USDOE], 1983). This report argues that we need to prepare our students for a globally competitive world and that our schools are not keeping pace. Twenty-five years later, the USDOE report, *A Nation Accountable*, found that we are at even greater risk due to demographic and technological shifts that have resulted in a global economy more impactful than anticipated, and that our students are still victims of "diluted content now hiding behind inflated course names" (U.S. Department of Education [USDOE], 2008, p. 4). We must change the way we educate our children if we hope to allow them to be competitive in this globally competitive environment.

Prensky (2001a) describes our youth as "digital natives" as they were born into an era in which they have never known a world without digital technologies. These students spend their time outside of school multitasking and parallel processing information from multiple technological devices. In contrast to students as digital natives, Prensky (2001b) labels teachers as "digital immigrants" as they were born prior to this insurgence of digital tools and content. While capable of learning new tools, they do so with an "accent" just as learners of a foreign language might. Prensky posits the existence of a discontinuity between the students in our classrooms today and the structure of the system designed to educate them. Today's students are different, and the world they need to succeed in is different, thus educators must become more technology fluent to meet students' needs.

For example, digital tools allow students more control of their learning. They offer avenues for students to access information, communicate, collaborate, think critically, and solve complex problems. This personalized learning moves students from passive learning to active learning. These tools allow students to use the available tools to create products and share their learning with others, not just those in the same class or the same school but potentially the world (Grant & Basye, 2014; Collins & Halverson, 2010; Downes & Bishop, 2012). While these students come to school with some familiarity with digital tools, it is frequently in the most basic of ways such as social networking or "googling" information; students are lacking more advanced skills necessary to critically think about or apply information (Luterbach & Brown, 2011; National Science Foundation Task Force on Cyberlearning, 2008). For students to take this basic knowledge to the next level, educators' knowledge must also advance. For example, teachers cannot teach students how to use digital tools to process information and become producers of content if they do not have the knowledge and skills to do so.

In addition to processing information and producing content, Hobgood and Ormsby (2010) found effective use of digital tools related to leveling content input, individualizing learning activities, individualizing student assessments, and delivering content to meet students' needs. Giving concept mapping that uses visual or auditory modalities lessens the need for review and remediation following initial instruction (Hobgood & Ormsby, 2010). The problem is teachers are not using available tools for these types of activities. Rather, teachers are using new tools to augment existing practices or on administrative tasks (National Center for Educational Statistics, 2006). Thus, Daccord and Reich (2015) suggest that investments in technology tools be paired with investments in teacher capacity and a clear vision for student outcomes.

Another important consideration concerning technology integration and preparing students is the roles principals and other school leaders play to support these efforts. For example, in 2010, Project RED conducted a survey of 997 U.S. schools. The researchers found that technology integration efforts led to improved student achievement *if* leaders provided time for teacher professional development and collaboration (Greaves, Hayes, Wilson, Gielniak, & Peterson, 2012). The Partnership for 21st Century Learning (P21), a nonprofit advocacy group, defines critical student outcomes and requisite support systems needed to achieve this goal;

foremost among these recommendations is administrative support for teachers' efforts to create 21st century curriculum and instruction (Partnership for 21st Century Skills, 2008). Additionally, school or division leadership support is necessary for the provision of the time, tools, and financial investment necessary for the provision of 21st century professional development (see Appendix A). This change in pedagogy requires teachers to have more than a simple understanding of the available tools; it requires that educational leaders ensure that teachers have access to professional development that incorporates using technology to support curricular goals and pedagogically sound instructional strategies for teaching, learning, and assessing (Harris & Hoffer, 2011; Greaves et al., 2012).

Statement of the Problem

Classroom teachers struggle to balance their available time for lesson planning, grading assignments, and meeting the day-to-day needs of students (An & Reigeluth, 2012; Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012; Hixon & Buckenmeyer, 2009). Teachers often create classroom ecosystems that best fit their personal practices, and for many, implementing emerging technologies challenges deeply held beliefs concerning traditional instructional pedagogies that do not involve evolving digital tools (Davis, Eickelmann, & Zaka, 2013; Zhao & Frank, 2003). The changes suggested by Prensky and P21 go beyond the use of technology tools to merely do what has always been done. They present an expectation that what and how we teach be changed to meet changing societal needs (Prensky, 2010; Partnership for 21st Century Skills [P21], 2008). Change of this magnitude requires a comprehensive plan that includes an appropriate model for professional development that moves beyond the tools and focuses on pedagogy while offering necessary layers of support during the change process

(Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012; Hixon & Buckenmeyer, 2009; Lowther, Inan, Strahl, & Ross, 2008).

Rationale for the Study

The 2003-2009 Virginia Educational Technology Plan, emphasized the importance of integrating technology into instruction. Dr. Jo Lynne DeMary, Virginia Superintendent of Instruction, in the foreword to the plan, states that the "use of technological tools by teachers in classrooms will motivate and engage students, enliven instruction, extend learning beyond the school, and assist by increasing students' achievement" (Virginia Department of Education [VDOE], 2003, p. iii). The 2010-2015 National Education Technology Plan also advocates these goals:

> [T]he model for learning described in this plan calls for engaging and empowering learning experiences . . .[that] focus what and how we teach on what people need to know, how they learn, where and when they will learn, and who needs to learn it . . . [and] leverages the power of technology to provide personalized learning. (United States Department of Education [USDOE], 2010, p. 8)

Federal government initiatives are in place to aid in efforts to prepare teachers to implement 21st century teaching and learning. As part of NCLB, the Enhancing Education Through Technology Program (EETT), Title II, Part D of the Elementary and Secondary Education Act of 1965 (2001) identified three primary goals:

1. Improve student academic achievement by integrating technology in instruction in elementary schools and secondary schools;
2. Assist every student in crossing the digital divide by ensuring that every student is technologically literate by the time the student finishes eighth grade, regardless of the

student's race, ethnicity, gender, family income, geographic location, or disability, and

3. Encourage the effective integration of technology resources and systems with teacher training and curriculum development to establish research-based instructional methods that can be implemented as best practices by state education agencies and local education agencies (United States Department of Education. [USDOE], 2001)

Initially, EETT focused grant funds on helping districts, divisions, or localities in lower socioeconomic areas where access to technology tools was limited. In the most recent federal education law, the Every Student Succeeds Act (ESSA), signed by President Obama in December of 2015, reauthorized the Elementary and Secondary Act (ESEA) which gives states the opportunity for competitive grant funds of over one billion dollars to be used for educational technology. Districts, divisions, and localities used these funds for the purchase of technology hardware, software, and infrastructure to improve internet access. These funds allowed schools to make great strides in increasing teachers' and students' access to technology tools. However, expanding access to technology tools has not achieved the goal of increasing use of the tools or changes in pedagogy (Duncan, 2010; Partnership for 21st Century Skills [P21], 2008).

Expected changes in instruction in our classrooms is not keeping pace with increased access to hardware and internet networks (United States Department of Education, National Center for Educational Statistics [NCES], 2010). The Virginia Educational Technology Plan for 2010-2015 (VDOE, 2010) recognized the complexity of creating 21st century teaching and learning:

> [H]ow do we make room for 21st century skills in the current curriculum? What if anything do we throw out and still ensure that students have the knowledge and skills they need to succeed? We must look critically at our pedagogy and how we can move to more active learning in student centered classrooms. (VDOE, 2010, p. 12)

Karen Cator, former Director of the Office Education Technology echoed this concern stating:

> Tomorrow's graduates are growing up in a world where technology dominates various aspects of daily life, from social interactions to data analysis to professional advancement. Their education should reflect this reality, by better equipping them to interact with a digital world, and by using technology to drive student achievement, measure student progress, and create an individualized approach to learning that instills students with invaluable critical thinking skills. (Cator, 2010, para. 2)

Recognizing the need for teachers to have more than basic technology skills to meet state and federal goals, VDOE recommended, and the Virginia General Assembly approved, new staffing requirements to move forward with technology integration efforts. These two positions, one a hardware support position and the other a professional development support position, were added to the State Standards of Quality (SOQ) for public schools. The SOQ required that for every 1,000 students in each school division there should be one of each position. VDOE used the title, Instructional Technology Resource Teacher (ITRT) for the position responsible for supporting teachers in the effective integration of technology tools and instruction (VSOQ, 2004). The VDOE issued guidelines (issued in 2005 and updated in 2008) for teachers and administrators to define parameters for the duties and responsibilities of the ITRT (VDOE, 2008). Most importantly, the guidelines state, "ITRT are intended to be teachers of teachers, providers of technology professional development, and supporters of instruction" (Virginia Department of Education [VDOE], 2008, p. 20).

The EETT (2001) program also recognized that offering funds for technology infrastructure is not sufficient to achieve its original goals. The program guidelines added the ability to use grant funds for professional development, curricula that integrate technology, and public private partnerships stating:

- Supporting innovative strategies for the delivery of specialized or rigorous academic courses and curricula with technology, and offering other technical assistance to grant applicants and recipients, with priority given to high-need LEAs.
- Supporting high-quality professional and curriculum development that includes the integration of advanced technologies into curricula and instruction.
- Developing performance measurement systems to evaluate the effectiveness of programs supported with Ed Tech funds, particularly in determining the extent to which activities funded are effective in integrating technology into curricula and instruction, increasing the ability of teachers to teach, and enabling students to meet challenging State academic content and student academic achievement standards. (United States Department of Education, 2009, p. 3-4)

These funds provide scaffolding necessary to achieve the goals of instructional use of technology tools and restructuring of curriculum to a more student centered paradigm. Recognizing the need to aid teachers in successful implementation requires research into what effective professional development and support for technology integration looks like. An examination of the Commonwealth's program may offer needed insight to other states, divisions, or localities.

Unfortunately, the structure of the Virginia SOQ may be limiting its success at meeting teacher-learning goals. The SOQ wording, of one ITRT per 1,000 students, leaves flexibility for localities to decide the ITRT deployment method and job description. Additionally, an evaluation of the program in 2006 found a significant majority, all but 14, of Virginia school divisions failed to follow state guidelines for ITRT responsibilities (Virginia Department of Education Division of Technology and Human Resources Office of Educational Technology, 2007). Hooker found ITRTs are spending their time teaching students, performing administrative tasks, and trouble-shooting hardware issues (2006). The flexibility provided by the wording of the SOQ may be limiting the ITRTs' ability to provide sound professional development that is immediate, job-embedded, and collaborative. Lacking these characteristics makes the learning from professional development unsustainable due to teacher reticence to use technology in instruction without an immediate, on-site support system (Plair, 2008; Hixon & Buckenmeyer, 2009; Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012; An & Reigeluth, 2012).

In 2007, VDOE issued an information brief that summarized the results of a study done by Virginia Tech to assess the success of the ITRT program after its first year. The study used results from the same online survey (see Appendix A) conducted by Hooker (2006) of all Commonwealth ITRTs. The study found that only 14 of 132 school divisions matched actual time use with the time usage rubric in the VDOE guidelines for the position (see Appendix B). Comparing Standards of Learning test scores for students from these 14 school divisions, the study found that improvements occurred in one-third of subject areas tested. Additionally, the study found ITRTs from these divisions were overwhelmingly qualified for their positions, worked on appropriate instructional professional development tasks, and trained teachers regularly in the latest technologies (VDOE, 2007).

In 2008, VDOE updated its guidelines based on the results of the Virginia Tech and Hooker studies to clarify its expectations for the ITRT position. The report showed ITRT "roles are not well-defined or widely understood" (VDOE, 2008, p. 10). It states that its overall goal and "challenge is to provide effective support for curriculum and technology integration . . . [and] provide adequate support and training to bring teachers . . . to an adequate level of technical expertise to meet learning goals" (VDOE, 2008, p. 10). To meet this goal, the state identified duties and responsibilities of an ITRT to include the following:

- Working collaboratively with individual teachers or groups of teachers to integrate technology into instruction
- Assisting with curriculum and content development
- Disseminating information regarding technology resources, emerging technologies, best practices using technology, and professional development opportunities
- Facilitating or conducting technology-related professional development for school staff
- Assessing levels of teacher and student technology use and skills
- Modeling effective instructional strategies using technology
- Serving as a member of the school technology committee
- Supporting implementation of the state technology plan
- Researching use of newer technologies in instruction
- Using data to design technology-based instructional strategies

- Recommending hardware, software, and related resources
- Identifying trends in software, curriculum, teaching strategies, and other educational areas
- Creating learning resources for teachers, staff, and students
- Serving as a strong advocate for technology integration
- Participating in software selection and use (VDOE, 2008, p. 10-11).

Additionally, the guidelines outlined categorical time allocations as outlined in Figure 1.

Percent of Time	Task
>=68% Initial estimate: >=70%	Assist teachers with the integration of technology in the classroom, train teachers to use technology, assist with curriculum development as it relates to educational technology, model instructional strategies with students, provide training and professional development, collaborate with teachers, research technology-based instructional strategies, review/evaluate technology software, offer direct assistance to teachers by way of classroom visitations, or fulfill similar kinds of duties and responsibilities as the school division may deem appropriate. Provide professional development activities for administrators.
<=14% Initial estimate: <=15%	Meet with administrators and content supervisors at the building and/or central office level to coordinate services and resources. Serve on building and/or division leadership teams relating to technology and instruction, professional organizations related to technology, and other responsibilities. Assist administrators and content supervisors with data-driven decision making relating to all areas of curriculum and instruction.
<=9% Initial estimate: <=10%	Create and implement a plan to communicate progress and activities to school, faculty, and administration (e.g., newsletter, technology Web site, e-mail notifications).
<=3% Initial estimate: <=4%	Conduct minor troubleshooting of computer lab equipment, hardware, or software problems.
<=1% Initial estimate: <=1%	Maintain records necessary to document progress and activities, such as a journal, blog, or database of activities (see Spotsylvania database example: http://www.spotsylvania.k12.va.us/itrt/ITRTevaluation.htm).
<=5% Initial estimate: N/A	Conduct personal professional development, including research relating to professional growth goals, related conference attendance, workshops, and coursework.

Figure 1. VDOE Recommended ITRT Time Allocation. From "Instructional Technology Resource Teacher Guidelines for Teachers and Administrators," by The Virginia Department of Education Division of Technology and Career Education Office of Educational Technology, 2008.

Understanding that many of the support positions outlined in the SOQs are costly for Virginia school divisions, in 2010, the Virginia General Assembly enacted a recession era waiver that allowed school divisions to fall below SOQ per pupil staffing ratios for some of the instructional support positions outlined in the SOQs. This included the ITRT position. To further compound the issue, in 2012, the Virginia State Legislature passed legislation changing the wording of the SOQ for the ITRT position (Virginia Standards of Quality, 2012). This change added flexibility for Virginia school divisions' use of the position. It added the ability to use the position as a data coordinator, an ITRT, or one position with both responsibilities. These changes have the potential to impede the success of the progressive move by the VDOE to address the need for professional development and support to allow teachers to integrate technology tools in classroom instruction. The structure of professional development for technology integration efforts is critical in its success (Brinkerhoff, 2006; Cuban, Kirkpatrick, & Peck, 2001; Hixon & Buckenmeyer, 2009). Removing the support that the ITRT can provide to teachers will limit the diffusion of integration initiatives.

VDOE intends the ITRT position give the necessary support to counter the barriers that are inherent in technology tool integration and 21st century classroom instruction. The structure of the SOQ and the flexibility it allows for local control of implementation leaves fidelity of the program in question. An examination of the program in relation to best practices in professional development for technology integration aligned to instructional best practices is necessary to determine ITRT program effectiveness. This study contributes to policy research as its premise is to "uncover how particular policies, people, and places interact to produce particular results and to accumulate knowledge" (Skyes, Schneider, & Plank, 2009, p. 338). Policy implementation is dictated by these interconnected facets that are often dependent on each other.

The intent of this study was to gather descriptive data to describe the current context of the ITRT position and offer a context for examination of implementation of the SOQ.

Methodology and Research Questions

This descriptive study uses survey data to elucidate how the position is being implemented in Virginia. The use of a survey design gives a numeric description of trends, attitudes, and opinions of a population by studying a sample of that population (Creswell, 2014; McMillan & Schumacher, 2008; Shavelson & Towne, 2002). The survey used is similar to the survey used by Hooker (2006) to describe the context of the ITRT position after its first year. Hooker's survey was framed in three sections. The first identified demographic data that describe the ITRTs and their setting. The second addressed their role and responsibilities of the position. The third section included statements intended to determine ITRT perceptions of effectiveness and barriers to their efforts. This study did not include the statements related to perceptions. The statements could be leading, so this section was replaced with an open-ended question that allows ITRTs to provide any information that would describe their context and beliefs (Creswell, 2014). This qualitative data found themes that elucidate ITRT perceptions or barriers. Finally, qualitative data from this open-ended survey question was compared to quantitative findings and analyzed to identify common themes (Creswell, 2014; (Shavelson & Towne, 2002).

The following questions frame the study:

1. To what extent do ITRT reported professional activity time allocations compare to:
    a. Those suggested in the VDOE guidelines (2008)?
    b. Those identified by Hooker (2006)?

2. To what extent do ITRT reported professional activity time allocations vary as a function of:
    a. School grade levels served?
    b. ITRT years of experience?
    c. Deployment model-
        i. School or division?
        ii. Number of schools the ITRT is responsible for?
        iii. Number of teachers the ITRT supports?
    d. ITRT is responsible for data activities as well as ITRT activities?
3. What are the frequencies of ITRT activities?
    a. Do reported ITRT activities match the recommended job roles as identified by the VDOE guidelines (2008)?
4. To what extent and in what ways does the open-ended question contribute a more comprehensive and nuanced understanding of the current context of the ITRT position?

Limitations of the Study

This study is delimited to the 132 Virginia school divisions (see Appendix C) and results may not generalize to other states. Virginia school divisions do not appoint ITRTs to the position using the same hiring qualifications, prior teaching experiences, professional licensing, or degrees earned, and ITRTs have not all held the position for an equivalent amount of time. These factors affect the ability to make warranted claims concerning their professional context. The presentation of descriptive statistics shows relationships for these variables; however, no claims of causation are warranted. Adding a qualitative analysis of an open-ended question allows for the analysis of themes related to study variables to support or negate survey question results.

The researcher holds an ITRT position in one school division in Virginia. This level of background knowledge and any pre-established attitudes may influence interpretation of the results. However, since the study is nonexperimental and involves the use of survey data to describe context, the expectation of bias is minimal.

Summary

Chapter 1 introduces the research project. The following chapter, the Literature Review, offers a historical perspective of technology in education, and a description of today's students and the need to discuss a paradigm change that meets these students where they are; this research supports the need to move teaching and learning from a teacher-centered model to a student-centered model. Further elucidation of the ITRT position and its relationship to a new model for professional development, the educational coach, will provide justification for the need to provide transparency to the networks in which the ITRTs work. Chapter three explains the author's theoretical perspective and justification for a descriptive survey research design as necessary to describe the current context of the ITRTs in the Commonwealth of Virginia.

Vocabulary

1. Diffusion of Innovation- the process in which an innovation is communicated through certain channels over time among members of a social system (Rogers, 2003, p. 474).
2. Distributed leadership- the collective interactions among, leaders, followers, and their context (Spillane, 2006).

3. Emerging technologies- tools technologies, innovations, and advancements utilized in diverse educational settings to serve varied education-related purposes" (Veletsianos, 2010, p. 17) that empower "educators and students to engage in practices that are less dependent on institutions infrastructure" (Ng'ambi & Bozalek, 2013, p. 942).
4. Technology coach- staff member that offers technology training and support for the comprehensive integration of technology throughout the instructional environment (International Society for Technology in Education [ISTE], 2013; Sugar & Slagter van Tryon, 2014).

5. Technology integration- the use of technology resources (computers, mobile devices like smartphones and tablets, digital cameras, social media platforms and networks, software applications, the Internet) in classroom instructional practices. Technology use should be routine, be accessible, and be supportive of curricular goals (National Center for Education Statistics [NCES], 2003).

II. Review of the Literature

Historical Perspective

With the introduction of computer-technologies in the 1950's, people have been trying to leverage their power to work smarter by getting more output with less input (Cuban, 1986). While the use of these technologies has certainly been slow to influence classroom teacher behaviors, they have had an evolving influence. Schofield (1995) describes the confluence of classroom computer use as an intersection between how learning context influences computer use, and how computer use drives learning context.

Taylor (1980) identified three roles for computers in classrooms: as a tutor, a tool, or a tutee. The earliest application of computerized instruction, or computer as tutor, was IBM's Teaching Machines Project, which used an IBM 650 computer to teach binary arithmetic (Venezky & Osin, 1990). Additional examples of early computer tutoring are SOCRATES (System for Organizing Content to Review and Teach Educational Subjects) and CLASS (Computer-based Laboratory for Automation of School Systems) (Aslan & Reigeluth, 2011). Although these efforts solidified the use of computers as tutors, the initiatives were used in universities and did not breach the K-12 classroom.

The introduction of the microcomputer in the late 1970's and early 1980's saw a dramatic increase in the use of computers in K-12 settings (Cuban, 1986). Venezky and Osin (1990) called this the period of small wonders, as size and cost were no longer a deterrent for classroom computer use. The use of computers as tutor continued in this period, and the use of computers as tutee began. In 1967, Seymour Papert and the MIT Artificial Intelligence Laboratory created

LOGO, a computer programing language simple enough for children to use (Seymour Papert, n.d.). Additionally, Apple's introduction of the "Schoolbus Network" was the first foray in the use of a network structure for teacher-student communication (Cuban, 1986, p. 87). Schofield (1995) found the number of computers in schools increased tenfold during the 1980's. Expense continued to be an issue, and teachers were far from convinced of the necessity of the tool (Cuban, 1987).

Although a product of the 1960's, it was not until the 1990's that access to the World Wide Web (WWW) emerged as a K-12 tool. Per Wells and Lewis (2006), schools with internet access increased from just 3% in 1994, to 94% in 2005 (Wells & Lewis, 2006). A report by the National Center for Education Statistics (NCES, 2010) found

- Ninety-seven percent of teachers had one or more computers found in classroom every day.
- Fifty-four percent of teachers could bring computers into the classroom.
- Internet access was available for 93 percent of the computers found in the classroom and for 96 percent of the computers that could be brought into the classroom.
- The ratio of students to computers in the classroom every day was 5.3 to 1. (Gray, Thomas, & Lewis, 2010)

This portended the most influential educational technology innovation and the need for a pedagogical shift. The resultant increase in access to content altered the position of teachers and textbooks as the gatekeepers and purveyors of knowledge (Lajoie, 2000). Collaborative tools and social networks evolved from personal entertainment endeavors to blended learning opportunities in educational settings (Aslan & Reigeluth, 2011; Lajoie, 2000). Tools such as

Wikipedia, Blogs, and course management systems like Moodle and Blackboard ignited a movement towards shared knowledge creation.

Digital Natives Debate

Prensky's term "digital native" and others coined to describe this generation of students such as "net-generation," "millennials," or "iGeneration" sparked considerable debate among researchers. Some question classifying an entire generation as having an identical skill set (Hargittai, 2010, Bennett & Maton, 2010, Helsper & Enyon, 2009). Prensky claims that exposure to technologies has created an entire generation of multitaskers and parallel processors who think and process information differently than digital immigrants, and therefore there is a need for pedagogical changes to instruction (Prensky, 2001a). The term digital native has achieved a level of acceptance that finds its use in books, papers, conferences, and presentations as if a term of fact. Sheely (2008) claims the term has moved from "one person's speculative idea" to the status of fact because it helps address a question for which there is a lack of critical research and offers an answer that is intuitively justified (Sheely, 2008, p. 909). In examining the "digital natives" debate, Bennett and Maton (2010) found recent research indicates this generation is far from "homogenous," having a "diversity of interests, motivations, and needs" (Bennett & Maton, 2010, p. 325). Mere exposure to digital technologies does not equate with an equivalent 21st century skill set, and more importantly, may not prepare students to use technology tools effectively for academic or career pursuits. Helsper and Enyon (2009) state that becoming a digital native is less about age and more about "breadth of use, experience, self-efficacy, and education" (p. 1). Palfrey and Gasser (2008) claim that calling an entire generation digital natives is an overstatement, as more than five billion of the six billion in our world population lack access to digital technologies; they posit that only relatively wealthy kids, in wealthy countries, are digital natives (Palfrey & Gasser, 2008).

The digital divide, originally coined to describe a lack of access to technology and particularly the internet, has disproportionately affected the poor and minorities across the United States. This social inequity sparked ongoing efforts to mitigate inequitable technology access. One such effort is the Enhancing Education Through Technology (EETT) educational grant program that offers funds for purchasing hardware, software, and infrastructure for internet access for schools (United States Department of Education [USDOE], 2001). Hargattai (2010) posits that this is not enough; we must examine how differing social groups use the technology hardware, software, the internet, and web 2.0 tools. The inability to use them effectively may also perpetuate the social inequality the EETT efforts intend to erase.

The National Science Foundation Task Force on Cyberlearning posit that students are using technology for every form of communication *except* learning (National Science Foundation Task Force on Cyberlearning, 2008). In a study examining user web skills of first year college students at an urban university, Hargattai found that autonomy of use and web user experience are positively related to web skills and more importantly, women and minorities exhibit lower levels of web skills than others. Palfrey and Gasser (2008) state that “in the United States, most kids can access the technology itself, but there are huge divides between those kids who have the skills to use it effectively and those who do not” (p. 14). Differences such as these, within a population expected to have digital native skill levels, show that it is not enough to offer access to technology tools; we must also provide instruction that teaches effective uses for the tools if we hope to level the digital divide.

One might attribute the meteoric rise of the digital native, digital immigrant, and digital divide terminologies' acceptance to a need to classify the depth of change that has arisen with the rapid increase in information availability and ease of access. This evolution requires educators to examine what the changes mean for instruction, as there is evidence that the ever-evolving technologies have changed the landscape of society and the experiences of many, if not most, students of this generation (Buchmuller et al., 2011; Friedman, 2006; Palfrey & Gasser, 2008). Sheely (2008) asserts, the illusion of the existence of digital natives is necessary, and useful, as it has refocused our research on how students learn, and therefore on how they must be taught. Sheely suggests, "If it takes the illusion of Digital Natives to convince people of this and to promote the development of learning environments that acknowledge and utilize this then I would consider that a powerful and useful illusion indeed" (914). He contends that Prensky is mistaken in that he targets technology as both the cause of the difference and the solution. Downes and Bishop (2012) argue that the point is not if our students are digital natives, but how we engage them using the tools they see as native (which are those used for social networking) (Downes & Bishop, 2012). The question should not be what students already know about using technology tools, but what they need to know to be successful. Then, we must ask ourselves how we can help prepare them.

From Teacher-centered to Student-centered Instruction

The 2010 National Education Technology plan calls for moving away from teacher-centered instruction, often termed "sage on the stage" instruction, to a more personalized form of instruction. The plan defines this as:

> Personalization refers to instruction paced to learning needs, tailored to learning preferences, and tailored to the specific interests of different learners. In an environment

> that is fully personalized, the learning objectives and content as well as the method and pace may all vary (so personalization encompasses differentiation and individualization). (United States Department of Education [USDOE], 2010, p. 12)

This model of instruction allows students to have options for how their learning takes place *and* how they show evidence that learning has taken place. Technology provides the means for students to take ownership of their learning.

Teachers need to teach students how to use legacy content and future content. Current curriculum and high stakes testing required by NCLB focuses on legacy content, but our students will need to know not only how to leverage new technologies to access content, but skills to cull, manipulate, and create content. This does not mean that this instructional shift will saddle teachers with one more thing to teach. Rather, it requires a pedagogical shift toward constructionist instruction. Papert and Harel (1991) explain:

> Constructionism--the N word as opposed to the V word--shares constructivism's connotation of learning as 'building knowledge structures' irrespective of the circumstances of the learning. It then adds the idea that this happens in a context where the learner is engaged in constructing a public entity. (Papert & Harel, 1991, para. 2)

A constructionist classroom is where the 21st century skills are embedded and integrated across the current curriculum in engaging, authentic ways that encourage artifact creation (Becker, Hodge, & Sepelyak, 2010; Partnership for 21st Century Skills, 2007; USDOE, 2010; VDOE, 2010). Sheely (2008) argues this should not be because these students are digital natives and their teachers are digital immigrants, but because they are human, and as humans, they learn by constructing knowledge through social interactions while taking part in authentic experiences that have relevance to each student.

