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Music teacher perceptions of a model of technology training and support in Virginia

Welch, Lee Arthur

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MUSIC TEACHER PERCEPTIONS OF A MODEL OF TECHNOLOGY TRAINING AND SUPPORT IN VIRGINIA

by

LEE ARTHUR WELCH
BME, Shenandoah Conservatory of Music, 1980
M.A., Rowan College of New Jersey, 1992
Ed.S., The College of William and Mary, 1995

Submitted in partial fulfillment of the requirements for the degree of Doctor of Musical Arts 2013
Approved by

Jay Dorfman, PhD
Assistant Professor
School of Music

David B. Whittier, EdD
Clinical Associate Professor
School of Education
Dedication

I dedicate this dissertation to my wife, Sarah - soul mate, life collaborator, brilliant scholar - and to my children, Calum and Aidan, two wonderful people whom I am fortunate beyond measure to know. I love you all deeply, and now we can (finally) go out and play. . . .
As with any endeavor of this magnitude, it is nearly impossible to acknowledge all of the people who have spurred one to action, or lent support in times of deepest need. I am profoundly grateful to have had the incredible love and support of my wife, my children, my family, and my friends who understood the commitments and requirements to be met that were necessary for the completion of this dissertation, at times understanding them even better than I did myself. I am grateful for the guidance of my advisor, Dr. Jay Dorfman of Boston University, who kept my work focused, delivered excellent editorial advice at key moments, and always provided the right balance of nudge and support. I am also grateful to Dr. David Whittier of Boston University for serving on my committee and providing guidance from an educational technologists’ perspective, which helped to make my study even stronger. I am grateful as well to Dr. John Wallace of Boston University, and Dr. David Aday of the College of William and Mary for their unhesitating support at critical times of need during this process. I thank all of my colleagues for their support and encouragement throughout, and hope that I may someday return the favor tenfold.
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LEE ARTHUR WELCH

Boston University College of Fine Arts, 2013

Major Professor: Jay Dorfman, Ph.D., Assistant Professor of Music, Music Education

ABSTRACT

A plethora of technology resources currently exists for the music classroom of the twenty-first century, including digital audio and video, music software, electronic instruments, Web 2.0 tools and more. Research shows a strong need for professional development for teachers to properly implement and integrate instructional technology resources into the music classroom (Peters, 1984; see also Williams, 1992). The Instructional Technology Resource Teacher (ITRT) is a specific role in Virginia that provides professional development to teachers for technology integration. The ITRT position is mandated by the Commonwealth of Virginia's Standards of Quality.

The purpose of this study was to determine whether music teachers perceived the ITRT role as an effective means of professional development for the integration of instructional technologies in the delivery of music instruction. An analysis of the data collected for this study measured whether periodic interactions with the ITRT correlated with changes in music teacher comfort levels with technology use. Furthermore, this study examined whether the frequency or extent of the interactions with the ITRT influenced changes in music
classroom practice of technology integration.

The research questions that guided this study were:

1. Does technology integration training/support provided by Instructional Technology Resource Teachers (ITRTs) influence teachers’ degree of comfort with using technology for music education?
2. Does contact with the ITRT influence teachers’ tendency to engage in certain technology-based activities/behaviors?
3. Does the frequency of contact with the ITRT increase teachers’ likelihood of integrating technology in their classrooms?
4. What elements of technology-based instruction are most and least positively affected by the ITRT training/support?

Data were collected using multiple administrations of an online survey. Data from this study provided positive, and often significant results across each of the four questions researched. Beginning with music teachers’ degree of comfort with using technology for instruction through specific technology-based activities, results provided new and promising data in support of the efficacy of this training/support role, one that is targeted at increasing those very factors. Results established that participants perceived that the ITRT role positively affected their comfort with technology use, as well as their increased likelihood of using technology for instruction.
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CHAPTER 1: INTRODUCTION

Background

For more than thirty years computers and other technologies have been common instructional tools within our schools (Honey, Culp, & Spielvogel, 2005; O'Dwyer, Russell, Bebell, & Seeley, 2004). While the level of availability and instructional integration may vary widely, as each year dawns, an increasing variety of technology tools become available to teachers and students. The amount of technology resources designed specifically for music classrooms has grown exponentially (Rudolph, 2004; Webster, 2002), and many music educators and their students have quickly embraced them. Dammers (2009) stated, "As music technology has developed and advanced, music classes that use technology as the primary means for instruction have emerged" (p. 25). In a study of 175 high schools in New Jersey, Dammers found that 28 percent offered technology-based music classes. Varied technologies are ubiquitous facets of life in and out of the classroom, and increasingly throughout this decade we have heard the cry for digital literacy (Lankshear & Knobel, 2008), for meeting the needs of the digital native (Prensky, 2001), and for teaching twenty-first century skills in our schools (Partnership for 21st Century Skills, 2007). Describing the youth of today, Ito (2009) stated:

Social network sites, online games, video-sharing sites, and gadgets such as iPods and mobile phones are now fixtures of youth culture. They have so permeated young lives that it is hard to believe that less than a decade ago these technologies barely existed. Today's youth may be coming of age and struggling for autonomy and identity as did their predecessors, but they are doing so amid new worlds for communication, friendship, play, and self-expression. (p. 3)
Educators know that modern classrooms must change to reflect this technological world that our students inhabit. In a meta-analysis of studies focused on technology in schools, Fadel and Lemke (2006) found a variety of reasons and purposes cited by educators for the inclusion of technology in schools:

- Improving learning (e.g., higher standardized test scores)
- Increasing student engagement in learning
- Improving the economic viability of students (e.g., increasing students’ abilities to succeed in a 21st century work environment through teaming, technology fluency, and high productivity)
- Increasing relevance and real-world application of academics
- Closing the digital divide by increasing technology literacy in all students
- Building 21st century skills (e.g., critical thinking and sound reasoning, global awareness, communication skills, information and visual literacy, scientific reasoning, productivity, and creativity) (p. 2)

The idea of improved student learning as a result of technology use, and of increased student achievement when learning with technology are supported by studies such as a meta-analysis conducted by Christmann and Badgett (2003). This meta-analysis demonstrated a positive correlation between computer-aided instruction and student achievement with elementary students. Christmann and Badgett stated: “it can be concluded that CAI was more effective than traditional methods of instruction in raising overall academic achievement among elementary school students” (p. 98). More recently a meta-analysis of forty years of research on technology in education, conducted by Tamim, Bernard, Borokhovski, Abrami, and Schmid (2011) summarized:

The current second-order meta-analysis summarized evidence regarding the impact of technology on student achievement in formal academic contexts based on an extensive body of literature... revealed a significant positive small to moderate effect size favoring the utilization of
technology in the experimental condition over more traditional instruction (i.e., technology free) in the control group. The analysis of two substantive moderator variables revealed that computer technology that supports instruction has a marginally but significantly higher average effect size compared to technology applications that provide direct instruction. (p. 16)

These researchers have shown that student learning and achievement can be positively impacted through the use of instructional technology. While not the focus of the current study it bears mentioning that this most fundamental concern – student achievement – should be considered when planning for technology integration in education. It is the primary factor in using technology instructionally. The issue remains how to develop teachers to appropriately integrate technology, and most pertinent to this study, how to prepare music teachers to integrate music technology into their instruction. To date there have been relatively few studies that have focused on staff development for music technology integration, although, as will be seen in a later section, studies on music technology and instruction strongly underscore the desire of music teachers to participate in just such professional development.

**TPACK: Theoretical Framework**

Mishra and Koehler (2006) developed a comprehensive model to conceptualize the integration of instructional technology into the teaching and learning process. This model, built on the work of Shulman (1986), helps us conceptualize how teacher pedagogical knowledge and content knowledge work together in education. Mishra and Koehler presented a framework that addressed technological pedagogical content knowledge, known as TPACK. The TPACK framework “attempts to capture some of the essential qualities of teacher
knowledge required for technology integration in teaching, while addressing the complex, multifaceted, and situated nature of this knowledge” (Mishra & Koehler, 2006, p. 1019). In this framework, developing an understanding of the interplay between three domains of knowledge – technology, pedagogy, and content – allows for meaningful planning for integration of technology that is essential to the delivery of instruction and the acquisition of learning. Mishra and Koehler (2006) stated:

Technological pedagogical content knowledge is an understanding that emerges from interactions among content, pedagogy, and technology knowledge. Underlying truly meaningful and deeply skilled teaching with technology, TPACK is different from knowledge of all three concepts individually. Instead, TPACK is the basis of effective teaching with technology, requiring an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face; knowledge of students' prior knowledge and theories of epistemology; and knowledge of how technologies can be used to build on existing knowledge to develop new epistemologies or strengthen old ones. (p. 66)

Koehler and Mishra (2009) highlighted the importance of technology integration, in concert with pedagogical and content knowledge, to facilitate the ability of teachers to make appropriate decisions when choosing instructional models. Within the TPACK construct, each instructional opportunity presented to teachers allows them to develop unique solutions to appropriately integrate technology while simultaneously addressing pedagogical and content needs. In this construct, developing facility not only with each domain but also with how they interrelate in constructing instructional opportunities for students is critical. Mishra and Koehler (2006) stated: “This is the kind of deep, flexible, pragmatic,
and nuanced understanding of teaching with technology we involved in considering TPACK as a professional knowledge construct.” (p. 66)

Banister and Reinhardt (2011) demonstrated that job-embedded professional development using TPACK principles influence both technology integration and student achievement. In their study, 82 observations of 23 teachers determined that positive results in addressing social justice issues were evident with the infusion of technology in combination with solid content knowledge.

Ongoing issues with Professional Development for Technology Integration

Yet given the importance of infusing technology into educational environments, and considering a growing body of research to support its efficacy, our current system neglects crucial elements of teacher training in technology-based pedagogy. Salpeter (2004) noted, “For years, experts have been warning that investments in educational technology will only pay off if an adequate portion of the budget is devoted to professional development and support” (p. 4). Even the most current tools can be inappropriately used, or be underutilized, without training and instructional support.

Some music educators have been actively expressing a desire for greater instructional technology use in the classroom (Bush, 2007; Jassman, 2004), and there exists a plethora of technology resources available for the music classroom of the twenty-first century: digital audio and video, music software, electronic instruments, Web 2.0 tools, mobile devices such as iPods, iPads and more. Yet relatively few music educators and researchers have been actively engaged in the
application of instructional technology to music learning, perhaps due to the perceived lack of meaningful professional development. In studies such as those conducted by Ho (2004), students overwhelmingly believed that technology improved the quality of their music learning, and a majority of teachers agreed. Yet, as in other content areas, the need for professional development to properly integrate instructional technology resources into the music classroom is clearly a concern.

Dorfman (2006), researching interactions of students with computer music applications, found that “the depth to which teachers are familiar with technology, and to which they integrate it bears direct influence on the types of learning conditions they are able to design for their students” (p. 26). To encourage that familiarity, it is necessary to implement models of support for practicing teachers. Bauer, Reese, and McAllister (2003) investigated weeklong technology workshops for music teachers to determine if such a structure is perceived as an effective model for professional development, and found an increased likelihood of technology usage due to those workshops. Other researchers have found similar results. Sandholtz, Ringstaff, and Dwyer (1994) found that “lasting, significant change – in teachers’ beliefs about their role, in instructional practices, and in student outcomes – will not occur simply by giving teachers the latest technological tools. Rather, teachers must be provided with ongoing support” (p. 19). Other researchers concur, and seek models that provide measurable change in instructional technology integration. Schrum (1999), after reviewing research on the current state of technology in classrooms,
and professional development in appropriate technology use by teachers, stated, “More research must focus on alternative ways to provide effective professional development for our current and future educators” (p. 88). Schrum’s review indicated that even with research on what constitutes effective technology staff development, many schools continue to use the traditional one-session “chalk and talk” (p. 2). This still-common method of one-way delivery is often quite general, giving little or no consideration of the audience, is limited in duration and usefulness, and is rarely interactive. Research on effective practice indicates that personal and sustained professional development often equates to more meaningful results in terms of classroom practice (Joyce & Showers, 1983; 1995; 2002).

This study contributed to the research on professional development for teachers, which often includes efforts to increase the use of instructional technology in music classrooms. It examined a unique technology integration support model in use in the Commonwealth of Virginia, which serves as an example of the type of prolonged integration often recommended in previous research.

Context for the Present Study

Since 1995, the Commonwealth of Virginia Department of Education has demonstrated a commitment to technology use in Virginia’s public schools. The Virginia Standards of Learning (SOL) outline the commonwealth’s expectations for student learning and achievement in grades K-12 in the areas of English,
mathematics, science, history/social science, technology,¹ the fine arts, foreign language, health and physical education, and driver education. The Standards of Learning have included computer/technology standards since their initial adoption in 1995. These technology standards, revised in 2005, currently reflect five areas of competencies for students: (a) Basic Operations and Concepts, (b) Social and Ethical Issues, (c) Technology Research Tools, (d) Problem Solving and Decision-Making Tools, and (e) Technology Communication Tools. Three years after the initial adoption of the Standards of Learning, in an effort to ensure that Virginia teachers were facile in the use of technology and able to instruct students in its use, the Virginia legislature adopted the Technology Standards for Instructional Personnel (TSIP) as a requirement for teacher licensure (1998, 8VAC 20-25-10). School divisions were notified that the goal of the legislation was for all instructional personnel to meet the TSIP prior to the 2002-2003 school year.