Researchers found evidence that using technology to support learner-centered constructionist instruction positively affects student learning and performance (Grant & Branch, 2005; MacGregor & Thomas, 2005; Lei & Zhao, 2007; Hsieh, Cho, Liu, & Schallert, 2008; Greaves et al., 2012). Lei & Zhao (2007) in a longitudinal study on the effect of integrating technology in instruction found that when technology use focuses on specific subjects with methods that involve student constructions, there are positive effects on student grade point averages. Downes and Bishop (2012) postulate that students given opportunities for construction and expression exhibit higher levels of engagement, and that this level of engagement continued beyond the school day.

Digital tools offer a pathway to a constructivist pedagogy where shared knowledge and problem solving come together to move students from passive participants to active learners who take ownership of their learning (Lew, 2010; Grant & Basye, 2014; Alliance for Excellent Education, 2012; Greaves et al., 2012). For teaching and learning to transform from a teacher-centered enterprise to a constructivist student-centered model for the 21st century, there are barriers to overcome. Cited barriers include access to resources, time to plan and develop lessons, teacher attitudes and beliefs, professional development, and lack of clear vision on the part of administrators or district leaders (Hixon & Buckenmeyer, 2009; Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012; Niederhauser & Lindstrom, 2006).

Technology Integration and Achievement

In 2007, VDOE issued an information brief that summarizes the results of a study done by Virginia Tech to assess the success of the ITRT initiative. The study uses results from an online survey of all ITRTs and identifies 14 school divisions that match actual time usage with the time usage rubric in the VDOE guidelines for the position (see Appendix B). Comparing

Standards of Learning test scores for students from these 14 divisions, the study found improvements occurred in one-third of subject areas tested (Virginia Department of Education Division of Technology and Human Resources Office of Educational Technology, 2007).

Lowther et al. (2008) examined the effectiveness of a Tennessee educational technology professional development initiative designed to meet the NCLB requirements. When examining the student achievement results, program students either out-performed or performed as well as the control group students in all instances. Researchers describe program students exhibiting greater levels of experience with technology tools, and were "significantly more engaged in student-centered learning activities such as experiential, hands on learning, independent inquiry/research, and cooperative learning" (p. 204).

Bebell and Kay (2010) examined a one-to-one laptop initiative in Massachusetts called the Berkshire Wireless Learning Initiative. Using a pre-post comparative study design, the authors examined the program over three school years at both public and private middle schools. Although a few teachers were initially reluctant to change their teaching practices, most teachers welcomed the opportunity to make a pedagogical shift towards integrating the new computers into their instruction and quickly began using the new hardware. The results indicate positive changes in teacher practices, student engagement, and student achievement. Additionally, researchers noted improvements in student research skills. The authors conclude that "the current study found many positive impacts from participation in 1:1 computing program. . .(and) it is easy to conclude that the potential of 1:1 student and teacher computing holds major promises for transforming teaching and learning" (p. 54).

Shapely et al. (2011), in an experimental study of the effect of ubiquitous computing on student achievement and learning opportunities, longitudinally examined the immersion of technology in a one-to-one laptop initiative. The study compared 21 middle school classes with one-to-one laptops to 21 control classes who had a traditional model of computer access: fixed computer labs or mobile cart labs available by sign out. The researchers gathered data over a three-year period. The survey used contained items that measured student technology proficiency, classroom activities, and collaborative group work. Additionally, the researchers compared student achievement and attendance data. The results showed that the experimental group took part in learning activities involving technology and cooperative group work more often than the control groups. The teachers in the technology rich classrooms organized their classrooms with collaboration in mind. While not statistically significant, there was a positive trend in student achievement on state standardized tests. The study found students in the study group became more accomplished in their use of the technology than students in the comparison group. The schools with the highest level of implementation success had highly committed school leadership, greater rates of teacher buy-in, and greater investment in professional development and technical supports. These studies show that there is promise in giving students access to technology tools in conjunction with motivated school personnel who receive quality professional development.

Technology Integration Policy Efforts

Although the goal of technological literacy is not accorded equal emphasis in state and federal education plans when compared to the core content areas, there are still well-organized and well-funded efforts to advance technology education and technological literacy. Efforts by organizations such as the International Society for Technology in Education (ISTE) and The Partnership for 21st Century Skills (P21) provide resources and set standards for use in planning, researching, and training for our nation's schools (International Society for Technology in

Education website, 2015, Partnership for 21st Century Skills website, n.d.). Technology standards for teachers and students are found in 49 of the 50 states, 80% of which have adopted, adapted, or referenced the ISTE National Educational Technology Standards (Becker, Hodge, & Sepelyak, 2010). Embedded in these standards are the definitions of the knowledge, skills, and expertise that belong in 21^{st} century curriculum. All agree that the basics, reading, writing, and arithmetic, are still essential; however, the debate focuses on skills that are more difficult to define and assess. The P21 advocates a framework that includes the core content areas integrated with critical thinking and problem solving, communication, collaboration, and creativity and innovation. ISTE identifies these same skills and adds research and information fluency, decision making, digital citizenship, and technology operations and concepts to the list (International Society for Technology in Education website, 2014). Silva (2009) would argue that these skills are not new, but merely becoming of greater importance in this new century due to a growing emphasis on what students can do with information rather than on what information students can know (Silva, 2009). Freidman (2006) argues that globally accessible content forces educators to rethink what is happening in classrooms, as the emphasis must move from content access to processes that use content.

The Enhancing Education Through Technology grant program (EETT), part D of the No Child Left Behind Act (NCLB), has provided states with much needed funding in support of advancing technological literacy (United States Department of Education [USDOE], 2011). EEET states that one of its goals is to improve student academic performance by ensuring that every student is "technologically literate by the completion of eighth grade, regardless of the student's race, ethnicity, gender, family income, geographic location, or disability" (United States Department of Education (USDOE, 2010, Sec. 2402 b2A2). The EETT program offers grant funds to states that allow school divisions who lack local funding to create technology infrastructures necessary for instruction involving 21st century skills. Public schools use the clear majority of these funds to advance the acquisition of technology tools, and thus, there has been a decided improvement in student access to technology tools in schools across the nation (National Education Association, 2008; Snyder & Dillow, 2011). The United States Department of Education (USDOE) explains the meaning behind technological literacy in the National Education Technology Plan which states, "the model for learning described in this plan calls for engaging and empowering learning experiences . . .(that) leverage the power of technology to provide personalized learning" (United States Department of Education [USDOE], 2010, p. 8). In his speech introducing the new plan, Arne Duncan, former Secretary of Education, states, "In the 21st century, educators must be given and be prepared to use technology tools; they must be collaborators in learning—constantly seeking knowledge and acquiring new skills along with their students" (Duncan, 2010, para. 27). This new technology plan highlights a goal change from acquisition of technology tools to technology integration in instruction that engages our students. Thus, encouraging a move away from the industrial revolution public school design of the previous century. This move prohibits the assumption that all students are digital natives, and that all teachers are digital immigrants. The plan emphasizes a need to determine the skills students need to be successful in this century and identifies what pedagogical changes are necessary to teach 21st century skill sets to both students and teachers.

Virginia responded to the original NCLB mandate for students to be technologically literate by the eighth grade with the 2003-2009 Virginia Educational Technology Plan, which emphasized the importance of integrating technology into instruction. Dr. Jo Lynne DeMary, then Virginia Superintendent of Public Instruction, states in the forward to the plan, "the use of technological tools by teachers in classrooms will motivate and engage students, enliven instruction, extend learning beyond the school, and assist by increasing students' achievement" (Virginia Department of Education [VDOE], 2003, p. iii). She adds, "as school divisions align their local plans to the new state plan, all of Virginia's educators and children will have the opportunity to benefit from the impact of best practices in using educational technology in learning environments" (VDOE, 2003, p. iii). The 2010-2015 Virginia Technology Plan reiterates this goal stating, "While preparing children for this rapidly changing world, educators must incorporate technology that helps students learn the skills they need to participate fully in the global community" (VDOE, 2010, p. 11). Providing this level of infrastructure has been a costly endeavor. Virginia alone has invested more than $347 million dollars in technology hardware and infrastructure for state public schools (Neugent & McGraw, 2007), and an estimated total of $500 million dollars in professional development and personnel costs (Coffman, 2009).

The Virginia Constitution requires the Virginia State Department of Education (VDOE) to outline standards that divisions must follow called Standards of Quality (SOQ). These standards must go before the General Assembly of Virginia for approval prior to implementation. The state responded to the need for a position to facilitate staff development for instructional technology integration with an SOQ mandating the addition of the ITRT position by 2005. The mandate stated that there should be one ITRT for each 1000 students in a school division. In Virginia, the school divisions *must* follow the SOQ. The VDOE issues guidelines to explain the expectations for the implementation, but they are just that, *guidelines*. The state relinquishes control over school division implementation of the ITRT position resulting in disparities between VDOE expectations and locality practice.

Differences among the 132 divisions in Virginia exist in hiring requirements, contract length, and job expectations and responsibilities. Hooker (2006), using survey data of ITRTs from all 132 Commonwealth school divisions found that “instructional technology resource teachers were assisting teachers somewhat with technology integration, but the time spent on solving software (64.8%) and hardware (53.3%) problems remains a concern” (p. 2). Hooker also found that the ITRTs were spending time performing tasks not found in the VDOE guidelines such as maintaining websites and other administrative responsibilities. When comparing the time usage statistics recommended by VDOE (2005) guidelines, Hooker found that ITRTs spend 27.5% less time than the 70% recommended by the board of education integrating technology and 14.9% more time than the recommended 4% on technical support (p. 82).

The National Center of Educational Statistics (NCES) provides evidence that some of these educational goals have been met. The results of a survey of teachers, during the 2009 school year found 97% of the nation’s teachers report having one or more computers located in the classroom every day, and 93% of these computers had access to the internet. The ratio of students to computers was 5.3 to 1 (Gray, Thomas, & Lewis, 2010). In isolation, these numbers are impressive; however, further reading shows that while 96% of these teachers report using this technology for administrative purposes such as email, grade calculations, and attendance data, only 61% report students are using the computers sometimes or often for instructional purposes (Snyder & Dillow, 2011). A survey by the National Education Association found while 95% of our nation’s teachers felt that technology improves student learning, only 70% felt comfortable performing administrative tasks using technology, and fewer than half of the teachers reported feeling comfortable using technology to plan and implement lessons (National Education

Association [NEA], 2008). As both surveys are self-report, it is highly likely that these numbers inflate actual classroom practices related to integration activities.

A P21 survey found that 99 percent of voters felt teaching students 21st century skills (critical thinking and problem solving, computer and technology knowledge, and communication and self-direction) is important to our country's future economic success (Partnership for 21st Century Skills [P21], 2007). Advancing efforts to integrate technology is important for our students, not simply because some of our students are digital natives while others may not be, but because it provides them with skills that teach them to be life-long learners, and skills they will need in their future occupations (Partnership for 21st Century Skills [P21], 2008, Friedman, 2006). Technology integration is important because content has changed, not only in where it can be found or with what devices, but the content itself is constantly changing. Prensky (2001) calls this future content because the content that will be important to our students has not yet been created. Friedman predicts that young people of today will have as many as 14 different careers in their lifetime, due to changes in technology advancing so quickly that prior skills will be outdated (Friedman, 2006).

A survey of over 400 human resource professionals across the United States by The Conference Board, Corporate Voices for Working Families, the Partnership for 21st Century Skills, and the Society for Human Resource Management found "far too many young people are inadequately prepared to be successful in the workplace" (Casner-Lotto, Barrington, & Wright, 2006, p. 7). These workplace professionals identify professionalism, work ethic, oral and written communications, team work and collaboration, and critical thinking and problem solving as the most critically sought after skill sets. The researchers found that at the high school level, over one-half of new hires are unprepared in these skills, and while college entrants fare better, more than one-quarter were perceived as deficiently prepared.

If these stakeholders (policy makers, voters, and employers) recognize the need to use technology tools to *teach* a modified skill set *differently*, why is it that what is happening in our classrooms is not keeping pace with the increase in hardware and network access? The answer may be a misguided emphasis on the tools rather than the skills that embody quality instruction. Prensky, in his book *Teaching Digital Natives* (2010), presented an explanation that identifies the new technology tools as “nouns” (that are continually changing) and the requisite skills as “verbs” (that do not change very much), and therefore we should not focus on the nouns as new and better nouns will continue to emerge. Our emphasis should stay on the verbs that make up the skill-set our students need to learn. Additionally, Glazer et al. (2009) observed that past integration efforts suffered from inadequate professional development opportunities and stakeholder resistance to change. It is for this reason that research is needed to identify barriers to technology integration.

Barriers to Technology Integration

Research over the past 20 years has proposed the advances in educational technology would promote student-centered constructionist teaching and learning (Matzen & Edmunds, 2007; Grant & Branch, 2005). Hixon and Buckenmeyer (2009) propose that schools have been functioning under the mindset that “if you build it, they will come” (p. 131). The building has taken place, but the teachers have not come, and the expected change in instruction has not been evidenced (Peck, Cuban, & Kirkpatrick, 2002; Zhao & Bryant, 2006; Hixon & Buckenmeyer, 2009; Lowther, Inan, Strahl, & Ross, 2008). Cuban (2001), in a qualitative study of computers as classroom tools, found that only four of the 13 teachers observed made pedagogical changes in their teaching; the other nine teachers used the tool to perform administrative tasks or traditional teacher-centered instruction more efficiently (Cuban et al., 2001). The National Technology plan states,

> The technology that enables connected teaching is available now, but not all the conditions necessary to leverage it are. Many of our educators do not have the same understanding of and ease with using technology that is part of the daily lives of professionals in other sectors. (USDOE, 2010, p. 10)

If access is no longer a significant barrier to implementation, why is there a discontinuity between access and implementation? It is important to address existing barriers that teachers face in this change process to answer this question. Researchers classify the barriers to technology integration in four broad categories: resources, support, training and experience, and attitudinal factors (Brinkerhoff, 2006; Glazer, Hannafin, Polly, & Rich, 2009; Hixon & Buckenmeyer, 2009).

Surveys by NCES and the National Education Association (NEA) show that teachers have learned to use available technologies for productivity tasks that make traditional instructional practices more time efficient such as using word processing for creating documents, spreadsheet programs for calculating grades, presentation software for presenting information, and email for contacting parents, *but* teachers are still failing to implement technology tools in lesson design and delivery (Gray et al., 2010; NEA, 2008). Zhao and Frank found that teachers primarily use technology in ways that do not place additional burdens on their time; they use it to address administrative tasks such as communication with parents, and calculating grades, tasks where value and time savings are more evident than changes in instructional practice (Zhao & Frank, 2003).

If teachers have access to technology and the time necessary to learn to use the tools for administrative tasks, why are they not using those skills with students during instruction? Hixon and Buckenmeyer (2009) attribute this to “second order barriers,” arguing that integrating technology extends beyond just technical skill and into teaching practices where change initiatives are notoriously slow. Additionally, factors such as scheduling technology access and support can create other time concerns that prevent teachers from leveraging technology tools (Cuban et al., 2001; Kopcha, 2008; Hixon & Buckenmeyer, 2009; Glazer, Hannafin, & Song, 2005; Glazer, Hannafin, Polly, & Rich, 2009). Cuban et al. (2001) named a lack of technological support to troubleshoot hardware and software issues as one of the most hindering barriers to technology integration. Technology that does not work when needed for classroom instruction creates frustration and tension, resulting in increased reticence to employ technologies. Additionally, teachers often cite time for planning as justification for failed integration efforts (Kopcha, 2008; Brinkerhoff, 2006; Renard, 2005).

School culture and teacher individual belief systems also play a critical role in technology integration efforts (Lowther et al., 2008; Kopcha, 2008; Brinkerhoff, 2006). A school culture where instruction is teacher-centered rather than student-centered presents a challenge to most school change initiatives; this is particularly challenging for technology integration as there are definite predispositions and levels of self-efficacy concerning technology skills and aptitude (Cuban et al., 2001; Hew & Brush, 2007; Sugar, 2005; Brinkerhoff, 2006). Wozney, Venkatesh, and Abrami (2006) in a study of motivation factors related to technology integration posit that teachers’ negative attitudes concerning technology ability are self-fulfilling and require specific professional development efforts focused on enhancing teachers’ expectations of success.

Glazer et al. (2009) found that past technology integration efforts "suffered from inadequate training, insufficient human and physical resources, and resistance to change" (p. 22). Additionally, when the change initiative focuses on the technology tools rather than instructional needs, teachers frequently fail to see the necessity for learning to use the tools (Prensky, 2010; Sugar, 2005). As a change towards more constructionist instruction involving technology requires passing a portion of the control over learning to students; this pedagogical shift pushes against the teacher's identity in the classroom (Hixon & Buckenmeyer, 2009).

Dragula (2005), observed in his graduate classroom experience with future and practicing teachers that five questions surfaced when discussing the integration of technology. Teachers wanted to know why they needed to integrate technology tools, how doing so would affect their classroom, who would help them, and how to overcome common barriers. He recommended that teachers make themselves familiar with expected technology standards, make the necessary changes a priority, and know who to ask for support. Professional development for technology integration must take teacher beliefs and these common barriers into consideration when planning and delivering professional development.

Professional Development for Technology Integration

If schools are going to prepare our students for the 21st century, we must also prepare our teachers to teach using these essential skills. Research indicates that the most prevalent barrier to technology integration is a lack of training or professional development (Brinkerhoff, 2006; Zhao & Bryant, 2006; Kopcha, 2008). Hutchinson and Reinking (2011) in an examination of teacher perceptions concerning technology integration efforts found that 82% of the 1441 teachers in their national study cited professional development as a significant barrier to technology integration. The NCES survey found that 66% of teachers surveyed participated in fewer than eight hours of professional development in the past year, and only 61% of the teachers felt this prepared them to make effective use of educational technology for instruction (Gray et al., 2010). Traditional technology professional development that occurs in short bursts and focuses on the use of technology tools rather than on pedagogical shifts is ineffective at achieving the goals outlined at both the state and federal levels for student outcomes as it decontextualizes the uses of technology (Glazer et al., 2005; Belland, 2009). In a review of the extant literature on technology integration professional development, Lawless and Pellegrino (2007) found professional development efforts that last eight hours or less, and focused on the use of the tools rather than pedagogy, were unsuccessful. This fragmented approach to professional development does not meet the ongoing pedagogical needs of teachers as it is disconnected from the context of day-to-day classroom practice. The executive summary of the National Education Technology Plan (2010) calls for the replacement of "[e]pisodic and ineffective professional development [be] replaced by professional learning that is collaborative, coherent, and continuous" (p. 10).

Professional development targeted at the integration of technology shares some "best practice" with professional development but there are some nuanced differences. Lawless and Pellegrino (2007) posit "treating technology as an omnibus—an undifferentiated variable in education and in the professional development of teachers—perpetuates an overly simplistic view of what it means to integrate technology into the instructional environment" (Lawless & Pellegrino, 2007, p. 582). Key components of successful technology integration professional development include extended duration (Lawless & Pellegrino, 2007; Brinkerhoff, 2006); personalization (Zorfas & Rivero, 2005); constructivist learning opportunities (Kretlow & Bartholomew, 2010; Pierson & Borthwick, 2010; Gerard, Varma, Corliss, & Linn, 2011);

instructional content, context, and pedagogy (Koehler & Mishra, 2009; Blocher, Armfield, Sujo-Montes, Tucker, & Willis, 2011); and opportunities for professional collaboration (Thomas et al., 2012; Kretlow & Bartholomew, 2010).

Brinkerhoff (2006), in a study examining the efficacy of a long duration professional development academy, identified two essential factors that contribute to the success of the academy: the extended nature of the academy (over 90 hours of professional development) and the voluntary nature of teacher participation. In a comparison of teachers' self-efficacy ratings for technology skills after an initial summer session and following the entire 90-hour program, Brinkerhoff found there was no change following the initial summer training, but there was a significant increase following the end of the academy.

Effective professional development for technology integration needs to be longer in duration than traditional professional development. These experiences give teachers access to new technologies for teaching and learning through activities that engage teachers in ways that are meaningful and relevant for their individual contexts (Brinkerhoff, 2006; Lawless & Pellegrino, 2007; Hixon & Buckenmeyer, 2009; Kopcha, 2008). Providing experiences that are concrete examples of exemplary technology integration will solidify the transfer of knowledge from the professional development experience to the classroom.

Papert (1987) coined the term technocentric to identify the over emphasis on technology in educational technology advocacy efforts. Little seems to have changed, as Sandholtz and Reilly (2004) argue that too much time is spent on teaching the technology itself, and too little time is spent on what is truly important to teachers. "A more productive approach is to begin with teachers' strengths—thinking about curriculum and instruction—rather than putting them in the uncomfortable and unfamiliar role of technicians" (Sandholtz & Reilly, 2004, p. 507;

Koehler & Mishra, 2009). The professional development model must recognize the teacher as the content expert while providing "technology fluency," an understanding of which technologies are best suited to which types of subject matter content and how to leverage this understanding in lesson planning that focuses on student learning outcomes (Plair, 2008, p. 71). In an examination of the Microsoft peer coaching professional development model, researchers found "infusing pedagogical content knowledge in the technology integration component can help to counteract the tendency to focus on the hardware and software side of technology" (Barron, Dawson, & Yendol-Hoppey, 2009, p. 93). Even more than 20 years since Papert coined the term technocentric, educators must remember the focus should be on how the technology tools can improve instruction for improving student achievement outcomes, and therefore the professional development model implemented should focus on improving instruction.

Zhao and Bryant (2006), in their examination of the InTech training model, found teachers often feel overwhelmed by too much technology content targeted to different grade levels or content areas than those they teach. Frequently, the content focus is above or below their level of technology competency. Experiences such as this are frustrating to teachers and prevent the transfer of learning from the situation of the workshop to the classroom. Just as our students come to our classrooms with differing experiences, attitudes, and competencies, so do our teachers. This is particularly true when considering the use of technology tools. Technology professional development calls for a differentiated approach that assesses each teacher's individual skill level, attitudes and beliefs, and pedagogical needs (Hixon & Buckenmeyer, 2009; Kopcha, 2008; Plair, 2008). Typical professional development workshops, where teachers are from differing grade levels and content areas and have differing levels of technological proficiency, prevent the instructor from addressing individual teacher needs from both a technology *and* a curriculum standpoint. Successful models allow for a pre-assessment and reassessment of where each teacher is in her professional development goals (Hixon & Buckenmeyer, 2009; Plair, 2008; Zhao & Bryant, 2006).

Technology professional development activities that are most successful for pedagogical change efforts promote peer collaboration and are most effective when the facilitator is a peer who has formed a relationship based on trust with the classroom teacher (Billig, Sherry, & Harvick, 2005; Glazer, Hannafin, Polly, & Rich, 2009; Lawless & Pellegrino, 2007). Additionally, Glazer et al. (2009) found the most successful professional development model for technology integration requires ongoing support and mentorship that results in teachers becoming leaders for their own and their peer's technology integration learning. Belland (2009) argued that the habitus of many prior years of teacher directed instructional practices requires a greater level of support to encourage individuals to move instructional practices to a student-centered model. He argues that effective technology integration efforts must be of longer duration, and incorporate modeling and practical experience over a longer time. Providing this level of support requires placing individual(s) with expertise in both technology and pedagogy in close proximity to teachers. These experts need to be available not only for initial training opportunities, but also for when assistance is needed throughout the change process (Kopcha, 2008; Plair, 2008; Harris & Hoffer, 2011; Zhao & Bryant, 2006).

Henrico County Public Schools (HCPS) was the first division in Virginia to attempt a one-to-one laptop initiative for all students. During this implementation, Eric Jones (Jones, 2007) Director of High School Education in HCPS, determined that the following professional development structures must be in place for effective technology integration:

- a focus on an instructional rather than a technical viewpoint

- a system to offer learning on the use of technology tools to improve teaching and learning
- a system to provide ongoing support from an instructional professional.

Although costly, providing on-site technology support is critical. Teachers have little time for trouble-shooting technology hardware and software issues, and little time for taking risks with new pedagogies involving technology. The availability of an on-site support system negates this barrier to technology integration and provides teachers with a collaborative support system that provides them with the confidence to try constructionist instructional activities that involve technology tools.

The research suggests that professional development for effective technology integration for constructionist instructional shift occurs where the following criteria are met:

- Occurs over an extended time frame within the context of the learner,
- Focuses on the content and curriculum rather than the technology tools,
- Experiences are differentiated for each learner,
- Occurs in collaboration with peer(s), and
- Focuses on student outcomes (Kanaya, Light, & Culp, 2005; Kopcha, 2008; Brinkerhoff, 2006; Keengwe & Onchwari, 2009; Hew & Brush, 2007).

A collaborative coaching model for professional development has the capability to provide teachers with the requisite technology support for sustainable instructional change towards a student-centered constructionist instructional model.

The Coaching Model

Typical professional development for teachers that occurs in short bursts situated outside of the actual context of teaching is a method that is ineffective and gives unsustainable learning outcomes (Glazer, Hannafin, & Song, 2005). Professional development for integrating technology is most effective when customized, facilitated by a peer, and provided in context over an extended period (Billig, Sherry, & Harvick, 2005; Glazer et al., 2009; Sugar, 2005). Glazer et al. (2009) postulate that the most successful professional development model for technology integration needs ongoing support and mentorship. For this support to be effective, it requires an individual with expertise in both technology and pedagogy who is in close proximity and available when assistance is needed (Plair, 2008; Harris & Hoffer, 2011). Multiple studies over the past 25 years show the instructional coaching model for professional development to be a successful tool for job-embedded, professional learning that is sustainable over time (Barron, Dawson, & Yendol-Hoppey, 2009, Killion & Harrison, 2006, Atteberry & Bryk, 2010). This model meets all requisites for professional development for integrating technology and for moving instruction away from traditional 20th century models to an instructional model that is student-centered and constructionist and provides experiences that address the desired 21st century skills as outlined by ISTE, P21, VDOE, and USDOE (International Society for Technology in Education website, 2015; Partnership for 21st Century Skills website, n.d.; VDOE, 2010; USDOE, 2010).

Instructional coaching models for professional development in whole-school improvement initiatives are most commonly in math or literacy skills for high-stakes testing environments (Stover, Kissel, Haag, & Shoniker, 2011; Knight, 2007; Zepeda, 2008). Knight (2007) defines instructional coaches (IC) as “individuals who are full-time professional developers, on-site in schools” . . . (and) “work with teachers to help them incorporate research-based instructional practices” (p. 12). The primary goal of the IC is to provide scaffolding for successful implementation of instructional change within the context of needed improvement.

This requires the IC to have a wide repertoire of skills. Some of the more essential of these are communication skills, listening skills, and the ability to form relationships based on trust (Knight, 2007). An IC may take on many differing roles within the school setting. Killion and Harrison (2006) identified ten roles: "resource provider, data coach, instructional specialist, curriculum specialist, classroom supporter, learning facilitator, mentor, school leader, catalyst for change, and learner" (p.28). Depending on the context of the professional development and the needs of the teachers, a coach may perform some or all the roles simultaneously. It is this multiplicity of roles, in conjunction with the responsibility of working with an entire school population, which makes coaching a challenging instructional position (Killion & Harrison, 2006). An instructional technology coach must not only be viewed as a technical expert, but also as in instructional expert with the ability to problem solve and give prompt support (Coffman, 2009; Glazer et al., 2005; Sugar, 2005).

One of the most critical aspects of an instructional coaching program is that it is built on a platform of equality and collaboration rather than the typical evaluative relationship based on superiority (Killion & Harrison; 2006, Knight, 2007). While an instructional technology coach is an informal leader in the school setting, the interactions between coach and teachers are as peer-to-peer, and require a relationship built on trust (Billig et al., 2005; Killion & Harrison, 2006; Knight, 2007). The learning experiences take the form of a dialogue where "coaches listen more than they tell" allowing the teachers to have a voice in their learning goals and outcomes, while offering an opportunity for the coach to learn in concert with the teachers (Knight, 2007, p. 25). It is the conversation and collaboration of an effective coaching relationship that Sugar (2005) identified as the missing component in the technology integration puzzle.

Successful coaching requires the coach to have an extensive knowledge of the school's social network. The success of a coaching approach to professional development will hinge on the ability of the coach to become an instructional leader within the school relationship network. This new instructional role challenges the traditional school improvement model and takes on features of a community of practice (Penuel, Riel, Krause, & Frank, 2009). Depending on the number of teachers with whom the IC must work, the success of a change initiative may require the information the coach provides to reach members through their relationships with other members. It is essential to consider the complexity of human relationships in a coaching model to ensure the exchange of the resources that the coach brings to the community (Daly, 2010; Pitts & Spillane, 2009; Penuel et al., 2009).

A coach who is not central to school staff will have difficulty providing the necessary level of support to bring about instructional change (Atteberry & Bryk, 2010; Killion & Harrison, 2006). Successful coaching involves "ongoing classroom modeling, supportive critiques of practice, and specific observations" (Killion & Harrison, 2006, p. 12). The positioning of the coach at the school site allows for the necessary level of support for the specific needs of lessons that involve the use of technology tools (Sugar, 2005; Billig et al., 2005). The development of new technologies is ongoing, and as such, professional development for technology integration must be sustainable throughout the development of new initiatives and tools. The coaching model can provide a sustainable source of knowledge and expertise, as the instructional coach is an on-site expert trained to implement evolving technologies and changes in pedagogy.

VDOE intends for the ITRT to be an instructional coach, placing the ITRT where he/she readily provides professional development proximally within the context of instructional need. The VDOE Guidelines (2008) clearly define the overall goal of the program:

> The ITRT program is to provide effective support for curriculum and technology integration. The main challenge is to provide adequate training and support to bring teachers—at every point of the continuum, from *technophobia* to *technomania*—to an adequate level of technical expertise to meet learning goals (p. 10).

III. Methodology

Problem Statement

This research studies the ITRT position, as it exists ten years after its introduction, in the 132 Virginia school divisions (see Appendix C). The intent of the research is to inform legislative policy concerning the position. It is a non-educational policy group (Virginia State Legislature) making decisions about the SOQ that needs divisions to include prescribed positions to continue to receive state funding. Additional information about the ITRT position is needed to inform future policy decisions about this SOQ and for use by decision-makers at the school division level when implementing the SOQ.

The SOQ as originally written requires Virginia school divisions to have one ITRT for each 1,000 students in the division (Virginia Standards of Quality, 2004). The state issued guidelines for the position; however, there is no accountability for following the guidelines beyond the required number of positions based on student population (VDOE, 2008). This flexibility allowed by the ITRT SOQ leaves decisions regarding the actual use of the position to each division. This results in many differing iterations of the position in areas such as qualification, prior experience, roles, responsibilities, and deployment model.

This research became of importance when House Bill 1792 amended the SOQ for the position to include the following wording:

> To provide flexibility, school divisions may use the state and local funds for instructional technology resource teachers to employ a data coordinator position, an instructional technology resource teacher position, or a data coordinator/instructional

resource teacher blended position. The data coordinator position is intended to serve as a resource to principals and classroom teachers in data analysis and interpretation for instructional and school improvement purposes, as well as for overall data management and administration of state assessments. School divisions using these funds in this manner shall employ only instructional personnel licensed by the Board of Education. (HB 1792, 2004/2011)

The flexibility provided in the amended SOQ for the position by school divisions may limit the ability of the ITRT to meet the technology integration expectations as laid out in the VDOE (2008) guidelines. VDOE responded to the HB 1792 amendment in its 2012 Annual Report on the Condition and Needs of Public Schools in Virginia. The report requested that a bill be brought before the legislators to further amend the SOQ and address a critical need for *both* an ITRT position and a Data Coordinator position (Virginia Department of Education [VDOE], 2012). This did not occur. Results from this study provide a pragmatic context to elucidate the ITRT position as it exists. Research such as this is necessary to support future decisions concerning technology integration efforts.

This chapter will define a descriptive survey approach for defining the current context of the ITRT position. This study used descriptive statistics to identify correlations among variables: professional time usage, professional development, barriers to success, deployment model and perceived effectiveness of integration efforts. Additionally, qualitative analysis of an open-ended survey question revealed themes related to the investigation variables.

Philosophical Foundations

Historically, researchers attempted to force empiricism into its examination of educational processes and use a positivist philosophical lens for interpretation of results (Phillips

& Burbules, 2000; Paul, 2005). Stone (2005) suggests that all inquiry is premised in philosophical ideas about nature, humanity, society, and truth. Stone argues that this premise leads to another: “each researcher operates within a personal belief system of which philosophical ideas are a part and to which any disciplinary position, methodological selection, research stance, and specific research question relate” (Stone, 2005, p. 21). It is the acceptance of the influence of the perspectives of the researcher as an influential factor in knowledge claims that has led to the 21st century as “an intellectual environment in which there are many views of research” (Paul, 2005, p. 1). These added perspectives take into consideration factors previously ignored by an objectivist tradition, such as social, moral, ethical, and political values (Paul, 2005; Fowler, 2009). Phillips and Burbules (2000), in their argument in support of a post-positivist perspective, recognize that scientists are human, inherently biased, and may fall victim to a lack of objectivity, making it difficult to find a single reality or truth. The goal here is that the researcher be objective, or take a neutral role in describing observational data, with an emphasis on data that is quantifiable (Phillips & Burbules, 2000; McMillan, 2004). This researcher recognizes philosophical assumptions often determine the research process selected; this may shape the resulting perspectives on knowledge gained. Selecting a survey research design allows a pragmatic philosophical conceptual framework. This is done to objectively frame the current context of the ITRT position using both quantitative and qualitative data gathered in the survey while minimizing subjectivity that may exist in observational or interview data (Creswell, 2014). Data gathered identified patterns in the tasks performed by ITRTs and potential barriers to the success of the ITRTs in meeting the goals of the position as outlined in the VDOE guidelines.

Descriptive Survey Research

This researcher would ideally have chosen a post-positivist epistemology using an experimental methodological approach where the researcher identifies and intentionally manipulates variables to gather quantitative data to find causation and make warranted claims (Phillips & Burbules, 2000; Paul, 2005). However, the context of this study, as in much of educational research does not suit experimental methods, as the researcher is not able to manipulate variables or identify test and control groups. Additionally, this topic does not have a specifically measurable outcome. The goal of the ITRT program is to influence student learning positively by improving instructional practices using evolving instructional technology tools. Although the Virginia Tech study (Virginia Department of Education Division of Technology and Human Resources Office of Educational Technology, 2007) attempted to make warranted claims tying student Standards of Learning test scores to data gathered by Hooker (2006), this researcher feels there are too many unidentified or uncontrolled variables to support such claims.

Adopting a more pragmatic approach allows the researcher to search for truth as a description of *what is* while also allowing for conjecture about *why it is*, as there is no absolute reality (Paul, 2005; Noddings, 2005; Creswell, 2014;). Survey research is particularly suited for a pragmatic lens, as pragmatism requires an examination of theory and practice (Noddings, 2005). "If you want to know what is going on, you have to go out and look at what is going on. Such inquiries are descriptive" (Shavelson & Towne, 2002, p. 100). While maintaining a desire for quantifiable measures, this nonexperimental design utilized descriptive and inferential statistics to report quantitative data to describe relationships among variables, the *what is*. Finally, a qualitative analysis of an open-ended survey question added voice, or rich descriptions of authentic practice, to the quantitative data (Bogdan & Biklen, 2007). This structure creates an avenue for the ITRTs to share perceptions of context that would not be visible in fixed-response survey data. The examination of both closed and open survey questions allows the researcher to build warranted knowledge, as neither "detached theory nor a mere account of personal experience can yield warranted assertions" (Noddings, 2005, p. 58).

A pragmatic philosophical stance does not lend itself to a postpositivist epistemology as it adds depth that goes beyond the objective quantitative analysis by adding reality that is socially constructed (Noddings, 2005; McMillan, 2004). Adopting an interpretive epistemology allows the researcher to use multiple streams of information to construct meaning and produce warranted interpretations of the data (Creswell, 2014; McMillan, 2004). The questions being examined are intended to explain the context of the ITRT position as explained through data provided by the participants; it requires the researcher to subjectively interpret the reality of the context. This does not allow for the level of objectivity necessary in a postpositivist interpretation of the data. An interpretive perspective allows the researcher to use social constructs to construct meaning.

Methods

Research design. Reigeluth and An (2006) argue that although the goal of research is the search for truth, investigating context with a goal of finding usefulness is often necessary in studies of educational contexts. The intent of this nonexperimental study is to describe existing phenomena about the ITRT position in its current state. This data was compared to data gathered by Hooker (2006) after the first year of the ITRT program in Virginia. The educational setting prevented the manipulation of variables expected in an empirical study, therefore this quantitative study is descriptive in nature with the intent of giving needed explanation of the current context of the ITRT position (McMillan, 2004; McMillan & Schumacher, 2006;

McMillan, 2004; Creswell, 2014). This study used a survey instrument to provide a quantitative numeric description of trends, attitudes, or opinions of the ITRT population (Creswell, 2014; Mitchell & Jolley, 2007).

This body of research has the end goal of informing Commonwealth policy. The ITRT position, as mandated by SOQ, is costly (Neugent & McGraw, 2007; Coffman, 2009). Although VDOE has published guidelines for the position, school divisions are not required to abide them. The structure of the SOQ mandate, of one ITRT for each 1,000 students, offers little specificity as to deployment and use of the position and thus has many iterations across Virginia's 132 school divisions. This flexibility calls into question its effectiveness at achieving the goals as established by the VDOE.

Research questions. After conducting data analysis, the following questions are examined:

1. To what extent do ITRT reported professional activity time allocations compare to:
    a. Those suggested in the VDOE guidelines (2008)?
    b. Those identified by Hooker (2006)?
2. To what extent do ITRT reported professional activity time allocations vary as a function of:
    a. School grade levels served?
    b. ITRT years of experience?
    c. Deployment model-
        i. School or division?
        ii. Number of schools the ITRT is responsible for?

iii. Number of teachers the ITRT supports?

d. ITRT is responsible for data activities as well as ITRT activities?

3. What are the frequencies of ITRT activities?

   a. Do reported ITRT activities match the recommended job roles as identified by the VDOE guidelines (2008)?

4. To what extent and in what ways does the open-ended question contribute a more comprehensive and nuanced understanding of the current context of the ITRT position?

Research population. The target population for this study was the group of educators in the state of Virginia who hold a position as an ITRT. Every effort was made to reach ITRTs in every Virginia school division. Jean Weller, Instructional Technology Specialist at VDOE agreed to reach out to the state's ITRTs using her email list for current ITRTs. This list was not shared with the researcher and could not be examined for accuracy or completeness. Three of the larger school divisions (Fairfax, Hanover, and Chesapeake) filter content sent by Ms. Weller prior to sharing with their ITRTs and opted not to do so in this circumstance and therefore are not represented in this population. Responses were received from 431 ITRTs. The verified number of ITRTs in the identified population is 987 (Appendix D), after subtracting the number of ITRTs in the three divisions that opted not to participate, there are 847 in the population. The response rate of 51% supports generalizable findings

Data collection and analysis. Data collection for this study used a survey instrument (see Appendix D) modeled on the one used by Hooker (2006, Appendix A) in her investigation of the ITRT position. The addition of questions not found in Hooker's study served two purposes. First, it was important to determine if the change in SOQ in 2012 that added flexibility to the position (adding wording that allows for the ITRT position to be used as a data coordinator, an ITRT, or one position with dual roles) had an impact on how ITRTs spend their time and their perceptions of their effectiveness in meeting the goal of technology integration. Second, it was necessary to get information about how each division has deployed the position to identify any correlation to either responsibilities or perceptions. The use of a survey instrument is appropriate as this allows for ease of administration, rapid turnaround of data gathering, and limitation of researcher bias that may be found in interview or observational data (Creswell, 2014; McMillan & Schumacher, 2008). Survey data give a numeric description of trends, attitudes, and perceptions to investigate the technology integration efforts of ITRTs.

Quantitative data from the survey instrument were imported into SPSS from an Excel spreadsheet generated by the survey tool (Survey Monkey, n.d.). As this study is entirely descriptive, with the goal of describing current conditions of the ITRT program, all data were analyzed using the following descriptive statistics: percentages, frequency distributions, mean comparison, and standard deviations. Inferential statistics were also used to find correlations between variables.

Limitations of the Study

Researcher positionality. This researcher is an ITRT in a Virginia school division where each school building has a resident ITRT; student population is not a consideration. The school division meets the requirement of the SOQ by showing that they have 30 ITRTs and only 27,700 students, exceeding the SOQ requirement. This results in schools with 2,000 students having one ITRT and schools with 400 students having one ITRT. This is an example of local control of ITRT deployment meeting the expectation, while not necessarily having one ITRT serving teachers with student populations of 1,000. It was this structure, along with knowledge of other division practices, which sparked the desire to examine the current context of ITRTs in the Commonwealth. The researcher may be biased by her proximity and experiences regarding the position. As the descriptive statistics are gathered using a survey instrument, this limitation is mitigated. The software package NVIVO 11 is used to code qualitative data to minimize researcher bias in interpreting identified themes.

Data collection return rate. Instrument return rate is always a concern in educational research. This is of concern here, as the researcher does not have direct access to the sample population. This list was not shared with the researcher and could not be examined for accuracy or completeness.

Summary

Examining the effectiveness of a program such as the ITRT program presents an insurmountable confluence of variables with no empirical method for measuring student learning outcomes or teacher implementation of change initiatives. Using a survey approach allowed the researcher to describe the current context of the ITRT program in Virginia from the perspectives of the ITRTs. The survey instrument gave a self-reported snapshot of ITRT beliefs about their practice, which was compared to the study completed by Hooker (2006). This work offers a starting point for additional research to inform policy changes concerning the SOQ requirements for the position.

IV. Results

The current context of the activities of the ITRTs was examined using survey data. Based on this data, survey time allocation results were compared to those in the ITRT guidelines (2008) and those found by Hooker (2006). Additionally, these time allocations were examined using the following independent variables: grade levels, ITRT experience, deployment model, number of schools the ITRT supports, and if the ITRT is responsible for data related tasks. To further elucidate the activities of the ITRTs, data that describes the frequency that ITRTs performed specific responsibilities with teachers and with administrators is examined. Data were collected using an online survey. Additional examination of an open-ended question was done to identify themes from ITRT comments.

Demographics

The researcher contacted a representative from each school division and asked the following questions:

1. How many ITRT positions are there in your school division?
2. What is title for the position?
3. Does your position include responsibilities of a data coordinator?
4. Do you believe that your school division meets the SOQ requirement of one position for each 1000 students? (Appendix D)

If direct contact was not successful, the researcher used information gathered from school and division websites. The chart was sent to the division technology contact for each division (list provided by Jean Weller, Instructional Technology Specialist, VDOE) to review for accuracy. Twenty-nine divisions use one or more positions as a data coordinator, 53 are not meeting the SOQ of one per 1,000 students, and 23 exceed the minimum required by more than .5 positions (Figure 2).

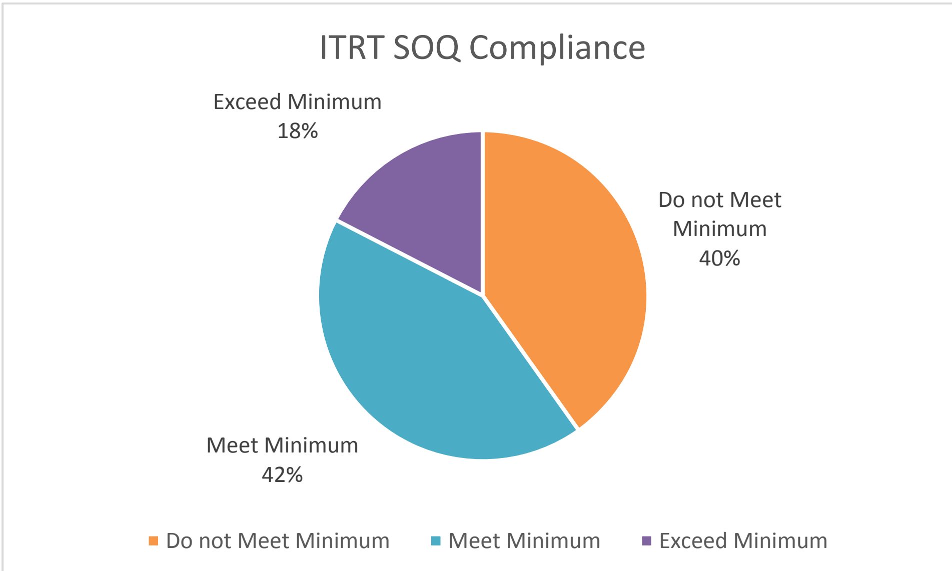

Figure 2: ITRT SOQ Compliance

Demographic data were gathered in the survey instrument to illustrate characteristics of ITRTs and for use as independent variables for question 2. ITRTs are known by 35 unique titles; ITRT is the predominant title used (Appendix F). Some titles indicate ITRTs are serving in more than one position: Director of Technology, Instructional Technology Liaison, Data assessment Technology Manager, and Library Media Specialist/TRT are a few examples. This is quantified by the results to the question about data performance tasks, as 59% of those surveyed say that they have some responsibilities that involve data. The most frequently mentioned data task is supporting Standards of Learning (SOL) testing.

The ITRTs have full-time positions (Appendix F) and contract terms that range from 10 to 12 months. School divisions deploy the ITRT position differently; however, the majority, (86%), report to work in one or more school locations with only 7% reporting to work in a division location. Additionally, 43% are assigned to only one school location, 23% are assigned to two schools, 17% to three schools, 6% to four schools, and 8% to five or more schools (Figure 3).

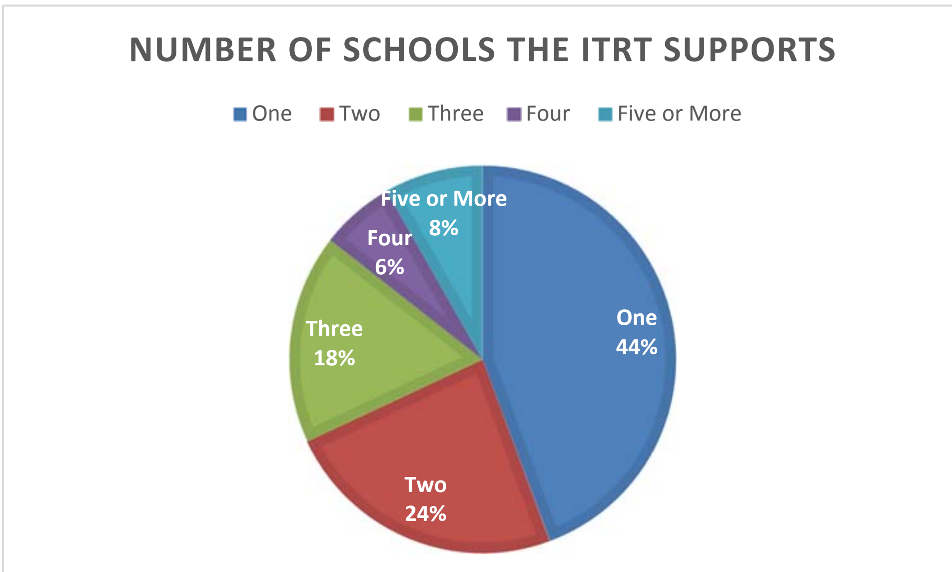

Figure 3: Number of Schools Supported by the ITRT

The number of teachers each ITRT supports varies from 14 to more than 500. Those ITRTs with larger numbers of teachers to support were frequently those serving multiple schools or a in a single larger high school (Figure 4).

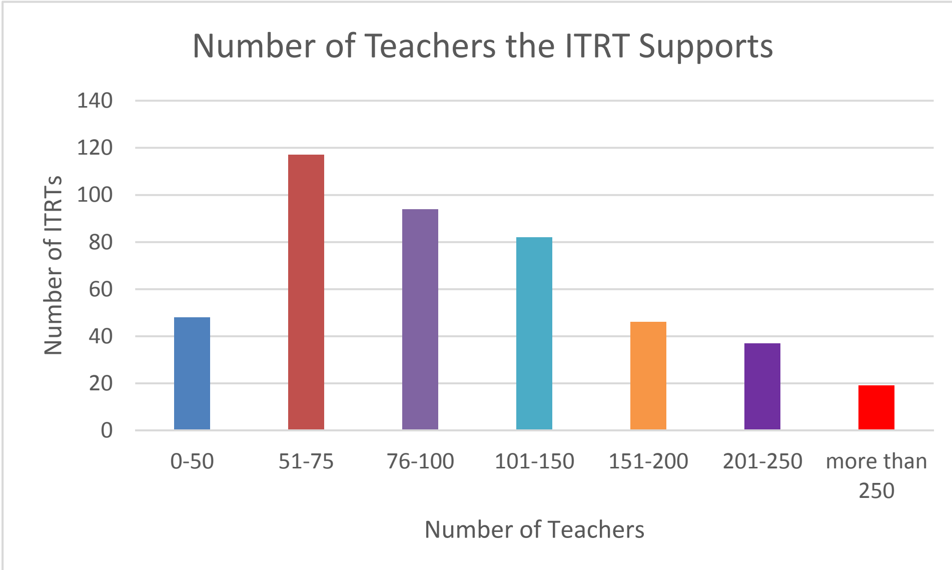

Figure 4: Number of Teachers the ITRT Supports

Most ITRTs (59%) work a traditional 10-month teacher contract while 29% work an 11 month-contract and 11% work a 12-month contract. Ninety-one percent of ITRTs work the position full-time; however, they do not necessarily perform only ITRT responsibilities. Fifty-nine percent of ITRTs said they perform responsibilities of a data coordinator at least some of the time. Most ITRTs work at either elementary, middle, or high school levels; however, 15% said they work at all three levels. Almost 60% of ITRTs have held the position for three years or longer, with 25% having held the position for more than 10 years.

Research Question 1

1. To what extent do ITRT reported professional activity time allocations compare to:
    a. Those suggested in the VDOE guidelines (2008)?
    b. Those identified by Hooker (2006)?

Study means were calculated for each of the six categories listed in the VDOE (2008) guidelines for the recommended percent of time:

1. Assist teachers with the integration of technology in the classroom, train teachers to use technology, assist with curriculum development as it relates to educational technology, model instructional strategies with students, provide training and professional development, collaborate with teachers, research technology-based instructional strategies, review/evaluate technology software, offer direct assistance to teachers by way of classroom visitations, or fulfill similar kinds of duties and responsibilities as the school division may deem appropriate. Provide professional development activities for administrators.
2. Meet with administrators and content supervisors at the building and/or central office level to coordinate services and resources. Serve on building and/or division leadership teams relating to technology and instruction, professional organizations related to technology, and other responsibilities. Assist administrators and content supervisors with data-driven decision making relating to all areas of curriculum and instruction.
3. Create and implement a plan to communicate progress and activities to school, faculty, and administration (e.g., newsletter, technology Web site, e-mail notifications).
4. Conduct minor troubleshooting of computer lab equipment, hardware, or software problems.
5. Maintain records necessary to document progress and activities, such as a journal, blog, or database of activities.

6. Conduct personal professional development, including research relating to professional growth goals, related conference attendance, workshops, and coursework. (VDOE, 2008, p. 12)

The study means were compared to those in the Hooker (2006) study and the time recommendations found in the VDOE Guidelines for Teachers and Administrators (2008) Figure 5. Table of data found in Appendix C.

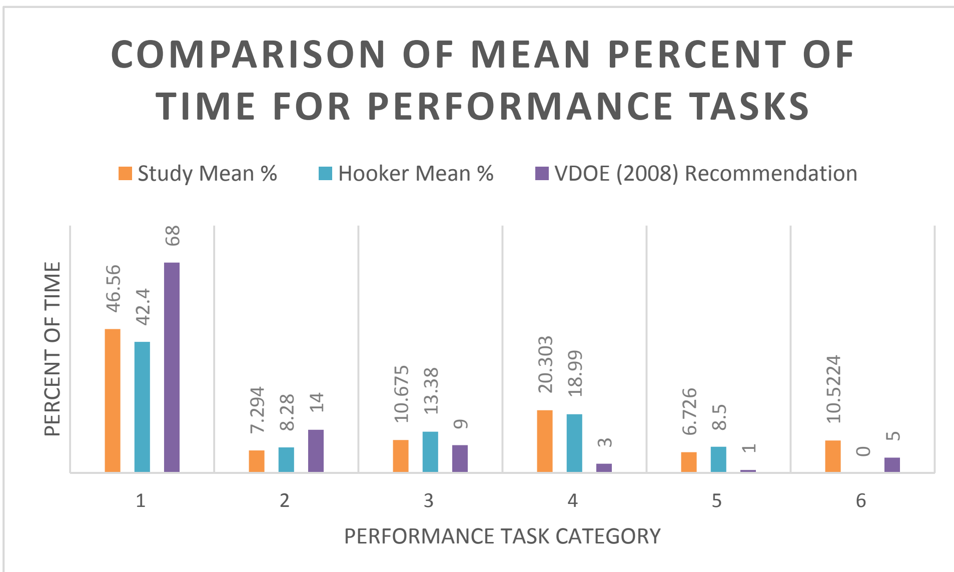

Figure 5: Mean Comparison for Performance tasks

Comparison of study results for professional activity time and VDOE recommendations. To answer this research question, six one-sample *t* tests (Table I1) were conducted to compare the mean percent of time ITRTs spend aiding teachers with technology integration and professional development, meeting with content specialists, communicating information, performing technical support duties, keeping records to document progress, and taking part in personal professional development with those suggested in the VDOE guidelines (2008) (Appendix I).

The recommended percent of time recommended by the VDOE guidelines (2008, Appendix B) for technology integration and professional development is 68%. The survey results indicate a combined mean (technology integration and professional development activities were measured separately in this survey) of only 47%. This is significantly lower than what is recommended by VDOE (t=-18.312.0, $p < .000$).

The recommended percent of time recommended by the VDOE guidelines (2008) for meeting with content specialists is 14%. The survey results show a mean of only 7.29%. This is significantly lower than what is recommended by VDOE (t=-16.398, $p < .000$). As ITRTs come from many different content backgrounds from their years teaching, it is essential that they work in conjunction with content specialists. These results show this is not happening.

The recommended percent of time recommended by the VDOE guidelines (2008) for communicating information about instructional technology is 9%. The survey results indicate a mean of 10.68% which exceeds that recommended by VDOE (t=3.081, $p < .002$). Although this meets the level needed for statistical significance, it may not be of practical significance as the expected mean is low, and the difference in means is not large.

The recommended percent of time recommended by the VDOE guidelines (2008) for performing technical duties is 3%. The survey results showed a mean of 20.30%. ITRTs are exceeding the VDOE guidelines by 17% (t=18.814, $p < .000$). This result is consistent with that of Hooker (2006). This is of great concern. Are school divisions fulfilling the SOQ for the technology support position?

The recommended percent of time recommended by the VDOE guidelines (2008) for maintaining records to document progress is 1%. The survey results showed a mean of 6.73%. ITRTs are exceeding the VDOE guidelines by 5.73% (t=11.535, $p < .000$). Further research on this would be interesting. What is it that ITRTs are having to do to document their progress that is taking so much of their time?

The recommended percent of time recommended by the VDOE guidelines (2008) for conducting personal professional development is 5%. The survey results showed a mean of 10.52%. ITRTs are exceeding the VDOE guidelines by 5.52% (t=9.286, $p < .000$). Although this result indicates ITRTs are spending too much time on personal PD, it might not be a problem as technology tools and instructional practices are continually evolving and the ITRT must stay current.

Comparison of study results for professional activity time and results from Hooker (2006). When Hooker (2006) completed her study, she used the VDOE guidelines from 2005 (Appendix B) for the ITRT position. These guidelines had five categories for percent of professional activity time estimates. Hooker found that there was a statistically significant difference in means for all five of the performance task categories when compared to the VDOE time recommendations (VDOE, 2005). This finding agrees with this study's findings, however to further elucidate changes from then to now, five one-sample *t* tests (Appendix J) were performed using Hooker's calculated means to determine if a statistical difference exists for time on task for each category. The results of the one-sample *t* tests indicate little has changed.

Time spent on integration and professional development activities, the task area that VDOE places the greatest importance, has only increased 2.4% (t=1.873, $p < .062$).