In 2004, in an effort to address the growing need for teacher training in instructional technology integration, the General Assembly of the Commonwealth of Virginia revised the Standards of Quality for its public schools to provide instructional positions that serve as teacher-to-teacher support for that purpose. The 2009 Standards of Quality re-authorized this support:

“Local school boards shall employ two full-time equivalent positions per 1,000 students in grades kindergarten through 12, one to provide technology support and one to serve as an instructional technology resource teacher” (Virginia Standards of Quality, §§22.1-253.13:2).

¹http://www.doe.virginia.gov/testing/sol/standards_docs/computer_technology/index.shtml
The role of the Instructional Technology Resource Teacher (ITRT) is to train teachers to integrate technology tools effectively in the classroom. The ITRT dedicates the majority of her time to collaboratively designing lessons that integrate technology, modeling strategies, supporting technology-infused classroom instruction, and conducting professional development in one-on-one, small group and larger group settings. The ITRT supports all content areas, serving music, art, and physical education teachers as well as “core” content area teachers.

Rationale for the Study

To date there have been few studies concerning the ITRT model.² Streich (2007) researched the skills ITRTs employ to meet the needs they encounter. Hooker (2006) investigated how ITRTs used their time in discharging their role. Pixley (2008) researched the social attributes of ITRTs’ connections with classroom teachers. There has been no research on the impact of the ITRT model on instructional technology use in music education, nor on changes in frequency of technology use or integration as a result of interactions with the ITRT. In this study I examined the effect of the ITRT model in which peer-to-peer professional development is offered on the integration of instructional technologies in the delivery of music instruction. In addition to adding to the literature on staff development models, this study also contributes to the literature on policy implementation. Data collected in the context of this study addresses the efficacy

² These studies are analyzed in greater detail in chapter 2.
of the ITRT position as conceived by state legislators, yet developed by local school divisions in Virginia.

**Purpose of the Study**

The purpose of this study was to determine whether music teachers perceive the ITRT model as effective in their professional development. Further, this study looked at whether the frequency or extent of the interactions with the ITRT influenced changes in music classroom practice related to technology integration. Analysis of the data collected for this study measured whether periodic interactions with the ITRT were positively correlated with changes in technology use by the music teacher. This study provided an opportunity to analyze specific areas where this was demonstrated, and others that may be targeted in the future to potentially increase both teacher use of instructional technology and student learning.

As with much professional development, the ultimate aim of the ITRT model is not only to provide support for teachers in the use of technology, but to do so purposefully in order to improve instruction to facilitate increased learning and achievement for students. Toward this end, results from this study also provide a baseline opportunity to begin exploring the value of the ITRT role in specific ways in the future, such as a purposeful focus on TPACK or other frameworks to assist in conceptualizing instructional integration of technology for music learning.
Research Questions

The research questions that guided this study were:

1. Does technology integration training/support provided by Instructional Technology Resource Teachers (ITRTs) influence teachers' degree of comfort with using technology for music education?

2. Does contact with the ITRT influence teachers' tendency to engage in certain technology-based activities/behaviors?

3. Does the frequency of contact with the ITRT increase teachers' likelihood of integrating technology in their classrooms?

4. What elements of technology-based instruction are most and least positively affected by the ITRT training/support?

Definition of Relevant Terms

*Instructional Technology* – for the purposes of this study, instructional technology shall be defined as any digital tool used to assist in or enhance the process of teaching and learning. It is acknowledged that non-digital tools (the chalkboard, for instance) have served in this capacity as well.

*Music Technology* – for the purposes of this study, music technology shall be defined as the application of digital tools and media to the musical arts.

*Professional Development* – for the purposes of this study, professional development shall be defined as a process that is intended to provide teachers the opportunity for professional growth, resulting in improved instructional skills.
Staff Development – for the purposes of this study, staff development shall be defined identically to professional development.

Instructional Technology Resource Teacher (ITRT) – an instructional position that exists in the Commonwealth of Virginia by legislative code. This position provides a teacher-to-teacher resource to assist classroom teachers in integrating technology into the teaching and learning process. ITRTs must hold a current license to teach in the Commonwealth of Virginia.

Instructional Technology Standard (ITS) – for the purposes of this study, the ITS is a specific set of technology tools available in every classroom in the Virginia school division where the participants teach, comprised of:

- Ceiling mounted projector
- Eight foot projection screen
- Stereo speakers
- Teacher laptop – controls streaming video content in addition to Internet content
- Document camera
- Bluetooth wireless tablet for data entry
- Wireless keyboard
- Sound field amplification
- Four station computer POD for student use
- Teacher panel – toggles between laptop and document camera, controls volume
- Access to classroom sets of personal response systems and wireless laptop labs with printer
CHAPTER 2: REVIEW OF LITERATURE

Introduction

In the past two decades, we have seen a growing discourse in the literature on the instructional needs of the “digital native,” our current technologically savvy student body (Prensky, 2001). There is an articulated belief in these discussions that to reach and teach this new “wired” generation of students, educators must themselves be facile with various digital technologies. Yet the best way to nurture the technology skills teachers need, and a myriad of other concerns, is very much a question of ongoing research. Frequently the solution is considered to be professional development.

A variety of professional development models and opportunities exist, targeted to groups of teachers with descriptive names such as one-shot workshops, train-the-trainer, and study group cohort, among others. There are also many individual growth opportunities such as graduate study and National Board Certification. How effective these various models are in changing teacher practice, and specifically how effective various models were in increasing technology and music technology integration in the teaching and learning process was the focal point of this review. Overarching themes investigated in this literature review were models of professional development, models of professional development focused on technology integration, and models of professional development focused on technology integration into the music classroom to support music learning.
The Need for Effective Professional Development Models

The need for professional development for teachers that results in sustainable change in classroom practice and provides for improvements in student learning has been the subject of a substantial amount of research. Villegas-Reimers (2003) examined the role of professional development in education reforms, and stated that “societies are finally realizing that teachers are not only one of the ‘variables’ that needs to be changed in order to improve their education systems, but they are also the most significant change agent in these reforms” (p. 7). Writing about effective professional development—that which results in change—Desimone (2011) stated:

Successful professional development follows these steps:

1. Teachers experience professional development.
2. The professional development increases teachers’ knowledge and skills, changes their attitudes and beliefs, or both.
3. Teachers use their new knowledge, skills, attitudes, and beliefs to improve the content of their instruction, their approach to pedagogy, or both.
4. The instructional changes that the teachers introduce to the classroom boost their students’ learning. (p. 70)

Learning Forward (formerly the National Staff Development Council) similarly define professional development as resulting in change: “The term ‘professional development’ means a comprehensive, sustained, and intensive approach to improving teachers’ and principals’ effectiveness in raising student achievement” (http://www.learningforward.org/who-we-are/professional-learning-definition). Yet, while many studies acknowledge the importance of professional development, opportunities for models that result in the changes described by Desimone are rarely the norm. Many professional development
opportunities are found to be inadequate regardless of the context. Birman, Desimone, Porter, and Garet (2000) stated:

Professional development plays a key role in addressing the gap between teacher preparation and standards-based reform; it is a key focus of U.S. efforts to improve education. Much of the professional development that is offered to teachers, however, simply does not meet the challenges of the reform movement. (p. 1)

A disconnect between professional development and change in instructional practice has been observed for decades. While teachers are certainly participants in various professional development opportunities aimed at influencing pedagogy and increasing student achievement, many of the models that have been relied on have not yielded exceptional results. Feiman-Nemser, quoted in Elmore (2002) stated: “The connection between professional development, as presently practiced, and the knowledge and skill of educators is tenuous at best; its relationship to the imperative of improving instruction and student performance is, practically speaking, nonexistent” (p. 6).