Time spent meeting with content specialists has decreased. Survey result has a mean of 7.29% with a difference of -0.986% (t=-2.411, $p < .016$). Although this is statistically significant, it is questionable if it is of practical significance.

Time spent on communicating information about instructional technology has decreased. The mean difference is -2.70% (t=-4.974, p < .000).

Time spent on performing technical duties was an area of concern for VDOE when the department saw the results from the Hooker study. Using this information when rewriting the guidelines, the recommended time for this task was reduced from 4% to 3%. (VDOE, 2008). Hooker found that ITRTs were spending 18.99% of their time on troubleshooting technical issues. This survey finds that ITRTs are spending 20.30% of their time on these tasks with a resulting increase of 1.31 (t=1.428, p < .154).

Time spent maintaining records to document progress has a mean of 6.73% which has decreased with a mean difference of -1.77% (t=-3.573, p < .000).

Research Question 2

> To what extent do ITRT reported professional activity time allocations vary as a function of:
>
> a. School grade levels served?
> b. ITRT years of experience?
> c. Deployment model-
>   i. School or division?
>   ii. Number of schools the ITRT is responsible for?
> d. ITRT is responsible for data activities as well as ITRT activities?

To answer question 2, inferential statistics were calculated (Appendix K). A one-way between subjects ANOVA was used for each of the independent variables to determine if any of these factors affected the actual time the ITRTs spend on each of the six expected task categories.

Table K1
Percent of Time on Professional Activities Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Assisting teachers with the integration of technology	412	0	100	32.56	20.795
Meeting with content specialists to coordinate services and resources.	391	.0	80.0	7.290	8.0818
Communicating information about Instructional technology (e.g. newsletter, Website, e-mail).	403	.0	100.0	10.768	10.9766
Performing technical support duties.	409	.0	100.0	20.331	18.4913
Maintaining records necessary to document progress and activities.	392	0	100	6.72	9.660
Conduct formal professional development for teachers you support or from your school division.	407	0	100	13.91	11.937
Conduct personal professional development	388	.00	100.00	10.2326	10.56948

Independent variable differences by grade levels served. A one-way between-subjects analysis of variance (ANOVA) was used to determine whether differences exist in the means for four levels for measure of grade level (elementary, middle, high, and all) and the seven dependent variables (Table K2). No significance was found at the $p<.05$, and differences in means indicate little practical significance.

Independent variable: ITRT experience. A one-way between-subjects ANOVA was used to determine whether differences exist in the five levels of the independent variable measure of years of experience on all six dependent variables. The independent variable was measured using the following increments for experience in years: <1, 1>3, 3>5, 5>10, and 10>. Mean differences for all dependent variables were tested for statistical significance at the $p<.05$. There were no significant differences for any of the activities except for technology integration ($F=2.401$, $p < .05$). A Tukey post hoc test was performed for that dependent variable to determine between level significance. The results indicate no statistically significant difference in means across any levels of the grade levels.

Independent variable: ITRT deployment model. The independent variable for deployment is categorized into three factors: ITRT base location, number of schools, and number of teachers supported

ITRT Location. The ITRTs' base location is important, as the role of the ITRT and good professional development practices indicate the need for the ITRT to be able to provide support that is on-going and proximal. This suggests the ITRT needs to be where the teachers are, in the schools. In 2008, VDOE used the results of the Hooker study to refresh the guidelines from 2005 for the ITRT position (2006). One survey finding that was of concern was that the ITRTs were "spread too thinly" (VDOE, 2008, p. 19). Recognizing that deployment of the ITRTs was a division level decision, they offered the suggestion that ideally one ITRT be placed in each school; where impossible, the ITRT should not be responsible for more than two schools. Of the 431 ITRTs who participated in this survey, 134 are working with three or more schools.

The independent variable for the number of schools the ITRT supports is divided into three levels to define location: school, division, and both school and division. A one-way between-subjects ANOVA was used to compare means for these three levels for statistical significance (Appendix K). The majority (86%) of ITRTs report to work at a (one or more) school location. There is a statistically significant relationship between location and the percentage of time conducting professional development ($F = 7.879$, $p < .000$). Further analysis using a Tukey post hoc test was completed to find between level significance. The Tukey test reveals that the difference lies between those who work at division all or part of the time and those who work in a school location. There is a mean difference between school location and division location of 6% and between school location and both school and division location of 8%. It is important to note here that the frequency count for division location is significantly less than for school location.

ITRT number of schools. The second measure of deployment model is the number of schools the ITRT supports This varies from one to five or more, although the majority support just one school (44%). A one-way between-subjects ANOVA was completed to determine if there are significant statistical differences between the means for number of schools supported and the professional task time variables (Appendix K, Table K5). There were no statistically significant differences in mean for any of the dependent variables and the differences in the means do not show the possibility of any practical significance when compared at the five test levels (1, 2, 3, 4, 5 or more).

The question of one school supported compared with more than one was an important aspect of this question, therefore, further evaluation was done to address the question. The levels of the variable were collapsed to two levels: one school or more than one school. The frequency counts for these as levels of the independent variable were 182 and 219 respectively. The means were calculated for one school and more than one school and used in a one-sample *t* test for each of the six dependent variables. The results proved interesting (Appendix K, Table K6).

There is a statistically significant difference in the means for the dependent variable assisting teachers with technology integration ($t = 34.34$, $p<.003$). What makes this interesting is it was the ITRTs who worked in more than one school that had the greater mean (+4.54%). The extant literature would have predicted the opposite result.

Another interesting result was for the technical duties dependent variable. ITRTs who work in only one school spend 4.56% more time on technical issues (t = 18.53, p<.001). This is of practical relevance as it is this task that, now and historically (Hooker, 2006), has been the most out of sync with the VDOE guidelines. With the recommended 3% of time and actual means of 18% and 23%, this is a concern.

There is one other result that has a significant result. ITRTs at more than one school spend 2.82% more time on formal professional development than their peers at one school (t = 15.03, p<.000). This result may be related to the earlier result for the formal professional development variable that found that ITRTs who spend some time at a division location provide more formal professional development.

ITRT number of teachers supported. The results for the deployment model question sparked the idea of investigating the number of teachers the ITRT was responsible for supporting. These data were included in the demographic questions. As this was a continuous variable with responses ranging between 14 and 2,000, a Pearson product-moment correlation coefficient was computed to assess the relationship between the number of teachers and the seven dependent variables (Appendix K-Table 8). Two of the seven dependent variables showed a significant relationship.

The Pearson product-moment correlation coefficient showed a negative correlation between number of teachers supported and the amount of time spent on technical support tasks (r = -0.109, n = 379, p = 0.035). Figure 6 shows a scatterplot that summarizes the results. ITRTs with fewer teachers to support are spending more time on technical support activities.

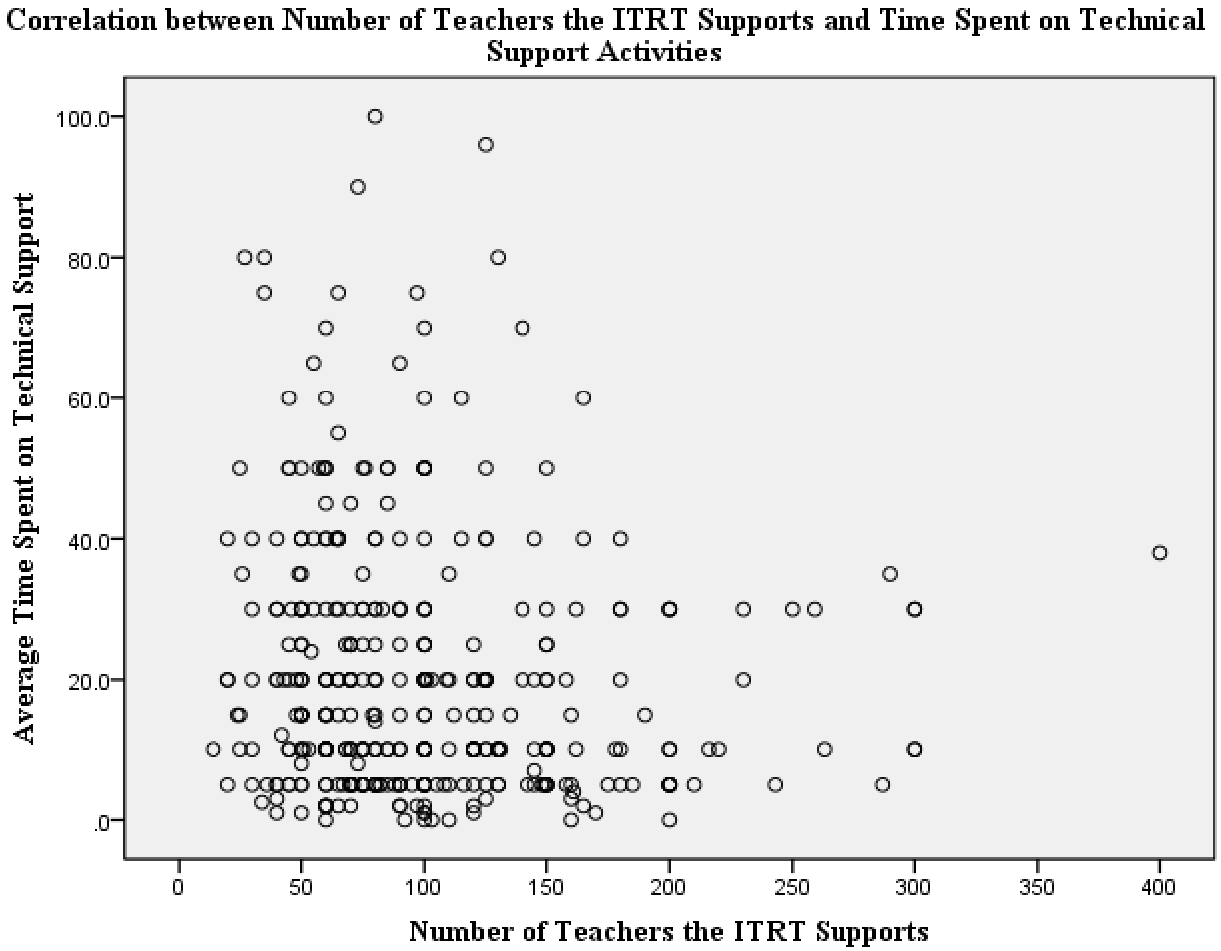

Figure 6

The Pearson product-moment correlation coefficient showed a positive correlation between number of teachers supported and the amount of time spent conducting formal professional development activities (r = 0.170, n = 377, p = 0.001). Figure 7 shows a scatterplot that summarizes the results. ITRT with larger numbers of teachers to support are spending more time on formal professional development.

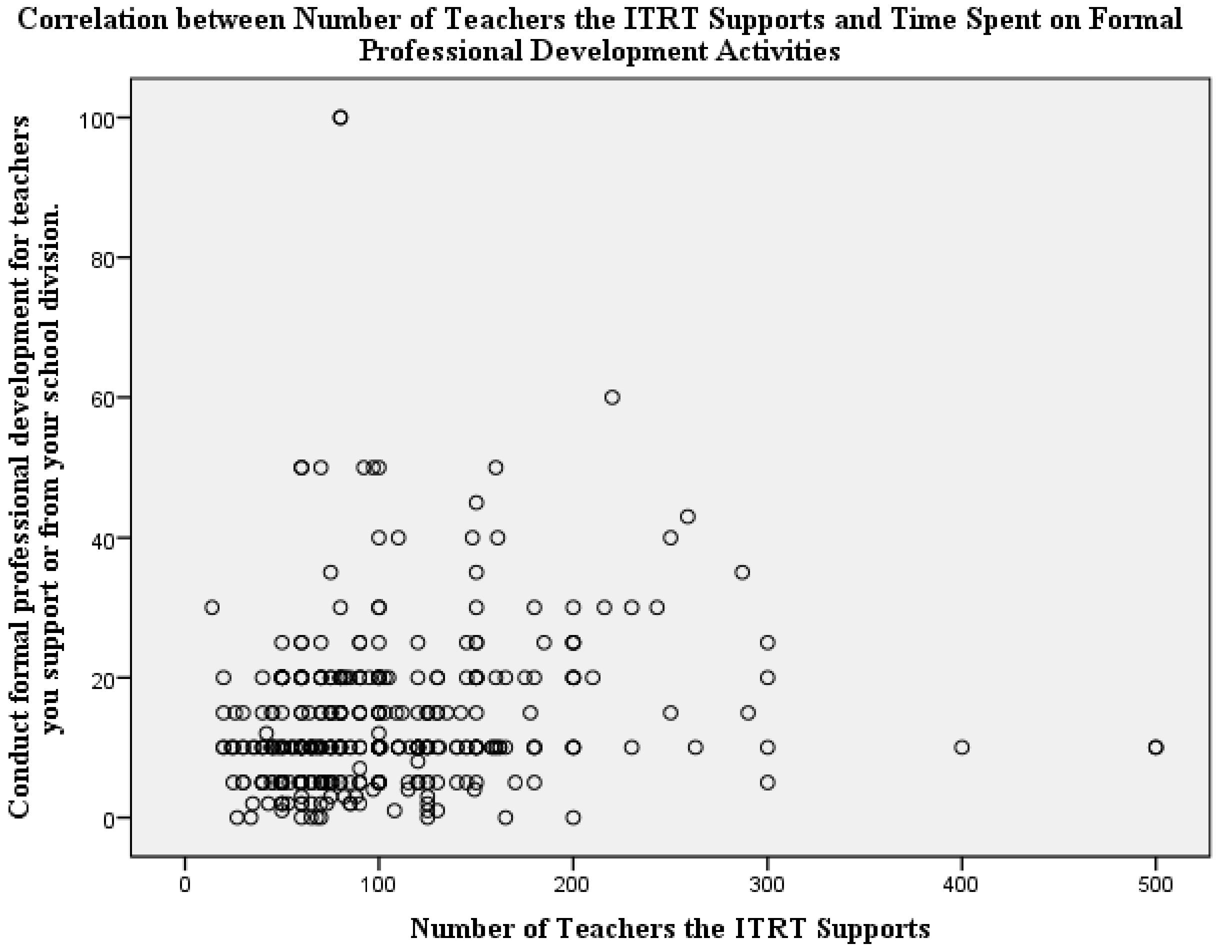

Figure 7

Independent variable: ITRT is responsible for data activities as well as ITRT activities. The change in the SOQ for the ITRT position in 2012 allows school divisions to use the position as an ITRT, a data coordinator, or one position that does both responsibilities (Virginia Standards of Quality, 2012). A question that was not in the Hooker (2006) survey was added to determine how this change has affected what ITRTs are doing. The question asked how many hours a week were devoted to data coordinator or testing responsibilities. Fifty-seven percent of the surveyed ITRTs indicated that they are responsible for data tasks; many specifically said these responsibilities involve testing. To get a picture of how this impacts the

ITRTs' ability to perform the tasks outlined in the guidelines, two levels of the independent variable were collapsed to, one for having some data responsibilities or zero for having no data responsibilities. This allowed for one-sample *t*tests to compare the means for the two levels of the variable. Four of the seven dependent variables had statistically significant ($p<.05$) differences (Appendix K, Table K7).

ITRTs with data responsibilities are spending 3.86% less time assisting teachers with technology integration ($t = -2.890$, $p<.004$). This suggests that adding these responsibilities affects the ITRTs' ability to accomplish the primary intent of the program, improving instruction by using technology tools.

ITRTs with no data coordinator responsibilities are spending more time meeting with content specialists with a mean difference of 1.26%. Although this is a relatively small difference, it is statistically significant ($t = 2.099$, $p<.004$), however this is questionable because both levels of this variable have a relatively small mean (7.78% and 6.52%). It is important to note that the time spent here is about half of the total recommended in the guidelines.

VDOE guidelines recommend that ITRTs spend less than 9% of their time communicating information about instructional technology. Those with no data responsibilities are spending 9.8% and those with data responsibilities are spending 11.5%. This resulted in a mean difference of 1.67% and is statistically significant ($t = 2.034$, $p<.043$). What is most important about these findings is that both are significantly below the 14% recommended by VDOE.

ITRTs with data responsibilities are spending 1.8% more time maintaining records to document progress than their peers without data responsibilities. While this is statistically significant ($t = 2.6$, $p < .009$). The most notable finding here is that the *mean difference* exceeds the total of <1% that VDOE recommends. Both are spending a significant amount of time documenting their activities when they should be *doing* their activities.

Research Question 3

To what extent do reported ITRT activities:

a. match the recommended performance tasks as identified by the VDOE guidelines (2008)?
b. To what extent do reported ITRT activities indicate that ITRTs are performing tasks not identified as recommended by the VDOE guidelines (2008)?

To provide additional context to what the ITRTs are doing, survey questions were included that address specific activities. The first set of questions relate to activities that involve teachers, and the second set of questions include questions about similar activities with school or division administration.

Job performance tasks with teachers. To further clarify job expectations, the VDOE guidelines provide a list of suggested job performance tasks:

- Working collaboratively with individual teachers or groups of teachers to integrate technology into instruction
- Assisting with curriculum and content development
- Disseminating information regarding technology resources, emerging technologies, best practices using technology, and professional development opportunities
- Facilitating or conducting technology-related professional development
- Assessing levels of teacher and student technology use and skills
- Modeling effective instructional strategies using technology

- Serving as a member of the school technology committee
- Supporting implementation of the state technology plan
- Researching use of newer technologies in instruction
- Using data to design technology-based instructional strategies
- Recommending hardware, software, and related resources
- Identifying trends in software, curriculum, teaching strategies, and other educational areas
- Creating learning resources for teachers, staff, and students
- Serving as a strong advocate for technology integration
- Participating in software selection and use (VDOE, 2008, p. 10-11)

Table L1 shows the frequency counts of the performance tasks designed to see if these suggested tasks describe what ITRTs are doing (Appendix L-Table L1 includes percentages). These results show that 60 to 70% of ITRTs are frequently or very frequently spending their time showing teachers how to integrating technology, researching instructional technologies, researching curriculum resources, and training teachers to use software applications. More than 40% are frequently or very frequently modeling instructional strategies, working with teachers on student projects, and training teachers on hardware use. When you add in the ITRTs who are occasionally performing these tasks, the percentage jumps to 80% or more. This indicates most ITRTs are spending their time with teachers on the tasks that VDOE defines as important.

Table L1: Level of ITRT Involvement with Classroom Teachers.

	Almost never	Rarely	Occasionally	Frequently	Very frequently
1. Collaborating with teachers to design lesson plans.	28	68	191	110	31

2. Showing teachers how to integrate technology.	2	22	107	202	95
3. Modeling effective instructional strategies using technology.	5	51	180	144	47
4. Training teachers on use of hardware.	11	58	182	152	25
5. Training teachers to use software or applications.	2	19	103	228	75
6. Assisting teachers with students' projects.	23	65	176	125	38
7. Participating in department or faculty meetings to discuss technology integration.	28	80	175	104	40
8. Finding curriculum resources or Internet sites for teachers.	6	29	116	189	88
9. Researching instructional technologies to share with teachers.	3	25	119	196	84
10. Assisting teachers with software problems.	0	21	105	189	111
11. Assisting teachers with hardware problems.	17	51	130	126	96
12. Assisting teachers with administrative tasks such as grading, email, and maintaining classroom web pages.	24	79	142	126	56

The VDOE guidelines describe what an ITRT, and should do, but they also say what an ITRT is *not*. ITRTs are not expected to provide “typical information (IT) assistance” (VDOE, 2008, p. 20). The Hooker study found that 92.3% of ITRTs were spending time on software issues and 84.4% were spending time on hardware issues (2006, p. 57). This problem has not improved. Ninety-four percent of ITRTs surveyed indicated they occasionally, frequently, or very frequently assist teachers with software issues, and 81.7% assist teachers with hardware issues. This is interesting, as the SOQ also requires a position whose sole responsibility is to maintain and support the hardware in schools (Virginia Standards of Quality, 2004).

Additionally, 75.1 % of ITRTs are assisting teachers, occasionally, frequently, or very frequently on administrative tasks such as grading, email, and class room web pages and 56% are maintaining their school’s website; all are activities that only marginally relate to instruction. VDOE describes the ITRTs as an “agent of change and actively engaged in curriculum development and lesson planning” (VDOE, 2008, p. 10). The fact that 23% of ITRTs never or rarely collaborate with teachers to design lessons, and another 44% do so only occasionally is of concern, particularly as this task is highly important for a position defined as an instructional coach.

Job performance tasks with administrators or division staff. Although ITRTs are primarily to work with teachers, there are job performance tasks that involve school or division leadership. Table L2 shows the frequency counts of the performance tasks designed to describe what ITRTs are doing with school or division personnel (Appendix L-Table L2 includes percentages). As expected, ITRTs are occasionally, frequently, or very frequently involved in technology hardware and software purchases (63.3%), technology planning at the school (81.2%) or division (67.7%), and giving presentations on technology integration (50.1%). They also spend time assisting administrators with instructional software applications (54.8%) and administrative software (64.5%). There are areas of concern; ITRTs are occasionally, frequently, or very frequently spending too much time on tasks that are not instructional such as maintaining school websites (56.6%) or division websites (13.2%). Additionally, there are tasks that ITRTs should be doing more. ITRTs almost never or rarely mentor others to assume a technology leadership role (54.5), develop assessments to track technology use (63.8), or assist administrators in writing grants for additional technology funding (78.9%).

Table L2: ITRT Involvement with Administrators/Division Leadership.

	Almost never	Rarely	Occasionally	Frequently	Very frequently	Response Count
1. Involved in division's technology planning.	58	78	144	98	50	428
2. Involved with school level technology planning.	25	53	107	156	87	428
3. Training administrators on the use of administrative software applications (student information, grading, or email).	42	106	191	66	21	426
4. Assisting administrators in writing grants or finding alternate funding for technology.	211	129	65	20	2	427
5. Preparing press releases related to technology integration in the school(s).	273	92	50	11	3	429
6. Mentoring others to assume a technology leadership role.	112	123	133	49	11	428

7. Developing and implementing assessments for tracking technology use.	136	139	111	32	8	426
8. Providing training for administrators on using software.	75	116	158	55	23	427
9. Maintaining the school's website.	133	51	61	78	105	428
10. Maintaining the division's website.	331	35	29	15	13	423
11. Editing or contributing articles on technology to school newsletters.	173	119	87	29	17	425
12. Giving presentations on technology integration at division wide meetings.	97	115	143	60	13	428
13. Working with content specialist(s) to assist in integrating technology.	62	112	160	71	22	427
14. Involved in school's purchases of technology equipment and software.	75	77	113	99	62	426

Research Question 4.

To what extent and in what ways does the open-ended question contribute a more comprehensive and nuanced understanding of the current context of the ITRT position?

Hooker in her study of the ITRT position included questions that addressed the ITRT perceptions about the position (2006). This researcher felt these questions were leading the respondent and potentially providing a skewed representation of the beliefs of the ITRTs. For example, “The most effective way to meet each school’s instructional technology needs is to have one full-time ITRT in each school” and “Support from division administrators assists teachers in successfully integrating technology into the classroom” (Hooker, 2006, p. 108). An open-ended question asking for comments was used to identify how the ITRTs perceived their position. Using NVivo 11 software. There were 147 responses coded for emerging themes. The ITRT comments illustrate ITRTs are happy with their job and feel that what they are doing is important work. Comments like, “greatest job ever,” “I love being an ITC,” and “love my position as ITRT” are frequently repeated. Others state, “our position is unique and very rewarding,” “my position is critical,” and “ITRTs if used properly are a wonderful asset.” However, many of these comments are followed with a but . . . showing that they feel there are barriers to their success. Six themes that emerged are: coaching, technical troubleshooting, support from leadership, role confusion, performing tasks not in the guidelines for the position, and time.

Theme: ITRT as technician. Providing support for fixing technical problems, supporting hardware, and administrating software or subscription services was the most significant theme in the comments. This supports the earlier result that showed ITRTs are still spending an inordinate amount of their time (20.3%) on technical issues (Table H1). Twenty percent of the comments mentioned the ITRTs were trouble shooting and this took away from other ITRT responsibilities:

- “The problem is that ITRTs are still the first line of defense for all technology problems and remain the “tech” person of the building.”
- “We are transitioning to a one to one school with Chromebooks, and much of my time this year is tied to helping with the transition, troubleshooting devices.”

- “I would like to do more training, but sometimes it is hard to get past dealing with technical issues.”
- “With only 9 techs and 20 or so sites I find that during crunch times I spend a good deal of my time in a tech support role.”
- “We spend a lot of time daily maintaining and configuring school purchased equipment, since the district does not support hardware we purchase.”
- “We have become highly paid technicians instead of strong professional developers.”

Theme: Leadership is critical. The Virginia Tech study recommended for the ITRT program to be effective, administrators “should be involved in the process of changing expectations about technology integration” (VDOE, 2008, p. 6). Many of the ITRT comments echo this premise. They feel that they need assistance from administration to have a clear shared vision and this vision. Additionally, they feel they need administration help finding time with teachers to provide professional development. These comments elucidate their thoughts:

- “Vision and supervision is lacking, with technical being supported - not instruction. No cohesion or vision between Dept of Instruction and Information Services groups.”
- “If fully backed by system administration an ITRT position can become one of the key positions to helping improve instruction.”
- “This position relies heavily on support from the building administrators as to whether or not it is effective for teachers. There are many administrators who do not support the integration of tech into the classroom on a regular basis. They do not necessarily prevent it, there is just no outward support for it. I personally feel

the more support given to tech integration and expectation, the better support from the top down, the more successful the program."

- "Administrators say they want teachers to use technology and plan with us however there is no accountability for the teacher to do so. Principals do not require anything of teachers to prove they worked with me."
- The schools where instructional technology is most successfully implemented are the ones where the school-level administrators model and use it with their faculty. It definitely trickles down - the more school-level administrative support we have, the better able we are to do our job and the less the teacher see it as just one more thing they "have" to do.

Theme: ITRT as …We are not sure? Hooker found that ITRTs had 48 different job titles and that 13 of the job titles did not include instructional technology (2006). Although the number of differing titles has decreased to 35 (Appendix F), it is still evidence that the role is defined differently across the state. ITRTs are still being assigned work that falls outside of the boundaries established by VDOE. ITRTs are still teaching students, working in school libraries, working as data coordinators, or serving as part-time administrators.

Additionally, ITRTs feel that this role confusion follows them to the schools where teachers and administrators are not sure of what an ITRT is supposed to do. The following comments are illustrative of this dilemma:

- "The ITRTs role is muddied by how it has been defined. When teachers hear the IT in ITRT, they assume you are a glorified Best Buy Geek Squad member. You can say Instructional Technology 'till you are blue in the face, but it doesn't change the fact that teachers have a hard time understanding what Instructional

Technology is (especially in our school district where we don't have full-time IT people at schools). Plus, teachers (typically) have a greater need to get their computers working than to create a motivational lesson.

- “The role of the ITRT is often misunderstood and mistaken for technology repair. It is up to ITRTs to educate teachers and staff about what we should do to support the schools.”
- “Districts need Instructional Technology positions that are DEDICATED to that role and not always pulled in to do this or that just because districts "need someone" to do it. What happens is that "it" then becomes their job or responsibility and so "it" has NOTHING to do with "Instructional Tech"...the other "it". Do you get "it"?”
- “My duties and responsibilities have changed drastically in the past year. Many of the duties an ITRT or ITS should do or are responsible for I no longer do. My title does not match my roles. In a very small division, my other responsibilities take priority.”
- “My role is constantly changing to meet the needs of my division. Over the years, I have been a regular ITRT, an ITRT who troubleshoots and fixes hardware issues, an ITRT who has a special affinity for PLC work.”
- “We have been asked to work more in a personalized learning coach role this year. Next year we have been told we will be doing more with data.”
- “It's a good job but does not need to be split with an administrator position. I cannot devote the time ITRT job needs.”

These concerns indicate that ITRTs continue to “have difficulty conveying their job duties to other personnel” (VDOE, 2008, p. 20).

Theme: Time. ITRTs mentioned the word time almost as many times in the comments as the words teachers and technology. ITRTs feel *they* need more time, and *teachers* need more time:

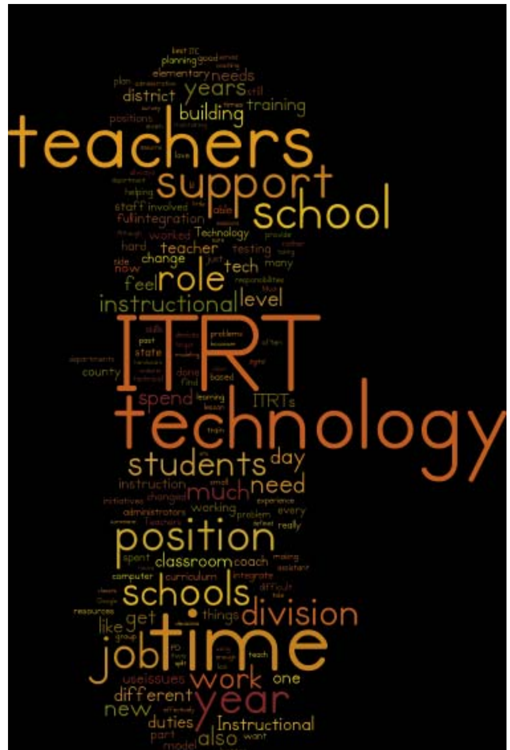

Illustration 1: Image created with all words from open-ended comments.

- “I'd like to clone myself so I can get work done 24 hours a day.”
- “Wish I could be more involved, but time does not allow.”
- “I support 4 curriculum departments and do not have enough time to fully commit to them during the school year.”
- “Too much to do and not enough time to do what I need to do and be with teachers to help them.”
- “I prefer spending time in the classroom, but I’m stretched too thin to be as effective as I would like.”
- “Very little time to invest in significant technology innovation.”

ITRTs feel that teachers need more time:

- “Teachers are progressing but time and a lack of devices is prohibitive.”
- “Too many demands on teacher time and focus.”
- “My biggest hurdle to doing my job to the best of my ability is getting time to plan with teachers.”

- Teacher time is very hard to gain due to my school's teacher planning requirement."

ITRTs feel they spend time on tasks that do not deal with technology integration that limit their time with teachers:

- "SOL testing time severely limits my time working with teacher."
- "I spend more time on devices rather than instruction."
- "90% of my time is spend doing administrative work."
- "My time is spent managing the technology in our building."
- "I would love to spend more time researching and implementing my findings rather than troubleshooting."
- "I spend a lot of my time on data."

Theme: ITRT as coach. Some ITRTs' comments indicated their position was moving to a coaching model. This initiative was perceived as a positive by some and a barrier to others. Some of the comments showed that some of the focus for the position is moving towards a model that places the emphasis on instruction and moves away from the technical side:

- "I am now much more coach than guru-how we can improve, what we can do better, how do things find alignment-no longer the guru who imparts all knowledge from on high."
- Our division "has worked hard for the past 5 years to evolve the role of the ITRT from a technology support to an instructional coach."
- "My role has shifted from and instructional technologist to an instructional coach and teacher leader…I provide instructional support tied to specific pedagogical approaches."

Others are concerned that a move to instructional coaches would hinder technology integration:

- "The [ITRT] position has been eliminated. The county will have 10 instructional coaches which will assume some of the ITRT duties."
- "Our district is trying to morph ITRTs into taking the roll of an instructional coach. It is a good idea, but they have stopped listening to us when making technology decisions."

These last statements are overwhelmingly supported by the next theme, technical troubleshooting.

- "Our county would like us to become instructional coaches, however we are not given the support to do this effectively and we are still responsible for our primary job duties which doesn't leave time for coaching."
- "Becoming an instructional coach and maintaining all other aspects (printers not working, website issues, login issues), even with an assistant, has proven to be challenging."

As with any change initiative, there are concerns about the role definition of ITRT as instructional coach. Some ITRTs feel that this change could detract from their ability to achieve their preconceived notion of what an ITRT is and is supposed to do.

Summary

The findings from this data are consistent with those of Hooker (2006); ITRTs are still spending time on technical issues that should fall to the technology administrator position and/or the technology support position required by SOQ (Virginia Standards of Quality, 2004). They are spending too much time documenting their progress and on personal professional development, and not enough time working directly with teachers. The position is still used to perform job tasks that are not part of the guidelines for the position. The addition of the data performance tasks as part of the restructured SOQ are taking time from ITRTs which may limit ability to provide necessary professional development for technology integration (Virginia Standards of Quality, 2012). All of these concerns revolve around time. ITRT time to do their job, administrator time to provide the vision for their job, and teacher time to participate in technology integration activities are barriers to technology integration.

V. Discussion

This study describes the context of the ITRT position in the Commonwealth of Virginia. Using data from a survey instrument (Appendix E) modeled after that used by Hooker (Appendix A, 2006), the researcher used quantitative methods using descriptive statistics to describe what ITRTs are doing now compared with what they were doing in 2006. The primary purpose of the study was to determine if a recession era waiver in 2010 waiving the requirement to meet SOQ staffing levels and a change to the SOQ in 2012 affected the staffing, deployment, and responsibilities of the position (Hooker, 2006; VDOE, 2012). Additionally, the study elucidates who the ITRTs are and what they do.

Findings of interest show there are still discrepancies in how ITRTs are deployed and used across the Commonwealth. Some ITRTs share ITRT responsibilities with another position, such as administrator or librarian. Other ITRTs are assigned performance tasks not found in the guidelines as established by VDOE (2008). ITRTS are still performing tasks that should be the responsibility of the tech support position from the SOQs that is responsible for maintaining hardware and software. Some ITRTs are teaching students, even though the guidelines state explicitly, "while ITRT serve as resources to classroom teachers, they should not serve *as* classroom teachers" (VDOE, 2008, p. 10). The role of others is being changed from ITRT to Instructional Coach, and ITRTs are unclear what that means for their responsibilities.

ITRTs: Who are they?

VDOE cited Hooker's (2006) findings that ITRTs had 48 distinct titles when stating, "ITRT have functioned under numerous job titles, indicating their roles are not well-defined or widely understood" (VDOE, 2008, p. 10). This study finds that ITRTs are licensed teachers who are full-time, work from 10 to 12 months a year, and have 35 unique job titles. Although this shows some improvement, it is marginal at best. In its guidelines for teachers and administrators VDOE recommended using the name Instructional Technology Resource Teacher to mitigate ITRT role confusion explaining the name was designed to explain the true roles of the position:

- teacher of teachers
- instructional--working to improve instruction,
- technology--providers of technology professional development,
- and resource--supporters of teachers' instruction (VDOE, 2008, p. 20).

While the number of distinct titles is decreasing, there are still an abundance of titles that suggest a level of role confusion with ITRTs functioning in multiple roles.

VDOE advocated, "ITRT must be available throughout the school day to plan and implement integration activities" (VDOE, 2008, p. 10). While ITRTs do principally work in schools (Table G1), many support teachers in as many as five or more buildings (Table G2), and deliver professional development to between 14 and more than 500 teachers (Table G3). The larger numbers identified here would limit the ability of ITRTs to be available to provide timely support to teachers as they plan and implement technology integration activities. VDOE goes on to explain what ITRTs are not:

> Some educators believe ITRT are solely responsible for everything related to technology, including teaching all technology enhanced lessons. In reality, ITRT are supposed to enable teachers to perform technology-related functions and integrate technology in the classroom; it is not the ITRT's responsibility to do this work for them. (VDOE, 2008, p. 15)

ITRTs: What do they do?

VDOE calls the ITRTs "agents of change . . . actively engaged in curriculum development and lesson planning" (VDOE, 2008, p. 10) and as such, it is important to examine what they are doing and what barriers they are facing. The goal of the ITRT program is to "provide effective support for curriculum and technology integration" (VDOE, 2008, p. 10). This is a daunting task as teachers are at differing levels of skill and knowledge concerning technology tools and innovations. Researchers have identified barriers to technology integration efforts: knowledge and skills, resources, support, training and experience, and attitudinal factors (Brinkerhoff, 2006; Glazer, Hannafin, Polly, & Rich, 2009; Hixon & Buckenmeyer, 2009).

Hooker found that ITRTs were spending 42% of their time on technology integration activities, which was 27% less than the VDOE (2005) guidelines (Hooker, 2006, p. 55). This study found ITRTs spend 33% of their time assisting teachers with the integration of technology and 14% on formal professional development for teachers and administrators. This is 21% below the threshold expected for the position in the VDOE guidelines (2008). These two areas are the foundation for the goal of providing support for technology integration as a change initiative. All of the other categories outlined in Table 3, Recommended Percentages of Time for Various ITRT Tasks, support ITRTs' ability to do these two tasks (VDOE, 2008, p. 12). It is important to note that ITRTs are still not meeting this expectation, which necessitates a look at potential barriers indicated by this survey's data. VDOE specifies that ITRTs are supposed to be involved in curriculum development. To do this, they need to meet with content specialists. Hooker found that ITRTs were spending 6.7% less than the VDOE guidelines (2005) recommendation for meeting with content specialists of 15%, and this study found ITRTs are spending 6.7% less than the VDOE guidelines (2008) recommendation of 14%. ITRTs are responsible for working with teachers from all content areas. As they would not have experience in all areas, it is important that they receive guidance and direction from content area experts. Additionally, the ITRTs should have technology expertise that is necessary to support curricular decisions made by the content specialists who lack this background knowledge. These results indicate ITRTs are spending a total of 27% less time on these two important areas.

ITRTs are spending too much time communicating with others about technology and maintaining records to document their work. These findings are consistent with those of Hooker. Hooker found that ITRTs spent 3.38% more time than recommended on communication tasks and 7.5% too much time maintaining records (Hooker, 2006, p. 55). This study found that this has not improved significantly. ITRTs are still spending 1.6% too much time on communication and 5.73% too much time maintaining records.

Having the word technology in most titles for the ITRT position may contribute to the most critical barrier to the program's success. Hooker found ITRTs spent 18.99% too much time performing technical support tasks. This study found ITRTs are still spending 17.3% too much time on these tasks. Although VDOE recognizes ITRTs have technology troubleshooting skills and will be asked to help with these tasks occasionally, it is recommended that this be kept to below 3% (1% less than the recommendation from guidelines of 2005). VDOE suggested that ITRTs spend no more than five or ten minutes on emergent technical assistance and use the technical support position for all other instances. As this tech support position is also required by SOQ, ITRTs spending 20% of their time troubleshooting technical issues is a significant concern (Virginia Standards of Quality, 2004).

It is also interesting to note that ITRTs who work at a school location spend almost 5% more time on technical support activities. This result may indicate that having the ITRT in the school may make them more available for performing technical responsibilities that fall outside of their job description. Also of note is ITRTs responsible for more than one school spent less time on technical support issues. It is also possible that being in more than one school typically means scheduling of ITRT time is more structured, thus leaving less unscheduled time for providing technical help. It is apparent from the quantitative survey and the open-ended survey question that ITRTs believe time spent on these activities is a significant barrier to technology integration efforts.

ITRTs who are working from a division location are spending more time offering formal professional development activities. It is not surprising that ITRTs who are at a division location are used more than those at schools as proximity to division leadership makes them an easy target for these types of professional development opportunities. ITRTs at more than one school spend 2.82% more time on formal professional development than their peers at one school. Additionally, ITRTs who work with the larger number of teachers also spend more time on formal professional development opportunities. These findings are of interest when looking at best practices for professional development for technology integration. Researchers discredit formal professional development opportunities as having little long-term effect on teacher practices as the support is not proximal and these activities are frequently once and done activities (Lawless & Pellegrino, 2007; Glazer et al., 2005; Billig et al., 2005). This study did not ask a clarifying question concerning informal professional development activities. Adding questions that are specific to different types of professional development activities would be helpful here.

The change in the SOQ for the ITRT position in 2012 allows school divisions to use the position as an ITRT, a data coordinator, or one position that does both responsibilities (Virginia

Standards of Quality, 2012). The survey data found ITRTs with data responsibilities are spending 3.86% less time assisting teachers with technology integration, spending more time meeting with content specialists (although they are spending half of the time recommended in the guidelines), spending more time communicating information about instructional technology, and spending more time maintaining records. The VDOE guidelines do suggest that ITRTs should support teachers in the use of data to drive instruction, but they do not suggest the ITRT be responsible for managing and delivering testing, which was a prevalent theme in the ITRT comments.

Recognizing that ITRTs needed professional development to stay apprised on the ever-changing technology landscape, VDOE added a new category and recommended time allocation for personal professional development in its restructured guidelines (VDOE, 2008). VDOE recommended ITRTs spend 5% of their time on personal professional development on instructional practices, emerging technologies, effectiveness of existing technologies, and instructional practices by:

- establishing personal goals,
- conference attendance,
- workshop attendance,
- reading related literature,
- and taking part in online or traditional coursework (VDOE, 2008, p. 11-12).

There is no indication in the Hooker study that ITRTs identified a lack of personal training as a barrier and no indication in the guidelines as to why the decision was made by VDOE to add this to the recommended time allocation chart. This study found ITRTs are exceeding the recommendation by 6.74%. Although this is a significant difference, it is not as critical as the discrepancies in the three previously discussed categories if ITRTs are participating in recommended pursuits to improve ITRT content, technology, and pedagogical knowledge. These pursuits have an instructional focus and are seen by the extant research as critical for quality professional development for teachers (Glazer et al., 2009; Dragula, 2005; Lawless & Pellegrino, 2007, Koehler & Mishra, 2009). Personal professional development was not covered by any of the survey questions, and it was not mentioned in the qualitative responses, so there is no data to elucidate how ITRTs are spending this time.

ITRTs: In Their Own Words

Hooker's survey instrument included questions intended to elucidate ITRT perceptions of their experience as an ITRT. "The most effective way to meet each school's instructional technology needs is to have one full-time ITRT in each school" is one example (Appendix A). This researcher elected to remove this section of questions from the survey instrument as the questions may lead ITRTs to identify barriers that might not be valid perceptions. This means that we must take the bad with the good, as there was the potential for some good information in those questions, and without them there may be some missing data. However, it seemed a better idea to get this information using the ITRTs' own words. The qualitative data from the open-ended question revealed six themes that illustrate and substantiate the quantitative survey data:

- technical troubleshooting,
- support from leadership,
- role confusion,
- performing tasks not in the guidelines for the position,
- time constraints, and
- coaching.

Technical issues impact ITRT time. Technical troubleshooting continues to be the most significant barrier that ITRTs face. Both the quantitative data and the qualitative data indicate a disparity in what ITRTs should do in this area and what they are doing. VDOE recommends that "ideally there should be one ITRT per school or per two schools" (VDOE, 2008, p. 19). In addition to this, there should be a technology position that supports the maintenance of devices, and software (Virginia Standards of Quality, 2004). This position would be most effective at the school location as well. Data from the survey suggested ITRTs in a school location, spent more time troubleshooting technology issues than those at an off-site location. VDOE contends, "ITRT time is continually tied up with providing technical support. This clearly is a full-time job and was the impetus for creating the technology support positions" (VDOE, 2008, p. 17). Is the reason ITRT are still spending 17% more time than they should on technology issues because the technical support position is not at the school location, and therefore not available for pressing needs? Or, are divisions not employing the required one per 1,000 students? Unfortunately, this was not addressed in this study. It would be a good question for future research.

Leadership support. Sepelyak (2016) in interviews with ITRTs from one central Virginia school division finds lack of leadership as an institutional barrier to technology integration. ITRTs echoed that concern in this study: "If fully backed by system administration an ITRT position can become one of the key positions to helping improve instruction." Leadership is a barrier to technology integration when administration does not have a clear vision for the end-goal and the process necessary to get there (Hew & Brush, 2007; Belland, 2009; Glazer et al., 2009; Sepelyak, 2016). Additionally, if there is a lack of direction to school-based administration from central administration, it may contribute to role-confusion concerning the ITRT position. In a study of over 800 schools, Anderson & Dexter (2005) characterized technology leadership as the most significant predictor of success of technology integration activities.

ITRT role confusion. In a multiple case study, Nash (2013) used social network analysis to examine role clarity for the ITRT position. Nash found role confusion at the administration, teacher, and ITRT levels. The most significant of Nash's findings concerned the administrators' definition of the role of the ITRT. Each administrator in her three case schools tacked on additional unrelated responsibilities to the ITRT role. However, the most concerning is the ITRTs themselves were unclear about their role. Most of the responsibilities described by the ITRTs were those designated by VDOE, but not all were; if the ITRTs did not understand the role, it is unlikely that others would.

This study found ITRTs recognize that administrators and teachers are unclear concerning the goals of the program as laid out in the VDOE Guidelines for Teachers and Administrators (2008). One states, "The ITRT's role is muddied by how it has been defined. When teachers hear the IT in ITRT, they assume you are a glorified Best Buy Geek Squad member." While this comment might encourage a chuckle, it is indicative of the most pervasive problem. The role still lacks clarity even though, VDOE has attempted to clearly define and quantify the expectations for the position.

ITRT and time. Sepelyak (2016) interviewed 25 ITRTs in heterogeneous focus groups. The ITRTs mentioned time as a barrier to their success 96 times. This study also found time to be a recurrent theme in ITRT comments. ITRTs need more time to meet the demands of the position. They need teachers to have more planning time or fewer demands on their time so they can meet with their ITRT, and they need the members of their community of practice to understand the responsibilities of the role, so they are not pulled in every direction that involves the use of a digital device.

ITRT as coach. Teachers are not using technology due to a lack of training, time, and on-site support to learn the necessary skills to reach a level of proficiency where they are comfortable using the tools (Lawless & Pellegrino, 2007; Hew & Brush, 2007; Lowther et al., 2008). Glazer et al. (2009) found that past technology integration efforts "suffered from inadequate training, insufficient human and physical resources, and resistance to change" (p. 22). Additionally, Glazer et al. (2009) determined the most successful professional development model for technology integration requires ongoing support and mentorship that results in teachers becoming leaders for their own and their peers' technology integration learning. For this support to be effective, it necessitates an individual with expertise in both technology and instructional pedagogy who is near and available when assistance is needed (Plair, 2008; Harris & Hoffer, 2011).

VDOE intends for the ITRT to be an instructional coach, placing the ITRT where he/she readily provides professional development proximally within the context of instructional need. The VDOE Guidelines (2008) clearly define the overall goal of the program:

> The ITRT program is to provide effective support for curriculum and technology integration. The main challenge is to provide adequate training and support to bring teachers—at every point of the continuum, from technophobia to technomania—to an adequate level of technical expertise to meet learning goals (p. 10).

Additionally, the guidelines define the role as a teacher who teaches teachers, emphasizing that the ITRT is not to teach students. The purpose of this condition is for the ITRT to be available to offer the necessary support for teachers. The expectation is that the position be filled with a teacher with proven instructional expertise. This is essential so the ITRT can apply this knowledge with available technology tools to create learning experiences for students that involve skills critical for the 21st century workplace.

The data here show that some school divisions have concluded that their ITRTs are coaches, and while this is cause for concern for some who currently hold an ITRT position, others feel it is the direction and role clarification the position needs. Typical professional development for teachers that occurs in short bursts situated outside of the actual context of teaching is an ineffective method and provides unsustainable learning outcomes (Glazer, Hannafin, & Song, 2005). Professional development for integrating technology is most effective when it is provided on-site, customized to individual teacher needs, and addressed by a peer who has formed a collaborative relationship with the classroom teacher (Billg, Sherry, & Harvick, 2005; Glazer et al., 2009). Multiple studies over the past 25 years indicate this peer-coaching model for professional development to be a successful tool for job-embedded, professional learning that is sustainable over time (Barron, Dawson, & Yendol-Hoppey, 2009; Killion & Harrison, 2006; Atteberry & Bryk, 2010). VDOE expects the ITRT is a model or mentor for teachers to aid them in moving through this change process. These data indicate that ITRTs are not spending enough time doing this.

Successful coaching requires the coach to have an extensive knowledge of the school's social network. The coach must cultivate relationships with all colleagues for which he is responsible for providing professional development activities. Successful coaching involves "ongoing classroom modeling, supportive critiques of practice, and specific observations" (Killion & Harrison, 2006, p. 12). A coach who is not central to school staff will have difficulty delivering the necessary level of support to bring about instructional change (Atteberry & Bryk, 2010; Killion & Harrison, 2006).

Differences among the 132 divisions in Virginia exist in hiring requirements, contract length, job expectations, and responsibilities for their ITRTs. Virginia school divisions employ differing methods for assigning the position to schools and teachers. Some divisions assign one ITRT to each school even when the school meets or exceeds the requisite 1,000 students. Other divisions assign ITRTs to multiple schools where the ITRT spends certain days at each school. Another model places ITRTs at the school central office where teachers must prearrange appointment times with the ITRT in advance of actual need. The essential learning criteria (on-site, customized, and collaborative) are impossible within many of the existing deployment models implemented across the Commonwealth.

Hooker (2006) found ITRTs were devoting an excessive amount of time on activities that were outside the bounds of the VDOE time guidelines (Appendix B). This study echoed that finding. Specifically, ITRTs are spending excessive time troubleshooting hardware issues and are being tasked with jobs that involve technology but are not instructional, such as managing websites. Activities such as these prevent the ITRT from being available to teachers when and where needed to support integration of technology and instruction.

Diffusion of Innovation

There is little debate about the need to use emerging technologies as most stakeholders realize, like it or not, the tools are here to stay; our students and their future workplaces are using them. If the technologies are no longer the innovation, what is? Zhao & Frank (2003) liken our schools to ecosystems where an invasive nonnative-species has taken hold, forcing the native species to adapt. Therefore, “the task …is to understand how computers ‘live’ in schools and homes to suggest ways for teachers and students to maximize the benefits and minimize the harms of computer usage" (Zhao, Lei, & Frank, 2006, p. 137). This premise adds emphasis to the I in ITRT. No longer should the T be the foremost mission, and yet it cannot be forgotten, just as ignoring the invasive nonnative zebra mussel species taking over the great lakes is impossible (Zhao & Frank, 2003).

The uses of emerging technologies in schools are not "independent and isolated events or artefacts, but are situated in complex relations within the school ecosystem" (Zhao et al., 2006, p. 146). These influences force a paradigm shift in our teaching strategies and our methods of assessing learning (Davis, Eickelmann, & Zaka, 2013; Zhao et al., 2006). The information rich environment created by recent technology trends does not align with traditional sage on the stage teaching paradigms. This has forced a shift from a teacher-centered structure to a student-centered structure. This challenge to teaching as we know it forces school leaders to evaluate ways to diffuse these teaching and learning innovations to all stakeholders in our social ecosystem (Rogers, 2003; Baker-Doyle & Yoon, 2010).

The current professional development focus on collaboration, teacher knowledge, and school community make evaluating reform programs difficult due to the complexity of human relationships and interactions. The success of a coaching approach to professional development will hinge on the ability of the coach to become an instructional leader within the school relationship network. This new instructional role challenges the traditional school improvement model and takes on features of a community of practice (Penuel et al., 2009; Baker-Doyle & Yoon, 2010).

Policy Considerations and the ITRT SOQ

The Virginia General Assembly in HB 895 (2016) requires stakeholders to create a profile of a Virginia Graduate that includes "the knowledge and skills that students should attain during high school to be successful contributors to the economy of the Commonwealth, giving due consideration to critical thinking, creative thinking, collaboration, communication, and citizenship." This is additional evidence that Virginia lawmakers understand that our needs have morphed from a knowledge recall centric education system to a knowledge construction system which emphasizes teaching students how to use content to solve real-world problems. This shift requires teachers to think differently about how they teach.. The need for the ITRT position to be an instructional coach is even more essential in order to meet this goal.

The SOQ for the position, requiring one ITRT position for each 1,000 students leaves a great deal of latitude for school divisions to implement this requirement effectively. The VDOE guidelines state that ITRT are to be teachers of teachers. Given this, it is an inappropriate criteria to define the requirement using the number of students. Additionally, adding the flexibility to the SOQ of using the position as a data coordinator or an ITRT is counter to the intent of the position as defined by the guidelines. The fact that the VDOE Guidelines for the position are just guidelines and have no oversight, it is inherent upon the construction of the SOQ wording to accurately define its intent.

If Virginia lawmakers truly intend the ITRT position to support educational outcomes that engender the 21st century skills outlined in HB 895, a critical policy analysis is necessary to examine the roots of the policy and create an SOQ definition that improves the fidelity of the implementation. The process of raising critical questions concerning program intent and educational outcomes allows for consideration of the contextual intricacies of the policy (Diem, Young, Welton, Mansfield, & Lee, 2014). Not doing so will allow for the continuation of broad disparities in implementation of the policy by local school divisions. Additionally, consideration should be given to creating a vehicle for oversight of how the position is being implemented and utilized.

Recommendations for Future Study

This study examined the ITRT position from the perspective of the ITRTs. Future research should change the perspective to that of the teacher. Conventional educational research views individuals as a mere collection of attributes (traits or behaviors) that can be compared or correlated; relationships or associations are only found when one variable differs in some way from another (McMillan, 2004; Shavelson & Towne, 2002). This does not provide a way to examine how information or change initiatives, such as technology professional development, take place within a defined educational setting. Social network theory affords a way to examine the potential for diffusion of innovation. It differs from other methodological theories for evaluation of educational programs as it focuses on the social context and behavior of relationships among actors (Durland & Fredericks, 2005; Daly, 2010; Carolan, 2014). Wasserman and Faust (2009) posit that examination of social networks allows for viewing individuals and their actions as interdependent, and the relational ties between individuals are opportunities to examine the transmission of resources, or social capital. A network perspective allows for a view of how the expertise and resources that an ITRT can provide are exchanged through social ties to other members in the school network (Penuel, Riel, Krause, & Frank, 2009; Carolan, 2014; Prell, 2012). Since it is relationships that form the crux of a coaching model, traditional attribute based research methods fail to capture the nuances of the relationships between actors that illuminate available social capital and expertise.

Social Network Analysis is an appropriate theory for predicting the effectiveness of the ITRT reform effort. "The basic idea behind social network analysis as a methodology, like most other kinds of analytic research, is that visual, mathematical, or linguistic representations can help to simplify our understandings of large and complex phenomena" (Deal et al., 2009, p. 7). The SOQ for the ITRT position of one ITRT to 1,000 students assigns responsibility for diffusing complex information to approximately 40 teachers; depending on the deployment model, this number is significantly greater. A social network approach provides a theoretical framework for modeling advice networks of teachers in a professional development setting. This framework allows the researcher to interpret if variables such as the number of teachers the ITRT is responsible for or ITRT deployment are correlated to the pathways for diffusion of innovation within the ITRT network (Pitts & Spillane, 2009; Baker-Doyle & Yoon, 2010; Carolan, 2014; Prell, 2012; Deal, Purinton, & Waetjen, 2009). SNA allows the researcher to map relationships, and interactions between stakeholders that may both constrain or encourage the flow of resources within a school social network (Daly, 2010, Hawe & Ghali, 2007, Penuel et al., 2009, Durland & Fredericks, 2005; Carolan, 2014).

The ITRT, as a coach, holds a designated leadership role. In the past, researchers and educators have focused only on formal leadership roles and actions when evaluating reform initiatives. However, "informal webs of relationships are often chief determinants of how well and quickly change efforts take hold, diffuse, and sustain" (Daly, 2010, p. 2). Informal leaders in the school, teachers who share knowledge and skills with other teachers, are essential for the dissemination of information and resources (Deal et al., 2009; Daly, 2010; Penuel et al., 2009).

It is not enough to hold a leadership title or responsibility; to be a true leader of a change initiative, there must be a relationship built on social interactions among members. Mapping these interactions will allow the researcher to illustrate the flow of social capital, expertise, and resources an ITRT can provide.

Conclusion

Educational research has become particularly important in this time and place given the increasing presence of state and federal policies directing educational decisions. It is imperative that policymakers are not left to make policy decisions with only "personal experience, expert opinion, tradition, intuition, common sense, and beliefs about what is right or wrong" (McMillan & Schumacher, 2008, p. 4). The goal of this study is to offer needed context to inform policy decisions regarding the ITRT position, while additionally adding to the body of research on professional development for technology integration. Whether today's students are called digital natives, millennials, or the iGeneration, there is no question that consideration must be given to who they are, how they are different, and what they need to know and do.