As is evident in these and other studies presented herein, this tenuous connection is due, at least in part, to the way in which the majority of professional development for teachers has been conducted. For years, the most common model used for professional development in schools has been delivered through in-service workshops, either during the day or after school (Barnett, 2003; Schrum, 1999). Grant (1996) described early methods of staff development as following a specific training paradigm: short-term, standardized sessions designed to impart discrete skills and techniques. Generally, under that model, a consultant or even a member of the school faculty presents a one-shot training
opportunity on the topic of the day. Regardless of the topic, teachers rarely report meaningful change in classroom practice as a result. From a survey of 5,253 public school teachers across 50 states, Parsad, Lewis, and Farris (2001) found that:

For all but one content area of professional development, teachers typically reported that they had spent 1 to 8 hours or the equivalent of 1 day or less on the activity during the 12 months preceding the survey. In-depth study in the subject area of the main teaching assignment was the only area of professional development in which participation typically lasted more than 8 hours. (p. 4)

In that report, only 10 to 15% of the respondents nationwide received support as a follow-up to applying what was learned in the workshops. However, the same report determined that:

The likelihood of teachers reporting that they felt very well prepared to meet the overall demands of their classroom assignments was related to the extent to which professional development was linked to other program improvements and follow-up activities at the school. This relationship held for every program improvement and follow-up activity examined in the survey. For example, teachers who indicated that their professional development was linked to other program improvements at the school to a large or moderate extent were more likely to report feeling very well prepared to meet the overall demands of their classroom assignments, compared with teachers whose professional development was linked to a small extent or not at all (65% versus 56%). (Parsad, Lewis, & Farris, 2001, p. 9)

Despite the frequency of ineffective professional development, improvements in professional development models and practice have been observed. Over the last few decades, studies identifying effective professional development models that support the efficacy of sustained and targeted opportunities for growth have emerged in greater numbers. Weiss, Montgomery, Ridgway, and Bond (1998) found that the longer teachers participated in the
professional development under study the more they were likely to: (a) feel well prepared in both content and pedagogy, (b) establish an investigative culture in the classroom, and (c) use investigative instructional strategies. The frequency and duration of professional development activities is related to the degree of change in teacher behaviors.

Sparks (1997), too, found effective professional development can be observed as that which is school-focused, targeted toward the specific needs of the particular school environment, and job-embedded, happening collaboratively during the workday. Similar evidence for job-embedded, collaborative models producing measurable results is found in the seminal work on staff development. Joyce and Showers (1983; 1995; 2002) studied the transfer of new ideas and skills acquired through staff development models into classroom practice. Their results demonstrated the power of peer-to-peer support for desired implementation. The models of professional development investigated by Joyce and Showers were: providing teachers with theory and discussion only; providing theory, discussion and demonstration; providing theory, discussion, demonstration with opportunities to practice and receive feedback; and providing theory, discussion, demonstration with opportunities to practice and receive feedback with added coaching in the classroom. As shown in Table 1.1, of these four models of staff development investigated, only the model that included peer coaching had more than minor impact on classroom practice. It was also this model that demonstrated greatest growth in effectiveness across all three areas of investigation: knowledge, skill level and classroom use.
Table 1.1

<table>
<thead>
<tr>
<th>Models of Staff Development</th>
<th>Knowledge</th>
<th>Skills</th>
<th>Use in Classroom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory and Discussion w/ Demonstration in Training</td>
<td>10%</td>
<td>5%</td>
<td>0%</td>
</tr>
<tr>
<td>w/ Practice &amp; Feedback in Training</td>
<td>30%</td>
<td>20%</td>
<td>0%</td>
</tr>
<tr>
<td>w/ Coaching in Classroom</td>
<td>95%</td>
<td>95%</td>
<td>95%</td>
</tr>
</tbody>
</table>

Note. Adapted from *Student Achievement Through Staff Development*, by B. Joyce and B. Showers, 2002, Association for Staff and Curriculum Development (3rd Ed.).

Findings such as these on sustained, supported, and targeted professional development are part of the rationale for organizing collaborative opportunities, known as professional learning communities, as promoted by Learning Forward:

Staff development that has as its goal high levels of learning for all students, teachers, and administrators requires a form of professional learning that is quite different from the workshop-driven approach. The most powerful forms of staff development occur in ongoing teams that meet on a regular basis, preferably several times a week, for the purposes of learning, joint lesson planning, and problem solving. ([http://www.learningforward.org/standards/learningcommunities.cfm](http://www.learningforward.org/standards/learningcommunities.cfm))

Professional learning communities were not the focus of this study, but elements of regular collaboration, problem solving, and support for lesson planning certainly were. Two studies in particular (Parsad, Lewis, & Farris, 2001; Skoretz, 2011) indicated that when teachers collaborate with colleagues, there is a positive impact on instructional practices. Job-embedded professional development, particularly when teachers were provided time to collaborate with
one another was shown to be efficacious. The aforementioned Parsad, Lewis, and Farris (2001) National Center for Education Statistics (NCES) report found that the frequency of participation in a collaborative activity was positively related to teachers’ beliefs about the extent to which the activity improved their classroom teaching. For example, 45% of teachers who engaged in regularly scheduled collaborative activities with other teachers at least once a week believed that their participation had substantially improved their teaching, as compared with teachers who had participated only two to three times a month (23%). Belief in improved instruction declined substantially for teachers who participated in collaborative activities only once a month (15%), or a few times a year (7%).

Skoretz (2011) researched the difference in efficacy levels for technology integration for 65 elementary and middle school teachers who participated in a school-based, job-embedded professional development program. Statistically significant differences in levels of efficacy for technology integration were found between the experimental and comparison groups on three measures of efficacy: total efficacy for technology integration, computer technology capabilities and strategies, and external influences of computer technology use. In addition, Pullan and Hargreaves (1996) advocated that professional development be focused not on workshops or in-service sessions, but on opportunities for “teachers to learn from, observe, and network with each other” (p. 103).