Today's schools, as currently structured, are not designed for the information rich, communication driven, global society in which people find themselves. Educators will fail students if the field of education does not consider how society is changing. The change process in schools is complicated and influenced by many barriers. A structured plan is required to educate school personnel to meet the changing needs of our students. The coaching model embraces research-based best practices for professional development (Zepeda, 2008; Killion & Harrison, 2006; Knight, 2007). It also meets the unique needs of professional development for technology integration, as it is site-based, embedded within the context of the need, on-going, collaborative, and provided by an expert who has both technology expertise and instructional expertise (Kopcha, 2008; Glazer et al., 2009; Sugar, 2005). Policy-makers, school division leadership, and school-based leaders would do well to consider the use of ITRTs as a critical component of technology integration efforts.

List of References

List of References

Alliance for Excellent Education. (2012). *Culture shift: Teaching in a learner-centered environment powered by digital learning*. Retrieved from http://all4ed.org/reports-factsheets/culture-shift-teaching-in-a-learner-centered-environment-powered-by-digital-learning/

An, Y., & Reigeluth, C. (2012). Creating technology-enhanced, learner centered classrooms: K-12 teachers' beliefs, perceptions, barriers, and support needs. *Journal of Digital Learning in Teacher Education*, *28*(2), 54-62. Retrieved from http://www.iste.org/learn/publications/journals/jdlte

Anderson, R. E., & Dexter, S. (2005). School technology leadership: An empirical investigation of prevalence and effect. *Educational Administration Quarterly*, *41*(1), 49-82.

Aslan, S., & Reigeluth, C. M. (2011). A trip to the past and future of educational computing: Understanding its evolution. *Contemporary Education Technology*, 2(1), 1-17.

Atteberry, A., & Bryk, A. S. (2010). Centrality, connection, and commitment: The role of social networks in a school-based literacy initiative. In A. J. Daly (Ed.), *Social network theory and educational change* (pp. 51-75). Cambridge, MA: Harvard Education Press.

Baker-Doyle, K. J., & Yoon, S. A. (2010). Making expertise transparent: Using technology to strengthen social networks in teacher professional development. In A. J. Daly (Ed.), *Social network theory and educational change* (pp. 115-126). Cambridge, MA: Harvard University Press.

Barabasi, A. L. (2003). *Linked*. New York, NY: Plume.

Barron, A. E., Dawson, K., & Yendol-Hoppey, D. (2009). Peer Coaching and technology integration: An evaluation of the Microsoft peer coaching program. *Mentoring and Tutoring: Partnership in Learning*, *17*(1), 83-102.

Bebell, D., & Kay, R. (2010, January). One to one computing: A summary of the quantitative results from the Berkshire Wireless Learning Initiative. *Journal of Technology, Learning, and Assessment*, *9*(2), 3-59.

Becker, J. D., Hodge, C. A., & Sepelyak, M. W. (2010). *Assessing technological literacy: The case for an authentic, project-based learning approach* (White Paper). Virginia Commonwealth University: Author.

Belland, B. R. (2009, September). Using the theory of habitus to move beyond the study of barriers to technology integration. *Computers & Education*, *52*, 353-364. http://dx.doi.org/10.

Bennett, S., & Maton, K. (2010). Beyond the ’digital natives’ debate: Towards a more nuanced understanding of students’ technology experiences. *Journal of Computer Assisted Learning*, *26*, 321-331.

Billig, S. H., Sherry, L., & Harvick, B. (2005). Challenge 98: Sustaining the work of a regional technology initiative. *British Journal of Educational Technology*, *36*(6), 987-1003.

Blankstein, A. M. (2011). *The answer is in the room*. Thousand Oaks, CA: Corwin Press.

Blocher, J. M., Armfield, S. W., Sujo-Montes, L., Tucker, G., & Willis, E. (2011). Contextually-based professional development. *Computers in Schools*, *28*(28), 158-169. http://dx.doi.org/10.1080/07380569.2011.577398

Bogdan, R. C., & Biklen, S. K. (2007). *Qualitative research for education: An introduction to theories and methods* (5th ed.). Boston, MA: Pearson.

Borgatti, S. P., Everett, M. G., & Freeman, L. C. (2002). Ucinet for Windows: Software for Social Network Analysis [Measurement instrument]. Published instrument. Retrieved from https://sites.google.com/site/ucinetsoftware/downloads

Borgatti, S. P., Everett, M. G., & Johnson, J. C. (2013). *Analyzing social networks*. Thousand Oaks, CA: SAGE Publications Limited.

Borgatti, S. P., & Lopez-Kidwell, V. (2011). Network theory. In J. Scott & P. J. Carrington (Eds.), *The SAGE handbook of social network analysis* (pp. 40-50). Retrieved from https://books.google.com/

Borgatti, S. P., & Molina, J. L. (2003, September). Ethical and strategic issues in organizational social network analysis. *Journal of Applied Behavioral Science*, *39*, 337-349. http://dx.doi.org/10.1177/0021886303258111

Brinkerhoff, J. (2006, Fall). Effects of a long-duration, professional development academy on technology skills, computer self-efficacy, and technology integration beliefs and practices. *Journal of Research on Technology in Education*, *39*(1), 22-43.

Buchmuller, S., Joost, G., Bessing, N., & Stein, S. (2011). Bridging the gender and generation gap by applying a participatory design process. *Personal and Ubiquitous Computing*, *15*(7), 743-758. doi: 10.1007/s00779-011-0388-y

Carolan, B. V. (2014). *Social network analysis and education: Theory, methods, and applications*. Thousand Oaks, CA: Sage.

Casner-Lotto, J., Barrington, L., & Wright, M. (2006, October). *Are they really ready to work? Employers perspectives on the basic knowledge and applied skills of new entrants to the 21st century workforce* (White Paper BED-06-Workforce). Retrieved from The Conference Board website: http://www.conference-board.org/publications/publicationdetail.cfm?publicationid=1218

Cator, K. (2010, August 4). Learning powered by technology [Blog post]. Retrieved from Homeroom: The Official Blog of the U.S. Department of Education: https://blog.ed.gov/2010/08/national-education-technology-plan/

Christensen, C. M., Horn, M. B., & Johnson, C. W. (2011). *Disrupting class: How disruptive innovation will change the way the world learns*. New York, NY: McGraw Hill.

Coffman, T. (2009). Getting to the heart of technology. *Learning and Leading with Technology*, *36*(7), 20-23.

Coleman, J. S. (1988). Social capital in the creation of human capital. *American journal of sociology*, *94*, 95-120. Retrieved from http://www.jstor.org/stable/2780243

Collins, A., & Halverson, R. (2010, January). The second educational revolution: Rethinking education in the age of technology. *Journal of Computer Assisted Learning*, *26*(1), 18-27. http://dx.doi.org/10.1111/j.1365-2729.2009.00339x

Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4 ed.). Thousand Oaks, CA: Sage.

Cuban, L. (1986). *Teachers and machines: The classroom use of technology since 1920*. New York, NY: Teachers College Press.

Cuban, L., Kirkpatrick, H., & Peck, C. (2001, Winter). High access and low use of technologies in high school classrooms: Explaining an apparent paradox. *American Educational Research Journal*, *38*, 813-834. Retrieved from http://www.jstor.org/pss/3202504

Daccord, T., & Reich, J. (2015, May). How to transform teaching with tablets. *Educational Leadership*, *72*(8), 18-23.

Daly, A. J. (Ed.). (2010). *Social network theory and educational change.* Cambridge, MA: Harvard University Press.

Davis, N., Eickelmann, B., & Zaka, P. (2013, September 9). Restructuring of educational systems in the digital age from a co-evolutionary perspective. *Journal of Computer Assisted Learning*, *29*(5), 438-450. http://dx.doi.org/10.1111/jcal.12032

Deal, T. E., Purinton, T., & Waetjen, D. C. (2009). *Making sense of social networks in schools*. Thousand Oaks, CA: Corwin Press.

Diem, S., Young, M. D., Welton, A. D., Mansfield, K. C., & Lee, P. (2014). The intellectual landscape of critical policy analysis. *Journal of Qualitative Studies in Education*, *27*(9), 1068-1090. http://dx.doi.org/10.1080/09518398

Downes, J. M., & Bishop, P. (2012, May). Educators engage digital natives and learn from their experiences with technology. *Middle School Journal*, *43*(5), 6-15.

Dragula, P. J. (2005, April 1). How to overcome technology integration barriers. *Tech & Learning*. Retrieved from http://www.techlearning.com/default.aspx

Duncan, A. (2010, March 3). Using technology to transform schools—Remarks by Secretary Arne Duncan at the Association of American Publishers annual meeting. *Ed.Gov website*. Retrieved from http://www.ed.gov/news/speeches/using-technology-transform-schools%E2%80%94remarks-secretary-arne-duncan-association-american-

Durland, M. M., & Fredericks, K. A. (2005, Fall). An introduction to social network analysis. *Wiley Interscience*, *107*, 5-13. http://dx.doi.org/10.1002/ev.157

Ed.Gov website. (2001). http://www2.ed.gov/programs/edtech/index.html

Elementary and Secondary Education Act of 1965, 2 U.S.C.A., art. Part D §§ 2401-2404 (2001).

Elementary and Secondary Education Part D--Enhancing Education Through Technology, §§ 2401-2404 (2001).

Ertmer, P. A., Ottenbreit-Leftwich, A. T., Sadik, O., Sendurur, E., & Sendurur, P. (2012). Teacher beliefs and technology integration practices: A critical relationship. *Computers & Education*, *59*, 423-435.

Fowler, F. C. (2009). *Policy studies for educational leaders: An introduction* (3rd ed.). Boston, MA: Pearson Education.

Frank, K. A., Zhao, Y., Peneul, W. R., Ellefson, N., & Porter, S. (2011). Focus, fiddle, and friends: Experiences that transform knowledge for the transformation of innovations. *Sociology of Education*, *84*(2), 137-156. doi: DOI: 10.1177/0038040711401812

Friedman, T. L. (2006). *The world is flat: A brief history of the twenty-first century*. New York, NY: Farr, Straus, and Giroux.

Gerard, L., Varma, K., Corliss, S., & Linn, M. (2011). Professional Development for technology-enhanced inquiry science. *Review of Educational Research*, *81*(3), 408-448.

Glazer, E., Hannafin, M. J., Polly, D., & Rich, P. (2009). Factors and interactions influencing technology integration during situated professional development in an elementary school [Entire issue]. *Computers in Schools*, 26

Glazer, E. M., Hannafin, M. J., & Song, L. (2005,). Promoting technology integration through collaborative apprenticeship. *Computers in Schools*, *53*(4), 57-67.

Grant, M. M., & Branch, R. M. (2005, Fall). Project-based learning in a middle school: Tracing abilities through the artifacts of learning. *Journal of Research on Technology in Education*, *38*(1), 65-98.

Grant, P., & Basye, D. (2014). *Personalized learning: A guide for engaging students with technology*. Eugene, OR: International Society for Technology in Education.

Gray, L., Thomas, N., & Lewis, L. (2010, May 5). *Teachers' use of educational technology in U.S. public schools* (Fact Sheet NCES 2010040). Retrieved from National Center for Educational Statistics website: http://nces.ed.gov

Greaves, T. W., Hayes, J., Wilson, L., Gielniak, M., & Peterson, E. L. (2012). *Revolutionizing education through technology: The project RED roadmap for transformation*. Eugene, Oregon: International Society for Technology in Education.

Hargittai, E. (2010, February). Digital na(t)ives? Variation in internet skills and uses among members of the "net generation". *Sociological Inquiry*, *80*(1), 92-113.

Harris, J. B., & Hoffer, M. J. (2011). Technological pedagogical content knowledge (TPACK) in action: A descriptive study of secondary teachers' curriculum-based, technology-related instructional planning. *Journal of Research in Technology Education*, *43*(3), 211-229.

Hayes, D. N. (2007). ICT and learning: Lessons from Australian classrooms. *Computers & Education*, *49*, 385-395. http://dx.doi.org/10.1016/j.compedu.2005.09.003.

HB 895, Chapter 55 VA Stat § 22.1-253.13:4 (2016).

HB 1792, Chapter 55 VA Stat. § 22.1-253.13:2 (2004 & Suppl. 2011).

Helsper, E., & Enyon, R. (2009). Digital natives: Where is the evidence? *British Education Research Journal*, 1-18. doi: 10.1080/01411920902989227.

Hew, K., & Brush, T. (2007, June). Integrating technology into k-12 teaching and learning: current knowledge gaps and recommendations for future research. *Educational Technology Research & Development*, *55*(3), 223-252.

Hixon, E., & Buckenmeyer, J. (2009). Revisiting technology integration in schools: Implications for professional development. *Computers in Schools*, *26*, 130-146.

Hobgood, B., & Ormsby, L. (2010). Inclusion in the 21st century classroom: Differentiating with technology. Retrieved from http://www.learnnc.org/lp/editions/every-learner/6776.

Hooker, K. M. (2006). *A study of Instructional Technology Resource Teachers in Virginia's public school divisions: Who are they and what do they do* (Doctoral dissertation). Retrieved from http://gradworks.umi.com/32/42/3242688.html.

Hsieh, P., Cho, Y., Liu, M., & Schallert, D. (2008, Summer). Examining the interplay between middle school students' achievement goals and self-efficacy in a technology enhanced environment. *American Secondary Education*, *36*(3), 33-50.

Hutchison, A., & Reinking, D. (2011, October-December). Teachers' perceptions of integrating information and communication technologies into literacy instruction: A national survey in the United States. *Reading Research Quarterly*, *46*(4), 312-333. http://dx.doi.org/10.1002/RRQ.002

International Society for Technology in Education. (2013). *NETS for coaches*. Washington, DC: Author.

International Society for Technology in Education website. (2015). http://www.iste.org/

Jones, E. (2007, February). Strategies to put instruction ahead of technology. *Principal Leadership*, 7(6), 35-39.

Kadushin, C. (2012). *Understanding social networks*. New York, NY: Oxford University Press.

Kanaya, T., Light, D., & Culp, K. M. (2005, Spring). Factors influencing outcomes from a technology-focused professional development program. *Journal of Research on Technology in Education*, *37*(3), 313-329.

Keengwe, J., & Onchwari, G. (2009, December). Technology and early childhood education: A technology integration professional development model for practicing teachers. *Early Childhood Education Journal*, *37*(3), 209-218. http://dx.doi.org/10.1007%2Fs10643-009-0341-0

Killion, J., & Harrison, C. (2006). *Taking the lead: New roles for teachers and school-based coaches*. Oxford, OH: National Staff Development Council.

Knight, J. (2007). *Instructional coaching: A partnership approach to improving instruction*. Thousand Oaks, CA: Corwin Press.

Koehler, M. J., & Mishra, P. (2009). What is technological pedagogical content knowledge? *Contemporary Issues in Technology and Teacher Education*, *9*(1), 60-70.

Kopcha, T. J. (2008, May 17). A systems-based approach to technology integration using mentoring and practice. *Educational Technology Research & Development*, *58*, 175-190. http://dx.doi.org/10.1007/s11423-008-9095-4

Kretlow, A. G., & Bartholomew, C. (2010). Using coaching to improve fidelity of EBPs for teachers: A review of studies. *TED and Special Education*, *33*, 279-299.

Lajoie, S. P. (2000). *Computers as cognitive tools: Volume II no more walls* (2 ed.). Mahwah, NJ: Lawrence Erlbaum Associates.

Lawless, K. A., & Pellegrino, J. W. (2007, December). Professional development in integrating technology into teaching and learning: Knowns, unknowns, and ways to pursue better questions and answers. *Review of Educational Research*, *77*(4), 575-614.

Lei, J., & Zhao, Y. (2007, September). Technology use and student achievement: A longitudinal study. *Computers & Education*, *49*(2), 284-296.

Lew, L. Y. (2010, Fall). The use of constructivist teaching practices by four new secondary school science teachers: A comparison of new teachers and experienced constructivist teachers. *Science Educator*, *19*(2), 10-21.

Lin, N. (1999). Building a network theory of social capital. *Connections*, *22*(1), 28-51. Retrieved from http://www.bebr.ufl.edu

Lowther, D. L., Inan, F. A., Strahl, D., & Ross, S. M. (2008, September). Does technology integration "work" when key barriers are removed? *Education Media International*, *45*(3), 195-213.

Luterbach, K. J., & Brown, C. (2011, August). Education for the 21st century. *International Journal of Applied Educational Studies*, *10*(2), 14-32.

MacGregor, S. K., & Thomas, W. R. (2005). Online project based learning: How collaborative strategies and problem solving processes impact performance. *Journal of Interactive Learning Research*, *16*(1), 83-107.

Matzen, N. J., & Edmunds, J. A. (2007, Summer). Technology as a catalyst for change. *Journal of Research on Technology in Education*, *39*(4), 417-430.

McMillan, J. H. (2004). *Educational research: Fundamentals for the consumer* (4 ed.). Boston, MA: Pearson.

McMillan, J. H., & Schumacher, S. (2006). *Research in education: Evidence-based inquiry* (6 ed.). Boston, MA: Pearson.

McMillan, J. H., & Schumacher, S. (2008). *Research in education: Evidence-based inquiry* (Custom Edition ed.). Boston, MA: Pearson Custom.

Mitchell, M., & Jolley, J. M. (2007). *Research design explained*. Belmont, CA: Thomson Wadsworth.

Nash, A. (2013). *Role clarity and instructional technology support: A naturalistic examination of various perceptions of the role of the ITRT within and across three high schools* (Doctoral dissertation). Retrieved from http://scholarcompass.vcu.edu/etd/2975

National Center for Education Statistics. (2003). *Technology in schools: Suggestions, tools, and guidelines for assessing technology in elementary and secondary education* (NCES-2003-313). Washington, DC: Government Printing Office.

National Center for Educational Statistics. (2006). *Internet access in U.S. public schools and classrooms* (Issue Brief NCES2007-020). Retrieved from National Center for Education Statistics: http://nces.ed.gov/pubs2007/2007020.pdf

National Education Association. (2008). *Access, adequacy, and equity in education technology: Results of a survey of America's teachers and support professionals on technology in public schools and classrooms* (). Retrieved from National Education Association: http://www.nea.org

National Science Foundation Task Force on Cyberlearning. (2008). *Fostering learning in the networked world: The cyberlearning opportunity and challenge*. Retrieved from http://www.nsf.gov/pubs/2008/nsf08204/nsf08204.pdf

Neugent, L., & McGraw, T. (2007, January). *An analysis of the Instructional Technology Resource Teacher program in Virginia* (Info Brief). Retrieved from Virginia Department of Education website: http://www.doe.virginia.gov/support/technology/info_briefs/analysis_teacher_prog.pdf

Ng'ambi, D., & Bozalek, V. (2013). Leveraging informal leadership in higher education institutions: A case of diffusion of emerging technologies in a southern context. *British Journal of Educational Technology*, *44*, 940-950. http://dx.doi.org/10.1111/bjet12108

Niederhauser, D. S., & Lindstrom, D. L. (2006). Addressing the NETS for students through constructivist technology use in K-12 classrooms. *Education Computing Research*, *34*(1), 91-128.

Noddings, N. (2005). Perspective 2: Pragmatism. In J. L. Paul (Ed.), *Introduction to the philosophies of research and criticism in education and social sciences* (pp. 57-60). Upper Saddle River, NJ: Pearson.

Palfrey, J., & Gasser, U. (2008). *Born digital: Understanding the first generation of digital natives*. New York, NY: Basic Books.

Papert, S. (1987). A critique of technocentrism in thinking about the school of the future. Retrieved from http://www.papert.org/articles/ACritiqueofTechnocentrism.html

Papert, S., & Harel, I. (1991). Situating constructionism. Retrieved from http://www.papert.org/articles/SituatingConstructionism.html

Partnership for 21st Century Skills. (2007). *21st century skills: Education and competitiveness* (Policy Guide). Retrieved from Partnership for 21st Century Skills:

http://www.p21.org/documents/21st_century_skills_education_and_competitiveness_guide.pdf

Partnership for 21st Century Skills. (2007). *Beyond the three rs: Voter attitudes toward 21st century skills* (White Paper). Retrieved from Partnership for 21st Century Skills website: http://www.p21.org/

Partnership for 21st Century Skills. (2008). *The intellectual and policy foundations of the 21st century skills framework* (Policy Guide). Retrieved from Partnership for 21st Century Skills: http://www.p21.org/route21/images/stories/epapers/skills_foundations_final.pdf

Partnership for 21st Century Skills. (2008). *Transition brief: Policy recommendations on preparing Americans for the global skills race*. Retrieved from Partnership for 21st Century Skills website: http://www.p21.org

Partnership for 21st Century Skills website. (n.d.). http://www.p21.org/

Paul, J. L. (Ed.). (2005). *Introduction to the philosophies of research and criticism in education and the social sciences*. Upper Saddle River, NJ: Pearson Education.

Peck, C., Cuban, L., & Kirkpatrick, H. (2002, February). Techno-promoter dreams, student realities. *Phi Delta Kappan*, *83*(6), 472-481.

Penuel, W., Riel, M., Krause, A., & Frank, K. (2009, January). Analyzing teachers' professional interactions in a school as social capital: A social network approach. *Teachers College Record*, *111*(1), 124-163.

Phillips, D. C., & Burbules, N. C. (2000). *Postpositivism and educational research*. Lanham, MD: Rowman & Littlefield.

Pierson, M., & Borthwick, A. (2010). Framing the assessment of educational technology professional development in a culture of learning. *Journal of Digital Learning in Teacher Education*, *26*(4), 126-131.

Pitts, V. M., & Spillane, J. P. (2009, July). Using social network methods to study school leadership. *International Journal of Research & Method in Education*, *32*(2), 185-207. doi: 10.1080/17437270902946660

Plair, S. K. (2008, November/December). Revamping professional development for technology integration and fluency. *The Clearing House*. Retrieved from https://files.pbworks.com

Prell, C. (2012). *Social network analysis: History, theory, and methodology*. Los Angeles, CA: Sage.

Prensky, M. (2001, December). Digital natives, digital immigrants, part II: Do they really think differently? *On the Horizon*, *9*(6), 1-6.

Prensky, M. (2001, October). Digital natives, digital immigrants part 1. *On the Horizon*, *9*(5), 1-6.

Prensky, M. (2010). *Teaching digital natives: Partnering for real learning*. [Kindle]. Retrieved from www.amazon.com

Reigeluth, C. M., & An, Y. (2006, February). Functional contextualism: An ideal framework for theory in instructional design and technology. *Educational Technology Research and Development*, *54*(1), 49-53.

Renard, L. (2005, April 1). Teaching the DIG generation. *Educational Leadership*, *62*(7), 44-47.

Rogers, E. M. (2003). *Diffusion of innovations* (5 ed.). New York, NY: Free Press.

Sandholtz, J. H., & Reilly, B. (2004, March). Teachers, not technicians: Rethinking technical expectations for teachers. *Teachers College Record*, *106*(3), 487-512.

Schofield, J. (1995). *Computers and classroom culture*. New York, NY: Cambridge University Press.

Scott, J., & Carrington, P. J. (Eds.). (2011). Network theory. *The Sage handbook of social network analysis* (pp. 40-54). [Adobe Digital Editions]. Retrieved from http://reader.eblib.com.proxy.library.vcu.edu/%28S%28i2pxnu4ozs31vk3cclfxsuzm%29%29/Reader.aspx?p=786857&o=423&u=ZDCNWR53qbYza3gNHpm96Q%3d%3d&t=1464019365&h=47108623C8688025094FEDC7D644AF5F875FB425&s=45413480&ut=1283&pg=1&r=img&c=-1&pat=n&cms=-1&sd=2#

Sepelyak, M. (2016). *The instructional technology resource teacher: A descriptive case study of deployment, use and perceptions* (Doctoral dissertation). Retrieved from http://scholarcompass.vcu.edu/etd/4592

Seymour Papert. (n.d.). http://www.papert.org/

Shapely, K., Sheehan, D., Maloney, C., & Caranikas-Walker, F. (2011). Effects of technology immersion on middle school students' learning opportunities and achievement. *The Journal of Educational Research*, *104*(5), 299-315. doi: 10.1080/00220671003767615

Shavelson, R., & Towne, L. (Eds.). (2002). *Scientific research in education*. Washington, DC: National Academy Press.

Sheely, S. (2008). *Latour meets the digital natives: What do we really know*. Retrieved from http://www.ascilite.org.au/conferences/melbourne08/procs/sheely.pdf

Silva, E. (2009, May). Measuring skills for 21st century learning. *Phi Delta Kappan*, *90*(9), 630-634.

Skyes, G., Schneider, B., & Plank, D. (Eds.). (2009). What works in defining "what works" in educational improvement: Lessons from education policy implementation research, directions for future research. *Handbook of education policy research* (pp. 333-347). New York, NY: American Education Research Association.

Snyder, T. D., & Dillow, S. A. (2011, April 5). *Digest of education statistics 2010* (Compendium NCES 2011015). Retrieved from Institute of Education Sciences website: http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2011015

Spillane, J. P. (2006). *Distributed leadership*. San Francisco, CA: Jossey-Bass.

Spillane, J. P., & Healey, K. (2010, December). Conceptualizing school leadership and management from a distributed perspective. *Elementary School Journal*, *111*(2), 253-281.

Stake, R. (2006). *Multiple case study analysis*. New York, NY: Guilford.

Stone, L. (2005). Philosophy for educational research. In J. L. Paul (Ed.), *Introduction to the philosophies of research and criticism in education and the social sciences* (pp. 21-40).

Stover, K., Kissel, B., Haag, K., & Shoniker, R. (2011, April). Differentiated coaching: Fostering reflection with teachers. *The Reading Teacher*, *64*(7), 498-509.

Sugar, W. A. (2005). Instructional Technologist as a coach: Impact on a situated professional development program on teachers' technology use. *Journal of Technology and Teacher Education*, *13*(4), 547-571.

Sugar, W., & Slagter van Tryon, P. J. (2014, May/June). Development of a virtual technology coach to support technology integration for K-12 educators. *TechTrends*, *58*(3), 54-62.

Survey Monkey. (n.d.). www.surveymonkey.com

Taylor, R. P. (1980). *The computer in the school: Tutor, tool, tutee*. New York, NY: Teachers College Press.

Thomas, C. N., Hassaram, B., Rieth, H., Raghavan, N. S., Kinzer, C. K., & Mulloy, A. M. (2012). The integrated curriculum project: Teacher change and student outcomes within a university-school professional development collaboration. *Psychology in Schools*, *19*(5), 444-464.

United States Department of Education. (2004, September 15). *Improve student performance: Part D — Enhancing education through technology* (Policy Brief SEC. 2402). Retrieved from Ed.Gov website: http://www2.ed.gov/policy/elsec/leg/esea02/pg34.htm

United States Department of Education. (2009). *Guidance on Enhancing Education through Technology (Ed Tech) program funds made available under the American Recovery and Reinvestment Act of 2009* (https://www2.ed.gov/programs/edtech/legislation.html). Washington, DC: Government Printing Office.

United States Department of Education. (2010). *Transforming American education: Learning powered by technology*. Retrieved from http://tech.ed.gov/netp/

United States Department of Education. (2011). *No child left behind* (Policy Brief). Retrieved from Ed.gov: http://www2.ed.gov/nclb/landing.jhtml

United States Department of Education, National Center for Educational Statistics. (2010). *Teachers' use of educational technology in U.S. public schools: 2009* (NCES 2010-040). Washington, DC: Government Printing Office.

U.S. Department of Education. (1983). *A nation at risk*, Washington, D.C., Retrieved from http://www2.ed.gov/pubs/NatAtRisk/index.html

U.S. Department of Education. (2008). *A nation accountable: Twenty-five years after a nation at risk*, Washington, D.C., Washington, DC: Retrieved from http://www.ed.gov/rschstat/research/pubs/accountable/

Veletsianos, G. (2010). *Emerging technologies in distance education*. Edmonton, Canada: Athabasca University Press.

Venezky, R., & Osin, L. (1990). *The intelligent design of computer-assisted instruction*. New York, NY: Longman.

Virginia Department of Education. (2003). *Virginia educational technology plan 2003-2009* (Education Plan). Retrieved from Virginia Department of Education website: http://www.doe.virginia.gov/support/technology/edtech_plan/plan_2003-2009.pdf

Virginia Department of Education. (2008, July). *Instructional Technology Resource Teacher: Guidelines for teachers and administrators* (Policy Brief). Retrieved from Virginia Department of Education website: http://www.doe.virginia.gov/support/technology/administrators_teachers_staff/teacher_guidelines.pdf

Virginia Department of Education. (2010). *2010-2015 educational technology plan for Virginia* (Educational Plan). Retrieved from Virginia Department of Education website: www.doe.virginia.gov

Virginia Department of Education. (2012). *2012 Annual report on the condition and needs of public schools in Virginia* (22.1-18). Washington, DC: Government Printing Office.

Virginia Department of Education Division of Technology and Human Resources Office of Educational Technology. (2007). An analysis of the Instructional Technology Resource Teacher program in Virginia. Retrieved from http://www.doe.virginia.gov/support/technology/info_briefs/analysis_teacher_prog.pdf

Virginia Department of Education Division of Technology and Human Resources Office of Educational Technology. (2007). *An analysis of the Instructional Technology Resource Teacher program in Virginia* (Retrieved from http://www.doe.virginia.gov/support/technology/info_briefs/analysis_teacher_prog.pdf). Washington, DC: Government Printing Office.

Virginia Standards of Quality, Code of Virginia §§ 22.1-253.13:1-22.1-253.13.10 (2004).

Virginia Standards of Quality, Code of Virginia §§ 22.1-253.13:1-22.1-253.13:10 (2012).

Wasserman, S., & Faust, K. (2009). *Social network analysis: Methods and applications* (19th ed.). New York, NY: Cambridge University Press.

Wells, J., & Lewis, L. (2006). *Internet access in U.S. public schools and classrooms: 1994-2005.* Washington, DC: Government Printing Office.

Wozney, L., Venkatesh, V., & Abrami, P. C. (2006, January). Implementing computer technologies: Teachers' perceptions and practices. *Journal of Technology and Teacher Education*, *14*(1), 173-207.

Zepeda, S. J. (2008). *Professional development: What works* (1st ed.). Larchmont, NY: Eye on Education.

Zhao, Y., & Bryant, F. L. (2006). Can teacher technology integration training alone lead to high levels of technology integration? A qualitative look at teachers' technology integration after state mandated technology training. *Electronic Journal for the Integration of Technology in* Education, 5, 53-62. Retrieved from http://ejite.isu.edu/

Zhao, Y., & Frank, K. A. (2003). Factors affecting technology use in schools: An ecological perspective. *American Educational Research Journal*, *40*(4), 807-840. doi: 10.3102/00028312040004807

Zhao, Y., Lei, J., & Frank, K. A. (2006, April). The social life of technology: An ecological analysis of technology diffusion in schools. *Pedagogies*, *1*(2), 135-149. http://dx.doi.org/10.1207/s15544818ped0102_5

Zorfas, J., & Rivero, H. K. (*20*05). Collaboration is key: How a community of practice promotes TI. *Journal of Special Education Technology*, 20(3), 51-60.

Appendix A: Hooker (2006) Instructional Technology Resource Teachers' Survey

*Source formatting retained.

General Information

1. Your current official job title:
2. What is your highest degree?
3. Are you a licensed school teacher in Virginia? Yes No
4. Are you a licensed school administrator in Virginia? Yes No
5. What is your work calendar?

9 months 10 months 11 months 12 months

6. What training or conferences have you attended to assist with your job as ITRT?

Training from your region's consortium (Blue Ridge West or East) Yes No NTTI (National Teacher Training Institute) Trainings Yes No VSTE Conferences Yes No Virginia's Educational Technology Leadership Conference Yes No ITRT Summer Camps - Virginia Department of Education Yes No ITRT Academies - Virginia Department of Education Yes No Division Trainings Yes No Online Trainings (Example: Marco Polo) Yes No National technology conferences Yes No College courses regarding instructional technology Yes No Other, please specify

7. Is your ITRT position full-time? Yes No

8. How many hours per week do you devote to ITRT duties?

____

9. Does your division have a written job description that defines the qualifications and duties of the ITRTs? Yes No

10. Please specify the approximate percentage of your total professional time that you devote to each of the following ITRT duties:

a. Assisting teachers with the integration of technology. ____

b. Meeting with content specialists to coordinate services and resources.

c. Communicating information about Instructional technology ____
(e.g. newsletter, Website, e-mail). ____

d. Performing technical support duties. ____

e. Maintaining records necessary to document progress and activities.

f. Other ____
____

Actual Role

INSTRUCTIONS: Please read each item carefully.
Please indicate the actual level of your current involvement:

1=Almost Never 2=Rarely 3=Occasionally 4=Frequently 5= Very Frequently.

<u>Involvement with Classroom Teachers</u>

1. Collaborating with teachers to design lesson plans.
2. Showing teachers how to integrate technology. ______
3. Modeling effective instructional strategies using technology. ______
4. Training teachers on use of hardware. ______
5. Training teachers to use software. ______
6. Assisting teachers with students' projects. ______
7. Maintaining a website or web portals for teachers on technology integration. ______
8. Participating in department faculty meetings to discuss technology integration. ______
9. Finding curriculum resources or Internet sites for teachers. ______
10. Researching instructional technologies to share with teachers. ______
11. Assisting teachers with software problems. ______
12. Assisting teachers with hardware problems. ______

Please indicate the actual level of your current involvement:

1=Almost Never 2=Rarely 3=Occasionally 4=Frequently 5= Very Frequently.

Involvement with Administrators

13. Involved in division's technology planning. ______
14. Training administrators on the use of software applications such as SASI.
15. Assisting administrators in writing grants or finding alternate funding for technology. ______
16. Preparing press releases related to technology integration in the school(s). ______
17. Mentoring others to assume a technology leadership role. ______
18. Developing and implementing assessments for tracking technology usage ______
19. Providing training for administrators on using software. ______
20. Maintaining the school's website. ______
21. Maintaining the division's website. ______
22. Editing or contributing articles on technology to school newsletters. ______
23. Giving presentations on technology integration at school board meetings. ______
24. Working with content specialist(s) to assist in integrating technology. ______
25. Involved in school's purchases of technology equipment and software. ______

Perceptions

INSTRUCTIONS:

Please indicate the degree to which you agree or disagree with each statement.

1=Strongly Disagree 2=Disagree 3=Neither Agree or Disagree 4=Agree 5=Strongly Agree.

1. The most effective way to meet each school's instructional technology needs is to have one full-time ITRT in each school. ______
2. Training provided by ITRTs is sufficient for teachers to gain state-mandated technology competencies. ______
3. Teachers use integration technologies to effectively engage students in the learning process. ______
4. Sufficient time is allotted for teachers to plan for technology in the classroom. ______
5. Sufficient funds for hardware and software provide for implementing technology into the classroom. ______
6. Support from division administrators assist teachers in successfully integrating technology into the classroom. ______
7. Standards of Learning (SOL) prompt teachers to use technology as a daily instructional tool. ______

Please provide any additional comments regarding your experiences as an ITRT.

____

____

Appendix B: Recommended Percentages of Time for Various ITRT Tasks- (Redefined from 2005 Guidelines) In 2008 Guidelines (VDOE, 2008, p. 12)

Percent of	Task
2008>=68% 2005 >=70%	Assist teachers with the integration of technology in the classroom, train teachers to use technology, assist with curriculum development as it relates to educational technology, model instructional strategies with students, provide training and professional development, collaborate with teachers, research technology-based instructional strategies, review/evaluate technology software, offer direct assistance to teachers by way of classroom visitations, or fulfill similar kinds of duties and responsibilities as the school division may deem appropriate. Provide professional development activities for administrators.
2008<=14% 2005<=15%	Meet with administrators and content supervisors at the building and/or central office level to coordinate services and resources. Serve on building and/or division leadership teams relating to technology and instruction, professional organizations related to technology, and other responsibilities. Assist administrators and content supervisors with data-driven decision making relating to all areas of curriculum and instruction.
2008<=9% 2005<=10%	Create and implement a plan to communicate progress and activities to school, faculty, and administration (e.g., newsletter, technology Web site, e-mail notifications).
2008<=3% 2005<=4%	Conduct minor troubleshooting of computer lab equipment, hardware, or software problems.
2008<=1% 2005<=1%	Maintain records necessary to document progress and activities, such as a journal, blog, or database of activities.
2008<=5% Not in 2005 Guidelines	Conduct personal professional development, including research relating to professional growth goals, related conference attendance, workshops, and coursework.

http://www.doe.virginia.gov/support/technology/administrators_teachers_staff/teacher_guidelines.pdf

Appendix C: Percentages of Time for Various ITRT Performance Tasks from this Study, Hooker (2006), and VDOE Guidelines

	Study Mean %	Hooker Mean %	VDOE (2008) Recommendation
Assist teachers with the integration of technology in the classroom, train teachers to use technology, assist with curriculum development as it relates to educational technology, model instructional strategies with students, provide training and professional development, collaborate with teachers, research technology-based instructional strategies, review/evaluate technology software, offer direct assistance to teachers by way of classroom visitations, or fulfill similar kinds of duties and responsibilities as the school division may deem appropriate. Provide professional development activities for administrators.	32.73 + 13.83 = 46.56**	42.4	≥ 68%
Meet with administrators and content supervisors at the building and/or central office level to coordinate services and resources. Serve on building and/or division leadership teams relating to technology and instruction, professional organizations related to technology, and other responsibilities. Assist administrators and content supervisors with data-driven decision making relating to all areas of curriculum and instruction.	7.294	8.28	≤ 14%

Create and implement a plan to communicate progress and activities to school, faculty, and administration (e.g., newsletter, technology Web site, e-mail notifications).	10.675	13.38	≤ 9%
Conduct minor troubleshooting of computer lab equipment, hardware, or software problems.	20.303	18.99	≤ 3%
Maintain records necessary to document progress and activities, such as a journal, blog, or database of activities.	6.726	8.50	≤ 1%
Conduct personal professional development, including research relating to professional growth goals, related conference attendance, workshops, and coursework.	10.5224	*	≤ 5%

Notes: * This category was not in the VDOE guidelines used by Hooker (2006)

** These data were gathered using two descriptors and has been added for comparison purposes.

Appendix D: ITRT Information by School Division

School Division	Student Population (State Report Card numbers for 2015-2016)	Number of Positions as Defined by SOQ (rounded to the closest .5 position)	Number of Full-time ITRTs	Number of Part-time ITRTs	Total Number includes 1 or more Data Positions	Total Meets SOQ Minimum within .5	Total Exceeds SOQ Minimum by 1 or more Positions	Comment
Accomack	5322	5	3		*	No		
Albemarle	13767	14	7		*	No		
Alexandria City	14,729	15	17		No		Yes	
Alleghany	2258	2	3		No		Yes	
Amelia	1827	2	1		No	No		
Amherst	4216	4	3		*	No		
Appomattox	2,294	2	4		Yes		Yes	
Arlington	25364	25	32		No		Yes	
Augusta	10,472	10.5	8		No	No		
Bath	574	0.5	3		*		Yes	
Bedford	9874	10	10		*	Yes		
Bland	755	1	1		Yes	Yes		
Botetourt	4757	5	5		No	Yes		
Bristol city	2289	2	3		No	Yes		
Brunswick	1,733	2	1		No	No		
Buchanan	3004	3	1		no	No		
Buckingham	2062	2		4	No	Yes		
Buena Vista City	1012	1	1		Yes	Yes		
Campbell	7948	8	5		*	No		
Caroline	4330	4.5	5		Yes		Yes	
Carroll	3707*	3.5	3		No	No		

Charles City	719	0.5	1		*	Yes		
Charlotte	1941	2	1		Yes	No		
Charlottesville City	4377	4.5	6		*		Yes	
Chesapeake City	39943	40	39		No	No		
Chesterfield	59,659	60	42		Yes	No		
Clarke County	2004	2	2		No	Yes		
Colonial Beach	608	0.5	0		*	No		
Colonial Heights	2795	3	2		No	No		
Covington City	1021	1	0		*	No		
Clarke	2004	2	2		*	Yes		
Craig	623	0.5	2		*		Yes	
Culpeper	8131	8	8		No	Yes		
Cumberland	1399	1.5	1		*	No		
Danville	6249	6	5		*	No		
Dickenson	2320	2.5	0		*	No		
Dinwiddie	4418	4.5	6		No		Yes	
Essex	1495	1.5	1		*			
Fairfax	185831	187			*		Yes	ITRTs staffed based on student membership at each school. ES with populations less than 555 receive a .5 ITRT. Our Large schools, with populations at or around 3,000 students

								only have 1 ITRT.
Falls Church City	2518	2.5	3		*	Yes		
Fauquier	11,155	11	19		No		Yes	
Floyd	2076	2	4		*			
Fluvanna	3557	3.5	4		Yes	Yes		
Franklin City	1132	1	3		No		Yes	
Franklin	7353	7.5	1.5		*			
Frederick	13,203	13	12		No	No		Adding a position for 2017-2018
Fredericksburg City	3532	3.5	3		Yes	No		
Galax City	1390	1.5	1		No	Yes		
Giles	2408	2	3		No	Yes		
Gloucester	5557	5.5	4		*	No		
Goochland	2567	2.5	2		No	No		Planning to add 2 ITRTs for the 2017-18 SY
Grayson	1684	2	2.5		Yes	Yes		
Greene	3192	3	2		*	No		
Greensville	2518	2.5	2		Yes	No		
Halifax	5364	5.5	4	2	No	Yes		
Hampton City	20,618	21.5	8		No	No		Counting other personnel as ITRTs
Hanover	18061	18	11		No	No		
Harrisonburg City	5923	6	8		*		Yes	
Henrico	51534	51.5	33		*	No		
Henry	7415	7.5	8		Yes	Yes		
Highland	207	0			*			Information not provided
Hopewell City	4376	4.5	4		No	Yes		

Isle of Wight	5483	5.5	0		*	No		Creating instructional coaching position to replace ITRT
King and Queen	878	1			*			Information not provided
King George	4385	4.5	5		No	Yes		
King William	2246	2	1		No	No		Plans to hire an additional ITRT
Lancaster	1243	2			*			Information not provided
Lee	3297	3.5	4		Yes	Yes		
Lexington City	493	0.5	1		No	Yes		
Loudoun	76,228	76	88		No		Yes	
Louisa	4876	5	3		No	No		
Lunenburg	1585	1.5	3		Yes		Yes	
Lynchburg City	8587	8.5	9		No	Yes		
Madison	1829	2	2		Yes	Yes		
Manassas City	7,605	7.5	8		No	Yes		
Manassas Park City	3443	3.5	2		*	No		
Martinsville City	2186	2	2		No	Yes		
Mathews	1106	1	1		*	Yes		
Mecklenburg	4529	4.5	4		Yes	No		
Middlesex	1232	1			*			Information not provided
Montgomery	9775	10	9		*	No		
Nelson	1960	2	2		No	Yes		
New Kent	3,042	3	2		No	No		
Newport News City	28843*	29	29		Yes	Yes		

Norfolk PS	32,149	32	15		No	No		
Northampton	1,700	1.5	1		*	No		
Northumberland	1377	1.5	2		Yes	Yes		
Norton City	835	1	2		*		Yes	
Nottoway	2254	2			*			
Orange	5,137	5	9		Yes		Yes	
Page	3459	3.5	3.5		Yes	Yes		
Patrick	2932	3	1		No	No		
Petersburg City	4282	4	4		*	Yes		
Pittsylvania	9239	9	7		Yes	No		
Poquoson City	2103	2	3		No	Yes		
Portsmouth	14,927	15	10.5		No	No		
Powhatan	4270	4.5	2	4	Yes			Duties are shared with other positions.
Prince George	6455	6.5	8		No		Yes	
Prince William	88920*	88	90		No		Yes	
Pulaski	4346	4.5	5		Yes	Yes		
Radford City	1661	1.5	3		No		Yes	
Rappahannock	894	1			*			Information not provided
Richmond	1282	1	1		*	Yes		
Richmond City	23,987	24	20		Yes	No		
Roanoke City	13676	13.5	11		*	No		
Rockbridge	2816	3	2		yes	No		
Rockingham	11,876	12	20		No		Yes	
Russell	4062	4	3		Yes	No		

Salem City	3790	4	4		Yes	Yes		
Scott	3475	3.5	3		No	No		
Shenandoah	6075	6	6		No	Yes		
Smyth	4,384	4.5	3.5		No	No		
Southampton	2793	3			*			Information not provided
Spotsylvania	23,731	24	20		No	No		
Stafford	27841	28	30		no		Yes	
Staunton City	2660	2.5	1		No	No		
Suffolk	14383	14.5	3		No	No		
Surry	815	1	1		No	Yes		
Sussex	1066	1	1		*	Yes		
Tazewell	6111	6			*			
Virginia Beach City	69777	70	85		No		Yes	
Virginia Department of Juvenile Justice	325	0.5	3		Yes		Yes	
Warren	5300*	5.5	5		No	Yes		
Washington	7200	7	6		Yes	No		
Waynesboro City	3025	3	3		No	Yes		
West Point	764	1	0		*	No		
Westmoreland	1666	1.5	5		Yes		Yes	
Williamsburg-James City	11597	11.5	11		No	No		
Winchester City	4414	4.5	4		*	Yes		
Wise	6,024	6	4		No	No		
Wythe	4237	4	4		No	Yes		
York	12699	12.5	11		*	No		

	* SY 2016-2017				*Information not available			

Appendix E: Hodge-Instructional Technology Resource Teachers' Survey

General Information

1. In what Virginia school division are you employed?
2. How many students are currently enrolled in your school division?
3. How many ITRTs does your school division employ full-time?
4. How many ITRTs does your school division employ part-time?
5. How many licensed professionals does your school division employ as data coordinators?
6. Where do you report to work each day?
    a. In a school
    b. At division building
    c. Other, please specify.
7. What is your current official job title?
8. How many teachers are you responsible for supporting?
9. Please specify total number of schools or locations you are responsible for supporting.
    a. 1
    b. 2
    c. 3
    d. 4
    e. More than 4
10. How long have you held your current ITRT position? How long have you been an ITRT in total number of years?

11. What grade levels do the teachers you work with teach?

12. What is the term of your work contract?

    a. 9 months 10 months 11 months 12 months Other

13. Is your ITRT position full-time?

    a. Yes

    b. No

14. How many hours per week do you devote

    a. to ITRT duties?

    b. to data coordinator or testing duties?

15. Please specify the approximate percentage of your total professional time that you devote to each of the following ITRT duties:

    a. Assisting teachers with the integration of technology.

    b. Meeting with content specialists to coordinate services and resources.

    c. Communicating information about Instructional technology (e.g. newsletter, Website, e-mail).

    d. Performing technical support duties.

    e. Maintaining records necessary to document progress and activities.

    f. Conduct formal professional development for teachers you support or from your school division.

    g. Conduct personal professional development.

    h. Other. Please specify.

ITRT Responsibilities

Please indicate the level of your current involvement:

1=Never 2=Rarely 3=Occasionally 4=Frequently 5= Very Frequently

Involvement with Classroom Teachers:

1. Collaborating with teachers to design lesson plans.
2. Showing teachers how to integrate technology.
3. Modeling effective instructional strategies using technology.
4. Training teachers on use of hardware.
5. Training teachers to use software or applications.
6. Assisting teachers with students' projects.
7. Participating in department or faculty meetings to discuss technology integration.
8. Finding curriculum resources or Internet sites for teachers.
9. Researching instructional technologies to share with teachers.
10. Assisting teachers with software problems.
11. Assisting teachers with hardware problems.
12. Assisting teachers with administrative tasks such as grading, email, and maintaining classroom web pages.

Involvement with Administrators/Division Leadership

1. Involved in division's technology planning.
2. Involved with school level technology planning.
3. Training administrators on the use of administrative software applications (student information, grading, or email).

4. Assisting administrators in writing grants or finding alternate funding for technology.
5. Preparing press releases related to technology integration in the school(s).
6. Mentoring others to assume a technology leadership role.
7. Developing and implementing assessments for tracking technology use.
8. Providing training for administrators on using software.
9. Maintaining the school's website.
10. Maintaining the division's website.
11. Editing or contributing articles on technology to school newsletters.
12. Giving presentations on technology integration at division wide meetings.
13. Working with content specialist(s) to assist in integrating technology.
14. Involved in school's purchases of technology equipment and software.

Additional Comments

1. Please provide any additional comments that expound upon your experiences as an ITRT.

Appendix F: Official Job Titles

		Frequency	Percent
	Curriculum Integration Technology Teacher	1	.9
	Data Assessment Technology Manager	1	.9
	Director of Technology	1	.9
	Educational Technology Facilitator	1	.9
	iSTEM-Integrator of Science, Technology, Engineering, and Mathematics	1	.9
	Instructional Technologist	1	.9
	Instructional Technology Coach	3	2.8
	Instructional Technology Coordinator	1	.9
	Instructional Technology Data Resource Teacher	1	.9
	Instructional Technology Integration Specialist	1	.9
	Instructional Technology Integrator	1	.9
	Instructional Technology Liaison	1	.9
	Instructional Technology Resource Coach	1	.9
	Instructional Technology Resource Specialist	1	.9
	Instructional Technology Resource Teacher	65	59.6
	Instructional Technology Resource Teacher Elementary	1	.9
	Instructional Technology Resource Teacher Special Projects	1	.9
	Assistant Director of Technology	1	.9

	Instructional Technology Resource Teacher/Webmaster	1	.9
	Instructional Technology Specialist	3	2.8
	Instructional Technology Training Specialist	1	.9
	Instructional/Data Coach & Instructional Technology Resource Teacher	1	.9
	Lead Technology Resource Teacher	1	.9
	Learning Technology Integrators	1	.9
	Librarian/Mini Instructional Technology Resource Teacher	1	.9
	Librarian/TRT	1	.9
	Library Media Specialist/ ITRS	1	.9
	Library Media Specialist/Instructional Technology Resource Teacher	1	.9
	Network Manager/Instructional Technology Resource Teacher	1	.9
	School Based Technology Specialist	1	.9
	Teacher	2	1.8
	Technology Integration Specialist	3	2.8
	Technology Resource Teacher	5	4.6
	Testing and Technology Resource Teacher	2	.9
	Total	109	100.0

Appendix G: Frequency Tables for Demographic Variables

Table G1
Where do you report to work each day?

		Frequency	Percent	Valid Percent	Cumulative Percent
	Both	25	5.8	5.8	6.0
	Division	32	7.4	7.4	13.5
	School	373	86.5	86.5	100.0
	Total	431	100.0	100.0	

Table G2
Please specify total number of schools or locations you are responsible for supporting.

		Frequency	Percent	Valid Percent	Cumulative Percent
	1	188	43.6	44.5	44.5
	2	100	23.2	23.7	68.2
	3	73	16.9	17.3	85.5
	4	26	6.0	6.2	91.7
	5	35	8.1	8.3	100.0
	Total	422	97.9	100.0	
	Missing	9	2.1		
Total		431	100.0		

Table G3
How many teachers are you responsible for supporting?

		Frequency	Percent	Valid Percent	Cumulative Percent
	<50	48	11.1	11.8	11.8
	50>75	118	27.4	29.0	40.8
	76>100	94	21.8	23.1	63.9

	100>150	82	19.0	20.1	84.0
	150>200	37	8.6	9.1	93.1
	200>250	9	2.1	2.2	95.3
	251>	19	4.4	4.7	100.0
	Total	407	94.4	100.0	
	Missing	24	5.6		
Total		431	100.0		

Table G4
How long have you been an ITRT?

		Frequency	Percent	Valid Percent	Cumulative Percent
	<1	64	14.8	16.5	16.5
	1>3	71	16.5	18.3	34.8
	3>5	51	11.8	13.1	47.9
	5>10	93	21.6	24.0	71.9
	10>	109	25.3	28.1	100.0
	Total	388	90.0	100.0	
	Missing	43	10.0		
Total		431	100.0		

Table G5
What grade-levels do you serve?

		Frequency	Percent	Valid Percent	Cumulative Percent
		5	1.2	1.2	1.2
	All	79	18.3	18.3	19.5
	Elementary	189	43.9	43.9	63.3
	High	95	22.0	22.0	85.4
	Middle	63	14.6	14.6	100.0
	Total	431	100.0	100.0	

Table G6
Is your ITRT position full-time?

	Frequency	Percent	Valid Percent	Cumulative Percent

		6	1.4	1.4	1.4
	Full-time	394	91.4	91.4	92.8
	I am an administrator part-time and an ITRT part-time.	8	1.9	1.9	94.7
	I teach part-time and am an ITRT part-time.	11	2.6	2.6	97.2
	Part-time	12	2.8	2.8	100.0
	Total	431	100.0	100.0	

Table G7

Are you responsible for data activities?

		Frequency	Percent	Valid Percent	Cumulative Percent
	No	175	40.6	40.6	40.6
	Yes	256	59.4	59.4	100.0
	Total	431	100.0	100.0	

Appendix H: Survey Results for Percent of Time Spent on Performance Tasks Specified by VDOE (2008)

	N	Minimum	Maximum	Mean	Std. Deviation
Assisting teachers with the integration of technology	406	0	100	32.73	20.827
Conduct formal professional development for teachers you support or from your school division.	407	0	100	13.83	11.963
Meeting with content specialists to coordinate services and resources.	386	.0	80.0	7.294	8.0348
Communicating information about Instructional technology (e.g. newsletter, Website, e-mail).	402	.0	100.0	10.675	10.9013
Performing technical support duties.	407	.0	100.0	20.303	18.5548
Maintaining records necessary to document progress and activities.	389	.0	100.0	6.726	9.7911
Conduct personal professional development	390	.00	100.00	10.5224	11.74495

Appendix I: One-Sample *t*-test Results by Task Type Comparing Survey Data to ITRT Guidelines (2008)

Table I1

Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Integration and Professional Development	426	44.41	26.585	1.288

Test

	Guidelines Recommended Percent of Time Test Value = 68					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Integration and Professional Development	-18.312	425	.000	-23.587	-26.12	-21.06

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Meeting with content specialists to coordinate services and resources.	386	7.294	8.0348	.4090

One-Sample Test

	Guidelines Recommended Percent of Time Test Value = 14					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Meeting with content specialists to coordinate services and resources.	-16.398	385	.000	-6.7060	-7.510	-5.902

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Communicating information about Instructional technology (e.g. newsletter, Website, e-mail).	402	10.675	10.9013	.5437

One-Sample Test						
	Guidelines Recommended Percent of Time Test Value = 9					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference Lower	Upper
Communicating information about Instructional technology (e.g. newsletter, Website, e-mail).	3.081	401	.002	1.6754	.607	2.744

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
Performing technical support duties.	407	20.303	18.5548	.9197

One-Sample Test						
	Guidelines Recommended Percent of Time Test Value = 3					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference Lower	Upper
Performing technical support duties.	18.814	406	.000	17.3034	15.495	19.111

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
Maintaining records necessary to document progress and activities.	389	6.726	9.7911	.4964

One-Sample Test						
	Guidelines Recommended Percent of Time Test Value = 1					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference Lower	Upper
Maintaining records necessary to document progress and activities.	11.535	388	.000	5.7262	4.750	6.702

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean

Conduct personal professional development	390	10.5224	11.74495	.59473

One-Sample Test

	Guidelines Recommended Percent of Time Test Value = 5					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Conduct personal professional development	9.286	389	.000	5.52244	4.3532	6.6917

Appendix J: One-sample *t* Test Results for Hodge and Hooker (2006) Results

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
Integration and Professional Development	426	44.41	26.585	1.288

One-Sample Test: Test Value = 42

	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Integration and Professional Development	1.873	425	.062	2.413	-.12	4.94

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
Meeting with content specialists to coordinate services and resources.	386	7.294	8.0348	.4090

One-Sample Test: Test Value = 8.28

	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Meeting with content specialists to coordinate services and resources.	-2.411	385	.016	-9860	-1.790	-.182

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
Communicating information about Instructional technology (e.g. newsletter, Website, e-mail).	402	10.675	10.9013	.5437

One-Sample Test: Test Value = 13.38

	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Communicating information about Instructional technology (e.g. newsletter, Website, e-mail).	-4.974	401	.000	-2.7046	-3.773	-1.636

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Performing technical support duties.	407	20.303	18.5548	.9197

One-Sample Test: Test Value = 18.99

	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Performing technical support duties.	1.428	406	.154	1.3134	-.495	3.121

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Maintaining records necessary to document progress and activities.	389	6.726	9.7911	.4964

One-Sample Test: Test Value = 8.5

	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Maintaining records necessary to document progress and activities.	-3.573	388	.000	-1.7738	-2.750	-.798

Appendix K: Question 2 Data Analysis

Table K1
Percent of Time on Professional Activities Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Assisting teachers with the integration of technology	412	0	100	32.56	20.795
Meeting with content specialists to coordinate services and resources.	391	.0	80.0	7.290	8.0818
Communicating information about Instructional technology (e.g. newsletter, Website, e-mail).	403	.0	100.0	10.768	10.9766
Performing technical support duties.	409	.0	100.0	20.331	18.4913
Maintaining records necessary to document progress and activities.	392	0	100	6.72	9.660
Conduct formal professional development for teachers you support or from your school division.	407	0	100	13.91	11.937
Conduct personal professional development	388	.00	100.00	10.2326	10.56948

Table K2
ANOVA for Independent Variable: Grade Levels

		Sum of Squares	df	Mean Square	F	Sig.
Assisting teachers with the integration of technology	Between Groups	2067.954	3	689.318	1.595	.190
	Within Groups	174986.291	405	432.065		
	Total	177054.245	408			
Meeting with content specialists to coordinate services and resources.	Between Groups	265.846	3	88.615	1.351	.257
	Within Groups	25187.501	384	65.592		
	Total	25453.347	387			
Communicating information about Instructional technology (e.g. newsletter, Website, e-mail).	Between Groups	110.522	3	36.841	.303	.823
	Within Groups	48174.477	396	121.653		
	Total	48284.999	399			
Performing technical support duties.	Between Groups	1748.364	3	582.788	1.704	.166
	Within Groups	137464.437	402	341.951		
	Total	139212.801	405			
Maintaining records necessary to document progress and activities.	Between Groups	290.356	3	96.785	1.030	.379
	Within Groups	36182.101	385	93.979		
	Total	36472.458	388			
Conduct formal professional development for teachers you support or from your school division.	Between Groups	924.187	3	308.062	2.173	.091
	Within Groups	56697.586	400	141.744		
	Total	57621.772	403			

Conduct personal professional development	Between Groups	283.504	3	94.501	.847	.469
	Within Groups	42531.101	381	111.630		
	Total	42814.605	384			

Post hoc comparison not necessary as no significance found in the data for the independent variable-grade levels.