As part of the No Child Left Behind Act, the federal government requires a percentage of all title grant funds be spent on professional development. One of the guiding principals provided in the guidelines requires that professional
development activities should be “sustained, intensive, and classroom-focused, and are not one-day or short-term workshops” (ESEA Title II Guidelines, 2006, p. 1). As studies reviewed here demonstrate, sustained classroom and content focused opportunities for professional development result in increased self-reported growth in knowledge, skills, and positive changes in practice by teachers (Garet, Porter, Desimone, Birman, & Yoon, 2001). The model researched in this study is focused on sustained, teacher-to-teacher interactions and is classroom situated.

**The Need for Effective Technology Professional Development Models**

As stated in chapter one, the instructional promise of educational technology has been a topic of research and debate for decades. Federal and state agencies, national and local education organizations, private, public, and higher education institutions have developed plans and requirements for school investment in and teacher use of instructional technologies. In 2001, Quality Education Data (QED) reported that K-12 schools were making an investment of over seven billion dollars per year. This amount has certainly grown in recent years. Yet despite this substantial investment and government and institutional monitoring there remains a concern that appropriate use and integration of technology lags behind the results envisioned. Even though available resources increased dramatically, Williams (2000) found that computer usage by students in schools did not. As for teachers, Cuban (2000) stated:

Two decades after the introduction of personal computers in the nation, with more and more schools being wired, and billions of dollars being spent, less than two of every ten teachers are serious users of computers in their classrooms (several times a week). Three to four are occasional users
(about once a month). The rest—four to five teachers of every ten teachers—never use the machines for instruction. When the type of use is examined, these powerful technologies end up being used most often for word processing and low-end applications in classrooms that maintain rather than alter existing teaching practices. After all the machines, money, and promises the results are meager. (p. 1)

While other reasons certainly exist, one barrier to technology use in the classroom is the hesitancy of the teacher to embrace technology tools due to lack of personal or instructional experience with technology. Shaw (1997) stated:

...what teachers actually need is in depth, sustained assistance as they work to integrate computer use into the curriculum and confront the tension between traditional methods of instruction and new pedagogic methods that make extensive use of technology. Such assistance should include not only purely technical support, but pedagogic support as well... (p. 49)

Wozney, Venkatesh, and Abrami (2006) supported this view in recent research. In this study, the researchers surveyed 764 elementary and secondary teachers in Quebec. They found that “expectancy of success and perceived value were the most important issues in differentiating levels of computer use among teachers” (p. 177). Further, they stated, “Teachers who believe that they have the skills to implement computers successfully and who valued the outcomes associated with integration were more likely to be at the high end of the ‘technology user’ spectrum” (p. 195). Harris and Hofer (2009), have been engaged in developing Instructional Planning Activity Types based on the TPACK framework, introduced in chapter 1, to assist teachers in curriculum planning for successful technology integration into instruction. Each activity type provides a template for teachers to use when planning lessons that combine
pedagogical steps, content focus and technology integration. Harris and Hofer state:

Each activity type captures what is most essential about the structure of a particular kind of learning action as it relates to what students do when engaged in that particular learning-related activity (e.g. "group discussion;" "role play;" "fieldtrip"). Activity types are combined to create lesson plans, projects and units. (p.101)

While attention has been focused on technology integration for learning (Bitner & Bitner, 2002; NCES, 2001; Hasselbring et al., 2000), researchers continue to find sustained training lacking in this area. In the Parsad, Lewis, and Farris survey (2001) cited above, researchers found:

Of the teachers who participated in professional development on the integration of educational technology in the grade or subject taught, 61 percent spent 1 to 8 hours, 28 percent spent 9 to 32 hours, and 11 percent spent more than 32 hours on professional development in that content area. (p. 4)

Researchers have shown that professional development can address teacher comfort levels with technology, and that raising comfort levels can result in greater technology use in the classroom (Leh, 2000; Price, Cates, & Bodzin, 2002; Schrum, 1999). Leh (2000) studied a technology integration course in which 68 in-service teacher participants reported increased comfort levels, confidence and attitude towards technology within the provided timeframe regardless of emphasis on technology integration. Connecting teacher comfort with technology and sustained opportunity to integrate its use seems to hold the most promise (Zhao & Frank, 2003). The Partnership for 21st Century Skills (2007) stated:

A 21st-century education depends on an integrative approach to curriculum – one that unites core academic subjects, interdisciplinary
themes, and essential skills – with an integrative approach to instruction in which modern pedagogies, technologies, resources, and contexts work together to prepare students for modern life. (p. 5)

Consistent with the broader research on effective professional development, that which results in change in practice through sustained and targeted focus, effective training for the integration of technology in the classroom appears to require similar structure and support. Johnson (2006), conducted a four-year study of the Adventure of the American Mind, a grant-funded train-the-trainer model graduate course, with 35 teachers from 22 schools participating. She found that the greater the number of hours spent on technology training, the greater the significance in changing classroom practice of technology use for teachers at the familiarization level of technology use occurred.

Clearly there is an increasing awareness of the need for meaningful professional development focused on technology integration. Yet, how much is available to teachers? In the fall of 2008, NCES reported that 95 percent of all public school districts offered some professional development focused on integrating technology into instruction, and 39 percent of all public school districts required teachers to participate (p. 17). In the same report, 58 percent of all teachers felt sufficiently trained to integrate technology into classroom instruction. This increased attention to integration training, if done well, may increase teacher satisfaction with technology professional development and result in greater classroom integration of technology.

From the NCES survey it would appear that over half of the respondents
are receiving training that is focused and successful in reaching the training objectives. Jacobsen and Lock (2004) suggest that investment in human support for "just-in-time" learning opportunities (provided when needed, rather than in advance) has the greatest potential for sustained technology integration. This sustained and targeted type of support for teachers differs greatly from a one-day training model, which offers insufficient opportunity to learn a new software application or online tool. Teachers need multiple opportunities to explore, use and integrate quality technology-based content resources. Beavers (2001) described the needed paradigm similarly:

> Effective integration of technology into education calls for a new vision of professional development – not one that attempts merely to add technology to an established system but one that takes a fresh look at teaching and learning in general. Professional development composed of a few days of in-service workshops every year must be replaced by ongoing programs that are tied to your school’s curriculum goals, designed with built-in evaluation, and sustained by adequate financial and staff support. (p. 43)

If technology is to improve education, teachers must be empowered to create meaningful opportunities to integrate it into teaching and learning processes. Effective professional development must be provided to facilitate such opportunities.

In addition to knowing how to use instructional technology, teachers must know what to do with such resources for and with their students. Research shows that connecting students to unique learning experiences through technology can result in greater achievement. Sivin-Kachala and Biala (2000) reviewed 311 studies that included students of all ages and across most content areas. In that review, achievement gains were found for all areas. One area of
interest, pertinent to the present research, was that students whose teachers had participated in more than 10 hours of professional development outperformed students whose teachers had participated in 5 hours or fewer. Clearly, lack of ongoing support for instructional integration is a major obstacle to implementation of new technologies in the classroom (Schrum, 1995; Honey & Henriquez, 1993). Hixon & Buckenmeyer (2009) stated: “Successful technology integration calls for more personalized professional development that focuses on teachers’ fundamental beliefs about teaching and learning” (p. 143).