Table K3
ANOVA for Independent Variable: ITRT Experience

		Sum of Squares	df	Mean Square	F	Sig.
Assisting teachers with the integration of technology	Between Groups	4119.492	4	1029.873	2.401	.050
	Within Groups	157417.957	367	428.932		
	Total	161537.449	371			
Meeting with content specialists to coordinate services and resources.	Between Groups	255.136	4	63.784	.933	.445
	Within Groups	23985.731	351	68.335		
	Total	24240.867	355			
Communicating information about Instructional technology (e.g. newsletter, Website, e-mail).	Between Groups	427.038	4	106.759	.835	.504
	Within Groups	46021.664	360	127.838		
	Total	46448.701	364			
Performing technical support duties.	Between Groups	2169.508	4	542.377	1.773	.134
	Within Groups	111953.321	366	305.883		
	Total	114122.829	370			
Maintaining records necessary to document progress and activities.	Between Groups	561.678	4	140.420	1.406	.231
	Within Groups	35143.453	352	99.839		
	Total	35705.132	356			
Conduct formal professional development for teachers you support or from your school division.	Between Groups	217.498	4	54.375	.369	.831
	Within Groups	53510.415	363	147.412		
	Total	53727.913	367			
	Between Groups	306.113	4	76.528	.654	.625

Conduct personal professional development	Within Groups	40395.485	345	117.088		
	Total	40701.598	349			
Tukey Post Hoc-- Dependent Variable: Assisting teachers with the integration of technology						
Multiple Comparisons						
Dependent Variable: Assisting teachers with the integration of technology Tukey HSD						
(I) How long have you been an ITRT	(J) How long have you been an ITRT	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1	3	7.551	3.635	.232	-2.41	17.51
	5	8.903	3.992	.171	-2.04	19.85
3	10	6.802	3.418	.273	-2.57	16.17
	15	1.690	3.289	.986	-7.33	10.71
	1	-7.551	3.635	.232	-17.51	2.41
	5	1.352	3.941	.997	-9.45	12.16
5	10	-.749	3.358	.999	-9.95	8.46
	15	-5.861	3.227	.366	-14.71	2.98
	1	-8.903	3.992	.171	-19.85	2.04
	3	-1.352	3.941	.997	-12.16	9.45
10	10	-2.101	3.742	.980	-12.36	8.16
	15	-7.214	3.624	.273	-17.15	2.72
	1	-6.802	3.418	.273	-16.17	2.57
	3	.749	3.358	.999	-8.46	9.95
15	5	2.101	3.742	.980	-8.16	12.36
	15	-5.112	2.980	.426	-13.28	3.06
	1	-1.690	3.289	.986	-10.71	7.33
	3	5.861	3.227	.366	-2.98	14.71

NOTE: Potential significance found at the $p<.05$ for the dependent variable, assisting teachers with the integration of technology, so a Tukey post hoc test was performed for all levels of the independent variable.

Table K4
ANOVA for Deployment Model: ITRT Location

		Sum of Squares	df	Mean Square	F	Sig.
Assisting teachers with the integration of technology	Between Groups	609.048	2	304.524	.702	.496
	Within Groups	177054.971	408	433.958		
	Total	177664.020	410			
Meeting with content specialists to coordinate services and resources.	Between Groups	119.602	2	59.801	.919	.400
	Within Groups	25191.750	387	65.095		
	Total	25311.352	389			
Communicating information about Instructional technology (e.g. newsletter, Website, e-mail).	Between Groups	367.043	2	183.521	1.524	.219
	Within Groups	48035.162	399	120.389		
	Total	48402.205	401			
Performing technical support duties.	Between Groups	1764.394	2	882.197	2.600	.076
	Within Groups	137429.017	405	339.331		
	Total	139193.411	407			
Maintaining records necessary to document progress and activities.	Between Groups	164.420	2	82.210	.879	.416
	Within Groups	36291.918	388	93.536		
	Total	36456.338	390			
Conduct formal professional development for teachers you support or from your school division.	Between Groups	2176.521	2	1088.260	7.879	.000
	Within Groups	55661.797	403	138.119		
	Total	57838.318	405			
	Between Groups	110.937	2	55.469	.495	.610

Conduct personal professional development	Within Groups	43036.922	384	112.075		
	Total	43147.859	386			

Dependent Variable: Conduct formal professional development for teachers you support or from your school division.

Tukey Post Hoc

(I) Where do you report to work each day?	(J) Where do you report to work each day?	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	Upper Bound
School	Division	-6.228*	2.270	.017	-11.57	-.89
	Both	-7.861*	2.582	.007	-13.94	-1.79
Division	School	6.228*	2.270	.017	.89	11.57
	Both	-1.633	3.323	.875	-9.45	6.18
Both	School	7.861*	2.582	.007	1.79	13.94
	Division	1.633	3.323	.875	-6.18	9.45

*. The mean difference is significant at the 0.05 level.

NOTE: Statistical significance at the $p<.05$ is indicated for the dependent variable, conduct formal professional development. A Tukey post hoc test was performed to determine if there is significance for a level of the independent variable.

Table K5
ANOVA for Deployment Model: Number of Schools Supported

		Sum of Squares	df	Mean Square	F	Sig.
Assisting teachers with the integration of technology	Between Groups	3770.599	4	942.650	2.217	.067
	Within Groups	169684.936	399	425.276		
	Total	173455.535	403			
Meeting with content specialists to coordinate services and resources.	Between Groups	97.797	4	24.449	.366	.833
	Within Groups	25252.408	378	66.805		
	Total	25350.205	382			
Communicating information about Instructional technology (e.g. newsletter, Website, e-mail).	Between Groups	181.448	4	45.362	.369	.830
	Within Groups	47878.940	390	122.767		
	Total	48060.389	394			
Performing technical support duties.	Between Groups	2940.030	4	735.007	2.157	.073
	Within Groups	134909.778	396	340.681		
	Total	137849.808	400			
Maintaining records necessary to document progress and activities.	Between Groups	362.338	4	90.584	.952	.434
	Within Groups	36045.621	379	95.107		
	Total	36407.958	383			
Conduct formal professional development for teachers you support or from your school division.	Between Groups	1095.069	4	273.767	1.985	.096
	Within Groups	54343.868	394	137.929		
	Total	55438.937	398			
	Between Groups	459.663	4	114.916	1.255	.287

Conduct personal professional development	Within Groups	34337.102	375	91.566		
	Total	34796.765	379			

Table K6
Mean Comparison for Deployment Model: Number of Schools- One or More than One

Please specify total number of schools or locations you are responsible for supporting.		Assisting teachers with the integration of technology	Meeting with content specialists to coordinate services and resources.	Communicating information about Instructional technology (e.g. newsletter, Website, e-mail).	Performing technical support duties.	Maintaining records necessary to document progress and activities.	Conduct formal professional development for teachers you support or from your school division.	Conduct personal professional development
1 school	Mean	29.80	7.720	10.858	23.091	6.90	12.20	9.7735
	N	182	173	180	182	173	181	170
	Std. Deviation	20.056	8.1246	10.7135	18.1704	8.247	10.080	8.69827
More than one school	Mean	34.34	6.943	10.814	18.534	6.64	15.03	10.2988
	N	222	210	215	219	211	218	210
	Std. Deviation	21.121	8.1667	11.3390	18.6747	10.846	12.945	10.25612
Total	Mean	32.29	7.294	10.834	20.602	6.76	13.75	10.0638
	N	404	383	395	401	384	399	380
	Std. Deviation	20.746	8.1463	11.0445	18.5641	9.750	11.802	9.58186

One-Sample *t* Test: One or More than One School

	Test Value = 34.34					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper

Assisting teachers with the integration of technology	-3.056	181	.003	-4.543	-7.48	-1.61
One-Sample *t* Test: One or More than One School						
	Test Value = 6.943					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Meeting with content specialists to coordinate services and resources.	1.257	172	.210	.7767	-.443	1.996
One-Sample *t* Test: One or More than One School						
	Test Value = 10.71					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Communicating information about Instructional technology (e.g. newsletter, Website, e-mail).	.186	179	.853	.1483	-1.427	1.724
One-Sample *t* Test: One or More than One School						
	Test Value = 18.534					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Performing technical support duties.	3.383	181	.001	4.5567	1.899	7.214
One-Sample *t* Test: One or More than One School						
	Test Value = 6.64					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper

Maintaining records necessary to document progress and activities.	.417	172	.677	.262	-.98	1.50

One-Sample *t* Test: One or More than One School

	Test Value = 15.03					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Conduct formal professional development for teachers you support or from your school division.	-3.771	180	.000	-2.826	-4.30	-1.35

One-Sample *t* Test: One or More than One School

	Test Value = 10.2988					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Conduct personal professional development	-.787	169	.432	-.5253	-1.842	.792

Table K7
Mean Comparison for Data Activities

Are you responsible for data activities?		Assisting teachers with the integration of technology	Meeting with content specialists to coordinate services and resources.	Communicating information about Instructional technology (e.g. newsletter, Website, e-mail).	Performing technical support duties.	Maintaining records necessary to document progress and activities.	Conduct formal professional development for teachers you support or from your school division.	Conduct personal professional development
Not Responsible for Data	Mean	34.87	6.520	9.772	18.812	5.61	14.55	10.3510
	N	166	152	162	165	153	163	156
	Std. Deviation	20.354	5.6486	7.6364	17.7708	7.601	11.542	10.91665
Responsible for Data	Mean	31.00	7.780	11.438	21.359	7.43	13.48	10.1530
	N	246	239	241	244	239	244	232
	Std. Deviation	20.984	9.2826	12.7112	18.9299	10.729	12.198	10.35262
Total	Mean	32.56	7.290	10.768	20.331	6.72	13.91	10.2326
	N	412	391	403	409	392	407	388
	Std. Deviation	20.795	8.0818	10.9766	18.4913	9.660	11.937	10.56948

One-Sample Test

	Test Value = 34.87

	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Assisting teachers with the integration of technology	-2.890	245	.004	-3.866	-6.50	-1.23

One-Sample Test

	Test Value = 6.52					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Meeting with content specialists to coordinate services and resources.	2.099	238	.037	1.2603	.077	2.443

One-Sample Test

	Test Value = 9.772					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Communicating information about Instructional technology (e.g. newsletter, Website, e-mail).	2.034	240	.043	1.6658	.053	3.279

One-Sample Test

	Test Value = 18.812				
	t	df	Sig. (2-tailed)	Mean	95% Confidence Interval of the Difference

				Difference	Lower	Upper
Performing technical support duties.	2.101	243	.037	2.5466	.160	4.934

One-Sample Test

	Test Value = 5.61					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Maintaining records necessary to document progress and activities.	2.624	238	.009	1.821	.45	3.19

One-Sample Test

	Test Value = 14.55					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Conduct formal professional development for teachers you support or from your school division.	-1.371	243	.172	-1.070	-2.61	.47

Table K8:
Correlation between Number of Teachers the ITRT Supports and Performance Tasks

		How many teachers are you responsible for supporting?	Assisting teachers with the integration of technology
How many teachers are you responsible for supporting?	Pearson Correlation	1	.047
	Sig. (2-tailed)		.359
	N	392	381
Assisting teachers with the integration of technology	Pearson Correlation	.047	1
	Sig. (2-tailed)	.359	
	N	381	381
		How many teachers are you responsible for supporting?	Meeting with content specialists to coordinate services and resources.
How many teachers are you responsible for supporting?	Pearson Correlation	1	-.044
	Sig. (2-tailed)		.401
	N	392	364
Meeting with content specialists to coordinate services and resources.	Pearson Correlation	-.044	1
	Sig. (2-tailed)	.401	
	N	364	364
		How many teachers are you responsible for supporting?	Communicating information about Instructional technology (e.g. newsletter, Website, e-mail).
How many teachers are you responsible for supporting?	Pearson Correlation	1	-.004
	Sig. (2-tailed)		.946
	N	392	373
Communicating information about Instructional technology	Pearson Correlation	-.004	1
	Sig. (2-tailed)	.946	
	N	373	373

		How many teachers are you responsible for supporting?	Performing technical support duties.
How many teachers are you responsible for supporting?	Pearson Correlation	1	-.109*
	Sig. (2-tailed)		.035
	N	392	379
Performing technical support duties.	Pearson Correlation	-.109*	1
	Sig. (2-tailed)	.035	
	N	379	379
*. Correlation is significant at the 0.05 level (2-tailed).			

		How many teachers are you responsible for supporting?	Maintaining records necessary to document progress and activities.
How many teachers are you responsible for supporting?	Pearson Correlation	1	-.033
	Sig. (2-tailed)		.531
	N	392	363
Maintaining records necessary to document progress and activities.	Pearson Correlation	-.033	1
	Sig. (2-tailed)	.531	
	N	363	363

		How many teachers are you responsible for supporting?	Conduct formal professional development for teachers you support or from your school division.
How many teachers are you responsible for supporting?	Pearson Correlation	1	.170**
	Sig. (2-tailed)		.001
	N	392	377
Conduct formal professional development for teachers you support or from your school division.	Pearson Correlation	.170**	1
	Sig. (2-tailed)	.001	
	N	377	377
**. Correlation is significant at the 0.01 level (2-tailed).			

		How many teachers are you responsible for supporting?	Conduct personal professional development
How many teachers are you responsible for supporting?	Pearson Correlation	1	.039
	Sig. (2-tailed)		.456
	N	392	364
Conduct personal professional development	Pearson Correlation	.039	1
	Sig. (2-tailed)	.456	
	N	364	364

Appendix L: Frequency Tables for ITRT Performance Activities

Table L1

Frequency Table for Performance Activities Working with Teachers

Level of your current involvement with classroom teachers.							
	Almost never	Rarely	Occasionally	Frequently	Very frequently	Response Count	
1. Collaborating with teachers to design lesson plans.	28	68	191	110	31	428	
2. Showing teachers how to integrate technology.	2	22	107	202	95	428	
3. Modeling effective instructional strategies using technology.	5	51	180	144	47	427	
4. Training teachers on use of hardware.	11	58	182	152	25	428	
5. Training teachers to use software or applications.	2	19	103	228	75	427	
6. Assisting teachers with students' projects.	23	65	176	125	38	427	
7. Participating in department or faculty meetings to discuss technology integration.	28	80	175	104	40	427	
8. Finding curriculum	6	29	116	189	88	428	

resources or Internet sites for teachers.							
9. Researching instructional technologies to share with teachers.	3	25	119	196	84	427	
10. Assisting teachers with software problems.	0	21	105	189	111	426	
11. Assisting teachers with hardware problems.	17	51	130	126	96	420	
12. Assisting teachers with administrative tasks such as grading, email, and maintaining classroom web pages.	24	79	142	126	56	427	
						answered question	429
						skipped question	2

Collaborating with teachers to design lesson plans.

		Frequency	Percent	Valid Percent	Cumulative Percent
		3	.7	.7	.7
	Almost never	28	6.5	6.5	7.2
	Rarely	68	15.8	15.8	23.0
	Occasionally	191	44.3	44.3	67.3
	Frequently	110	25.5	25.5	92.8
	Very Frequently	31	7.2	7.2	100.0
	Total	431	100.0	100.0	

Showing teachers how to integrate technology.

		Frequency	Percent	Valid Percent	Cumulative Percent
		3	.7	.7	.7
	Almost never	2	.5	.5	1.2

		Frequency	Percent	Valid Percent	Cumulative Percent
	Rarely	22	5.1	5.1	6.3
	Occasionally	107	24.8	24.8	31.1
	Frequently	202	46.9	46.9	78.0
	Very Frequently	95	22.0	22.0	100.0
	Total	431	100.0	100.0	
Modeling effective instructional strategies using technology.					
		Frequency	Percent	Valid Percent	Cumulative Percent
		4	.9	.9	.9
	Almost never	5	1.2	1.2	2.1
	Rarely	51	11.8	11.8	13.9
	Occasionally	180	41.8	41.8	55.7
	Frequently	144	33.4	33.4	89.1
	Very Frequently	47	10.9	10.9	100.0
	Total	431	100.0	100.0	
Training teachers on use of hardware.					
		Frequency	Percent	Valid Percent	Cumulative Percent
		3	.7	.7	.7
	Almost never	11	2.6	2.6	3.2
	Rarely	58	13.5	13.5	16.7
	Occasionally	182	42.2	42.2	58.9
	Frequently	152	35.3	35.3	94.2
	Very Frequently	25	5.8	5.8	100.0
	Total	431	100.0	100.0	
Training teachers to use software or applications.					
		Frequency	Percent	Valid Percent	Cumulative Percent
		4	.9	.9	.9
	Almost never	2	.5	.5	1.4
	Rarely	19	4.4	4.4	5.8
	Occasionally	103	23.9	23.9	29.7
	Frequently	228	52.9	52.9	82.6
	Very Frequently	75	17.4	17.4	100.0

		Frequency	Percent	Valid Percent	Cumulative Percent
	Total	431	100.0	100.0	
Assisting teachers with students' projects.					
		Frequency	Percent	Valid Percent	Cumulative Percent
		4	.9	.9	.9
	Almost never	23	5.3	5.3	6.3
	Rarely	65	15.1	15.1	21.3
	Occasionally	176	40.8	40.8	62.2
	Frequently	125	29.0	29.0	91.2
	Very Frequently	38	8.8	8.8	100.0
	Total	431	100.0	100.0	
Participating in department or faculty meetings to discuss technology integration.					
		Frequency	Percent	Valid Percent	Cumulative Percent
		4	.9	.9	.9
	Almost never	28	6.5	6.5	7.4
	Rarely	80	18.6	18.6	26.0
	Occasionally	175	40.6	40.6	66.6
	Frequently	104	24.1	24.1	90.7
	Very Frequently	40	9.3	9.3	100.0
	Total	431	100.0	100.0	
Finding curriculum resources or Internet sites for teachers.					
		Frequency	Percent	Valid Percent	Cumulative Percent
		3	.7	.7	.7
	Almost never	6	1.4	1.4	2.1
	Rarely	29	6.7	6.7	8.8
	Occasionally	116	26.9	26.9	35.7
	Frequently	189	43.9	43.9	79.6
	Very Frequently	88	20.4	20.4	100.0
	Total	431	100.0	100.0	
Assisting teachers with administrative tasks such as grading, email, and maintaining classroom web pages.					
		Frequency	Percent	Valid Percent	Cumulative Percent

		4	.9	.9	.9
	Almost never	24	5.6	5.6	6.5
	Rarely	79	18.3	18.3	24.8
	Occasionally	142	32.9	32.9	57.8
	Frequently	126	29.2	29.2	87.0
	Very Frequently	56	13.0	13.0	100.0
	Total	431	100.0	100.0	

Table L2

Frequency Table for Performance Activities Working with Administration or Division

Please indicate the level of your current involvement with Administrators/Division Leadership.							
	Almost never	Rarely	Occasionally	Frequently	Very frequently	Response Count	
1. Involved in division's technology planning.	58	78	144	98	50	428	
2. Involved with school level technology planning.	25	53	107	156	87	428	
3. Training administrators on the use of administrative software applications (student information, grading, or email).	42	106	191	66	21	426	
4. Assisting administrators in writing grants or finding alternate funding for technology.	211	129	65	20	2	427	
5. Preparing press releases	273	92	50	11	3	429	

related to technology integration in the school(s).							
6. Mentoring others to assume a technology leadership role.	112	123	133	49	11	428	
7. Developing and implementing assessments for tracking technology use.	136	139	111	32	8	426	
8. Providing training for administrators on using software.	75	116	158	55	23	427	
9. Maintaining the school's website.	133	51	61	78	105	428	
10. Maintaining the division's website.	331	35	29	15	13	423	
11. Editing or contributing articles on technology to school newsletters.	173	119	87	29	17	425	
12. Giving presentations on technology integration at division wide meetings.	97	115	143	60	13	428	
13. Working with content specialist(s) to assist in integrating technology.	62	112	160	71	22	427	
14. Involved in school's purchases of technology	75	77	113	99	62	426	

equipment and software.							
						answered question	430
						skipped question	1

Involved in division's technology planning.

		Frequency	Percent	Valid Percent	Cumulative Percent
		3	.7	.7	.7
	Almost never	58	13.5	13.5	14.2
	Frequently	98	22.7	22.7	36.9
	Occasionally	144	33.4	33.4	70.3
	Rarely	78	18.1	18.1	88.4
	Very Frequently	50	11.6	11.6	100.0
	Total	431	100.0	100.0	

Involved with school level technology planning.

		Frequency	Percent	Valid Percent	Cumulative Percent
		3	.7	.7	.7
	Almost never	25	5.8	5.8	6.5
	Frequently	156	36.2	36.2	42.7
	Occasionally	107	24.8	24.8	67.5
	Rarely	53	12.3	12.3	79.8
	Very Frequently	87	20.2	20.2	100.0
	Total	431	100.0	100.0	

Training administrators on the use of administrative software applications (student information, grading, or email).

		Frequency	Percent	Valid Percent	Cumulative Percent
		5	1.2	1.2	1.2
	Almost never	42	9.7	9.7	10.9
	Frequently	66	15.3	15.3	26.2
	Occasionally	191	44.3	44.3	70.5
	Rarely	106	24.6	24.6	95.1
	Very Frequently	21	4.9	4.9	100.0
	Total	431	100.0	100.0	

Assisting administrators in writing grants or finding alternate funding for technology.

	Frequency	Percent	Valid Percent	Cumulative Percent

		4	.9	.9	.9
	Almost never	211	49.0	49.0	49.9
	Frequently	20	4.6	4.6	54.5
	Occasionally	65	15.1	15.1	69.6
	Rarely	129	29.9	29.9	99.5
	Very Frequently	2	.5	.5	100.0
	Total	431	100.0	100.0	

Preparing press releases related to technology integration in the school(s).

		Frequency	Percent	Valid Percent	Cumulative Percent
		2	.5	.5	.5
	Almost never	273	63.3	63.3	63.8
	Frequently	11	2.6	2.6	66.4
	Occasionally	50	11.6	11.6	78.0
	Rarely	92	21.3	21.3	99.3
	Very Frequently	3	.7	.7	100.0
	Total	431	100.0	100.0	

Mentoring others to assume a technology leadership role.

		Frequency	Percent	Valid Percent	Cumulative Percent
		3	.7	.7	.7
	Almost never	112	26.0	26.0	26.7
	Frequently	49	11.4	11.4	38.1
	Occasionally	133	30.9	30.9	68.9
	Rarely	123	28.5	28.5	97.4
	Very Frequently	11	2.6	2.6	100.0
	Total	431	100.0	100.0	

Developing and implementing assessments for tracking technology use.

		Frequency	Percent	Valid Percent	Cumulative Percent
		5	1.2	1.2	1.2
	Almost never	136	31.6	31.6	32.7
	Frequently	32	7.4	7.4	40.1
	Occasionally	111	25.8	25.8	65.9
	Rarely	139	32.3	32.3	98.1
	Very Frequently	8	1.9	1.9	100.0
	Total	431	100.0	100.0	

Providing training for administrators on using software.

	Frequency	Percent	Valid Percent	Cumulative Percent
	4	.9	.9	.9
Almost never	75	17.4	17.4	18.3
Frequently	55	12.8	12.8	31.1
Occasionally	158	36.7	36.7	67.7
Rarely	116	26.9	26.9	94.7
Very Frequently	23	5.3	5.3	100.0
Total	431	100.0	100.0	
Maintaining the division's website.				
	Frequency	Percent	Valid Percent	Cumulative Percent
	8	1.9	1.9	1.9
Almost never	133	30.9	30.9	31.6
Frequently	78	18.1	18.1	49.7
Occasionally	61	14.2	14.2	63.8
Rarely	51	11.8	11.8	75.6
Very Frequently	105	24.4	24.4	100.0
Total	431	100.0	100.0	
Maintaining the school's website.				
	Frequency	Percent	Valid Percent	Cumulative Percent
	3	.7	.7	.7
Almost never	331	76.8	76.8	78.7
Frequently	15	3.5	3.5	82.1
Occasionally	29	6.7	6.7	88.9
Rarely	35	8.1	8.1	97.0
Very Frequently	13	3.0	3.0	100.0
Total	431	100.0	100.0	
Editing or contributing articles on technology to school newsletters.				
	Frequency	Percent	Valid Percent	Cumulative Percent
	6	1.4	1.4	1.4
Almost never	173	40.1	40.1	41.5
Frequently	29	6.7	6.7	48.3
Occasionally	87	20.2	20.2	68.4
Rarely	119	27.6	27.6	96.1
Very Frequently	17	3.9	3.9	100.0

	Total	431	100.0	100.0	
Giving presentations on technology integration at division wide meetings.					
		Frequency	Percent	Valid Percent	Cumulative Percent
		3	.7	.7	.7
	Almost never	97	22.5	22.5	23.2
	Frequently	60	13.9	13.9	37.1
	Occasionally	143	33.2	33.2	70.3
	Rarely	115	26.7	26.7	97.0
	Very Frequently	13	3.0	3.0	100.0
	Total	431	100.0	100.0	
Working with content specialist(s) to assist in integrating technology.					
		Frequency	Percent	Valid Percent	Cumulative Percent
		4	.9	.9	.9
	Almost never	62	14.4	14.4	15.3
	Frequently	71	16.5	16.5	31.8
	Occasionally	160	37.1	37.1	68.9
	Rarely	112	26.0	26.0	94.9
	Very Frequently	22	5.1	5.1	100.0
	Total	431	100.0	100.0	
Involved in school's purchases of technology equipment and software.					
		Frequency	Percent	Valid Percent	Cumulative Percent
		6	1.4	1.4	1.4
	Almost never	75	17.4	17.4	18.8
	Frequently	98	22.7	22.7	41.5
	Occasionally	113	26.2	26.2	67.7
	Rarely	77	17.9	17.9	85.6
	Very Frequently	62	14.4	14.4	100.0
	Total	431	100.0	100.0	

Vita

Cherise Ann Renne Hodge was born on April 27, 1960, in Washington D.C and is a citizen of the United States of America. She graduated from Manchester High School in Chesterfield, Virginia in 1978. She received her Bachelor of Science in Education from Virginia Commonwealth University in 1984 and her Master of Education Leadership from George Mason University in 2003. Cherise has worked in K-12 education for 27 years as both a teacher and an Instructional Technology Resource Teacher.