Individualized attention to teachers and opportunity for them to practice using the tools in a comfortable environment are key elements for technology adoption (Schrum, 1997).

In order to provide necessary professional development and meet the ongoing need for pedagogical support evidenced in this research, some school divisions have created a position to serve in this capacity. This position is often called a technology coordinator, a technology integration specialist, or something similar. Initially, the prevalence of these positions in schools was limited. In 2000, only 16 percent of U.S. schools had a full time technology coordinator on staff (NCES, 2000). In less than a decade, however, that number tripled. By the fall of 2008, an NCES study reported that 51 percent of all school divisions had a full-time position, and 32 percent had a part-time leadership position (NCES, 2008).

In 2004, during this period of technology position growth, the Commonwealth of Virginia passed legislation to create and fund positions to serve in the capacity of integration specialist in each of its 131 school divisions.
Known as the Instructional Technology Resource Teacher (ITRT), the role of the ITRT is to train and support teachers in effective technology integration. The ITRT dedicates the majority of her time to collaboratively designing lessons with classroom teachers for technology integration, modeling strategies, supporting technology-infused classroom instruction and conducting professional development in one-on-one, small and larger group settings. As of 2013, Virginia remained the only state to acknowledge the need for such a position through legislation. This position exists independently of IT support positions, which are also legislated by the Commonwealth of Virginia. This study researched the ITRT position and resulting data in relationship to the literature presented here.

**The Need for Effective Technology Professional Development Models for Music Educators**

Music educators have a variety of technology tools at their disposal, and researchers have focused on the need for staff development to encourage and support the effective use of them. Nearly three decades ago, Peters (1984) discussed the need for music teachers to be trained to use the “high technology” available to the music classroom in 1984. Williams (1992) described the lack of technology expertise among college music faculty as a roadblock to empowering pre-service music teachers to meet the current needs of the classroom and society.

In the time since the Peters article, music technology for a variety of purposes has become quite prevalent. The Internet, multimedia resources, digital studios, hand-held devices, computer software for composition and ear training,
and a variety of Web 2.0 tools are all readily available in many music classrooms across the country and around the world. While much of the research on technology in the music classroom has been focused on specific tools or approaches to using specific software, and while pedagogical literature abounds, there is less in terms of research on staff development for technology integration in the music classroom. Bowles (2003) surveyed 456 music teachers to determine their professional development interests and found that 66 percent of the respondents reported that technology was their top priority. It is apparent from this and other studies that this area is of some concern for practitioners and researchers in the field. In 1999, NAfME (formerly MENC), the National Association for Music Education added an addendum to their Opportunity to Learn standards that addressed music technology. In that addendum it states, “It is also essential that all schools provide a minimal level of training for their staff and teachers, and make an effort to effectively incorporate the technology into the music curriculum” (p. 1). While staff development recommendations are included in these standards, there is currently little research on whether school divisions are addressing those identified needs.

As stated, and like their colleagues in other disciplines, music educators have a need for meaningful staff development for technology integration. Ho (2004) found that when instructional technology use is carefully planned, designed and integrated into music classrooms, it can support students' motivation and enhance the quality of learning, but that great variation exists in the level of integration and even teachers' perceptions of usefulness. In semi-
structured interviews, Ho found that 486 out of 543 students in Hong Kong believed that they were more motivated to learn music if music technology was employed in their music lessons. Of the 30 music teachers in the study, however, eleven teachers believed that IT was more useful than traditional music pedagogy, 9 disagreed and 10 thought it depended on the nature of the activities. The 11 music teachers who favored technology instruction thought that the new technologies held the key to improved music learning.

Music teachers desire to be supported in growing their comfort with technology use and provided with models for music technology integration. Bush (2007) found technology ranked number two in music teacher professional development topic preferences. Jassmann (2004), in a survey of music teachers in South Dakota, found that 62 percent of respondents had not had formal music technology training, yet most wanted to learn more about integrating technology into their curricula. In a presentation on this topic, Bauer (2007) stated: “To truly establish the conditions where music technology can transform the music teaching/learning process, teachers need opportunities for high quality professional development that is designed around research-based principals and targets the knowledge, skills and dispositions necessary for success” (p. 20).

Consistent with research in the broader educator population, it is clear that even when opportunities for music technology professional development are available, music teachers need sustained support to continue to integrate technology appropriately. Without such support, teachers tend to use available technology for purposes other than instruction. Reese and Rimington (2000)
surveyed 320 music teachers across multiple schools in Illinois regarding their perceived technology training needs, ways in which they and their students use technology, amount, location, and frequency of access to music technology by teachers and students, types of hardware and software in active use by teachers and students and funding sources for music technology resources. The researchers found that a majority of teachers has some level of technology training, almost all desire more, and while a majority of music teachers used technology for school related purposes, most of that use was administrative. Only one-third of the teachers and students use music or multimedia software at school or at home (Reese and Rimmington, 2000, p. 30). Bauer, Reese, and McAllister (2003) used pre- and post-workshop questionnaires with 203 music teachers to determine if 1-week technology workshops can be an effective means for the professional development of music teachers in using technology for instruction. Bauer et al. determined that such training was an effective means of increasing technology use in the music classroom. Significant growth was measured across three questions:

1) Does music technology training change teachers' knowledge of music technology?
2) Does music technology training change teachers' degree of comfort with using technology for music learning?
3) Does music technology training change the frequency with which teachers use technology for music learning? (Bauer et al., 2003, p. 4)

However, music teachers in this study demonstrated a reduction of effect within a year of the training in terms of integration. Sixty-three participants who completed a follow-up questionnaire continued to feel comfortable with technology, yet usage dropped appreciably, from $m = 69.19$ to $m = 49.63$. Based
on these results, Bauer et al. (2003) stated:

Plainly, this gradual reduction of effect could be lessened with appropriate follow-up support for teachers in their schools. They need opportunities to discuss their efforts with colleagues, strategies for technology-based learning, resources to answer technical, pedagogical, and classroom organization questions, and prompt and knowledgeable technical support. (p. 7)

This need for support was further examined in a study conducted by Moore and Griffin (2007). This three-year project, known as the Professional Development for Music Educators (PDME), was conducted initially with music supervisors and 29 K-12 music teachers during the first two years, and expanded to include 38 music teachers during the third year. The goals of this project were to:

1. Establish a professional development program that is linked to research and provides the resources and opportunities for strengthening the musical knowledge, clinical skills, and technological expertise of music specialists who serve K-12 at risk students.
2. Establish the full implementation of the State Standards and Grade Level Expectations (GLE) for Music.
3. Create and establish models for assessing student progress.
4. Create models for curriculum integration that connect artistic training to the learning process that is necessary to the development of higher cognitive skills inherent in the arts and required as well by other subjects, such as mathematics and reading. (Moore & Griffin, 2007, pp. 48 – 49)

From the results of this study, Moore and Griffin (2007) reported that:

Data showed that 93% of the teachers surveyed “agreed” or “strongly agreed” that the training in the use of technology and music literacy improved their teaching, provided strategies and tools they have used in their classroom teaching, and increased their use of technology and music literacy in the classroom. Similar results were received for the evaluation of the peer coaching implemented throughout the project. An overwhelming majority (93%) of teachers surveyed “agreed” or “strongly agreed” that the “modeling of best practices and mentoring in my peer coaching team” improved their classroom teaching skills while 96% said the “support of my peer coaching team” was helpful to them as a teacher. (p. 52)
Based on the findings of these and similar studies, there exists a clear need to continue research on models that result in changes in technology integration in the music classroom, particularly those that embed ongoing support as a critical factor. While traditional professional development opportunities continue to be offered, it is clear that new models must be tried in an attempt to fill the gap between teacher needs and professional development practice for integrating music technology. One such model that may meet these needs is the Instructional Technology Resource Teacher (ITRT) in Virginia. In this unique professional development model, currently in practice but little researched to date, teachers in the ITRT role support all content areas, including music. Unlike other professional development models that may be limited in scope or to pilot studies, the ITRT is a position mandated by state code. It is required in all school divisions across the commonwealth, offering the potential for meaningful change in practice regarding classroom technology use.

**The Need for Research on The ITRT Role**

Virginia legislation to include the ITRT as part of the Standards of Quality had been in place for six years at the time data was collected for this study, during the 2010–2011 school year. Consequently, there had been very little research on any aspect of the ITRT role up to that point in time. Of the studies that have been conducted, Streich (2007) looked at the skills ITRTs employ to meet the needs they encounter. Hooker (2006) looked at how ITRTs used their time in discharging their role, and Pixley (2008) looked at how the ITRT negotiates the social constructs in the school environment to form relationships.
with teachers. In Striech’s study, there were eight ITRTs in one school division who participated, each were new to the ITRT role. Streich found that participants shared “similar core values, skills, and background experiences regarding students, teaching and learning, but did not share similar approaches in working with teachers and colleagues” (p. 182). Through observation, interviews and ITRT log analysis, Streich found that ITRTs who used a teacher-differentiated approach to their job were more effective in establishing themselves in their assigned buildings. Hooker (2006) surveyed 983 ITRTs in 133 school divisions in Virginia. Participants reported that 42.4% of their time was spent on assisting teachers with technology integration. 18.9% of their time was spent on technical support, 8.3% was spent with content specialists on coordinating resources and services, with the remaining time spent on communicating information about instructional technology and documenting and maintaining records. Pixley (2008) used case studies of four ITRTs in five schools to research how the ITRT negotiates the social constructs in the school environment. To do so Pixley interviewed the ITRTs, reviewed journals kept by them and sent a technology questionnaire to school staff. Pixley determined that ITRTs who were “good salesmen” were most successful in embedding themselves in the school culture and best able to assist in technology integration.

To date, there has been no research on the impact of the ITRT model on instructional technology use in music education, nor on changes in music teacher classroom practice as a result of the ITRT model. This study served to analyze the impact of the instructional technology resource teacher on effective
technology integration for music learning, and provided data on the efficacy of the model as implemented in the school division where the research took place.

**Delimitations**

This study researched the efficacy of the ITRT model in changing music teacher comfort, perceptions, and classroom practice related to technology integration. It was beyond the scope of the study to look at student learning as a result of music teacher integration of technology, but such a study would be a logical extension of the present work. As the study focused on the ITRT model in only one school division, generalizability was not expected nor claimed.
CHAPTER 3: METHODOLOGY

Purpose of the Study

The purposes of this study were to determine whether music teachers perceived the ITRT model as an effective professional development model, and whether interaction with the ITRT influenced the use of technology in their classrooms. An analysis of the data collected for this study measured whether periodic interactions with the ITRT result in changes in comfort levels with technology use by the music teacher. Further, this study investigated whether the frequency or extent of the interactions with the ITRT influenced changes in music classroom practice related to technology integration.

Research Questions

The research questions that guided this study were:

1. Does technology integration training/support provided by Instructional Technology Resource Teachers (ITRTs) influence teachers' degree of comfort with using technology for music education?
2. Does contact with the ITRT influence teachers' tendency to engage in certain technology-based activities/behaviors?
3. Does the frequency of contact with the ITRT increase teachers' likelihood of integrating technology in their classrooms?
4. What elements of technology-based instruction are most and least positively affected by the ITRT training/support?
Selection of Research Design

In order to answer the research questions, data reflecting changes in technology integration for music instruction as a perceived outcome of teacher and ITRT interaction were collected using an online password protected questionnaire. This allowed authentic data to be gathered with as little disruption to classroom and school day routines as possible. The choice of data collection by questionnaire has many advantages, one of which is the assurance of confidentiality. Respondents also had reflective time for answering questions, hopefully providing thoughtful responses about the outcomes of interactions with the ITRT. Concerns of reliability are minimized with questionnaires as well. Regarding reliability of questionnaire data, Kayrooz and Trevitt (2005) wrote: “Questionnaires can be very reliable since they are not likely to elicit different responses if administered by different people” (p. 221).

Identification of Participants

A purposive sample of twenty music teachers was identified and asked to participate from among music teachers in a school division in Virginia. Fourteen participants provided consent and agreed to participate in the study. The school division is comprised of fifteen schools: nine elementary, three middle, and three high schools. Twelve ITRTs serve these fifteen schools. Outcomes of interactions between music teachers and ITRTs were the focus of the study. It was the desire of this researcher that those interactions be as authentic as possible. For that reason the content of interventions was not prescribed; rather, the content was derived from the needs of the teacher and the typical practices of the ITRT. There
was an agreed-upon expectation that music teachers and ITRTs would collaborate on integration activities such as integrated lesson plans, multimedia presentations, podcasts, and digital recording projects in the music classroom that the teacher determined as appropriate, or activities that were identified collaboratively with the ITRT to address areas of need. Interactions between the music teacher and the ITRT occurred at a minimum of three times during the school year, survey responses were separated by four to six weeks. As this frequency of interaction is not unusual during a school year, this aspect of the design was seen as an opportunity to allow for authentic data collection, as well as equal and ethical treatment of all participants. The anonymity of all participants was guaranteed.

**Environment**

When appraising environment, equality of access to the ITRT and availability of instructional technology tools were identified as areas that did not vary. Each school, and thus each music educator, had ITRT staffing at the same level of .85 FTE, or nearly one per building. Just as their colleagues outside of music did, all music teachers in the division had a common classroom technology equipment configuration known as the Instructional Technology Standard (ITS) as described in chapter 1. In addition, each music teacher had equal access within their classroom to various music applications and audio players as appropriate to their curriculum.
Data Collection Instrument Design

Data provided by each participant on perceptions of their interactions with the ITRT, and of the value of the interactions over one school year were collected using multiple administrations of a questionnaire developed by the researcher. The design was informed by the review of the literature and on selected questionnaires used in related studies such as Bauer, Reese, and McAllister (2003) that was reviewed in chapter 2. The format and use of Likert-type scales in the questionnaire used by Bauer, et. al contributed to the instrument used in this study, as did the three areas investigated. In Bauer, significant growth was measured across three questions:

1) Does music technology training change teachers' knowledge of music technology?
2) Does music technology training change teachers' degree of comfort with using technology for music learning?
3) Does music technology training change the frequency with which teachers use technology for music learning? (Bauer et al., 2003, p. 4)

The researcher's own experience with instructional technology integration and music education contributed to the development of the questionnaire as well. Attention to neutrality of response items has been given to minimize the potential for Hawthorne effect changes in teacher behavior. To gather the data, the questionnaire was structured with Likert-type or frequency scales for each response section. In section I of the survey, a six-point Likert-type attitude scale ranging from "not comfortable at all" to "extremely comfortable" was used for a question regarding teacher comfort with using technology, and a six-point Likert-type attitude scale ranging from "novice" to "expert" was used on measures related to technology expertise by the teacher. In sections II and III, a
seven-point frequency scale ranging from “once a month” to “daily” was used for teacher assessment of frequency of use by the teacher and also for student technology use in her classroom. In section IV, a six-point Likert-type attitude scale ranging from “poor” to “outstanding” was used for statements regarding teacher beliefs of level of support for integrating technology in the music classroom by various providers. Sections I through IV of the questionnaire (Appendix A) alone served as pretest, as well as sections I through IV of posttest administrations, with an additional set of questions, sections V and VI (Appendix B), that specifically addressed teacher interactions with the ITRT answered during posttest administrations. A seven-point frequency scale was chosen for posttest questions in section V, ranging from “once a month” to “daily” on statements regarding teacher interactions with the ITRT. There was also one free response question provided that allowed the music teacher to describe the lesson planned or the activity engaged in with the support of the ITRT. Section VI included a four-point Likert-type scale to measure level of agreement with statements regarding teacher behavior after interactions with the ITRT, ranging from “strongly disagree” to “strongly agree.”

Validity in research is usually defined by whether the instrument utilized actually measures what is intended to be measured, which in this case concerns the questionnaire used to gather teacher responses. The questions asked were specific to the research questions: comfort with instructional technology, interactions with the ITRT, and change in perceptions and practice as reported by music teachers. Prior to beginning the study, the questionnaire was reviewed
and approved for use by Boston University faculty. Based on data from the survey and the ability to answer the research questions, it appeared that this instrument achieved face validity.

**Data Collection**

Data collection began in the fall of 2010, and concluded at the end of the 2010-2011 school year. Data were collected through the administration of an online, password-protected, researcher-created questionnaire (Appendices A and B) that was made available to all participants four times at six-week intervals. The initial administration of the questionnaire included only sections I through IV (Appendix A) and was used to collect baseline data. This administration was given prior to any interaction with the ITRT during the fall of 2010. Interactions between participant music teachers and ITRTs began between the first and second administrations of the questionnaire. Each subsequent administration included sections I through IV combined with sections V and VI (Appendices A and B), which served to measure changes in participant responses as a result of interactions with the ITRT. The combined questionnaire was administered three times throughout the school year. Each combined questionnaire was administered approximately six weeks after each interaction with the ITRT. The response rate was 100% for each of the four survey administrations.

Survey data were analyzed using means comparison and bivariate correlations of scores at Time 1 (pre-interaction), Time 2 (after first interaction) Time 3 (after second interaction) and Time 4 (after third interaction). This
procedure demonstrated whether there was a significant difference among the four sets of scores.
CHAPTER 4: DATA AND ANALYSIS

This study examined music teachers' perceptions of the ITRT model as to its effectiveness in increasing their comfort with and use of instructional technology, and whether the frequency or extent of interactions with the ITRT influenced changes in music classroom practice related to technology integration.

Research Questions

The research questions that guided this study were:

1. Does technology integration training/support provided by Instructional Technology Resource Teachers (ITRTs) influence teachers' degree of comfort with using technology for music education?
2. Does contact with the ITRT influence teachers' tendency to engage in certain technology-based activities/behaviors?
3. Does the frequency of contact with the ITRT increase teachers' likelihood of integrating technology in their classrooms?
4. What elements of technology-based instruction are most and least positively affected by the ITRT training/support?

Demographics and Description of the Sample

Elementary and secondary music teachers from a single school district in Virginia (N = 14) participated in the study. Instructional duties of the participants represented general, choral, and instrumental music. Survey participants interacted with approximately nine of twelve ITRTs employed in the school division. This number of ITRTs is approximate, as scheduling of interactions with the ITRT occurred in a manner consistent with the daily operations of the
school division as described in chapter 3. Interactions with the ITRT were experienced in exactly the same manner by study participants as by every teacher across the school division.

**Description of the Instrument**

A researcher-created questionnaire was used across four administrations covering one school year to collect data for this study. This instrument is described in detail in chapter 3. The initial administration, Time 1, served to collect baseline data prior to interactions between music teachers and ITRTs during the 2010–2011 school year. This initial administration included questionnaire sections I – IV, and is found in Appendix A. During the initial administration, participants answered questions regarding the following elements: (1) comfort with using technology as part of professional responsibilities; (2) their level of expertise with various technology applications or tools; (3) the frequency of teacher and student use of technology in their classroom; and (4) the perceived level of technology integration support they received from the ITRT and other individuals. In addition to serving as a baseline against which to measure technology usage growth, data from this initial administration provided a picture of how frequently music teachers were using technology in their instruction, or providing opportunities for their students to do so in their learning activities prior to the study. Once interactions between teachers and ITRTs began, Sections I through IV were again administered, as were additional questions specific to those most recent teacher–ITRT interactions. These additional questions comprised questionnaire sections V and
VI (Appendix B), were included during administration Times 2, 3, and 4.

Participant responses to each section of the questionnaire are analyzed in this chapter.

**Use and Treatment of Data**

In order to analyze the data collected as described in the methodology section, it was necessary to treat categorical data as continuous. Newsom (2012) stated that “In practice, most researchers treat ordinal variables with 5 or more categories as continuous, and there is some evidence to suggest this is not likely to result in much practical impact on results” (p. 1). Similarly, Norman (2010) found that “parametric statistics can be used with Likert data, with small sample sizes, with unequal variances, and with non-normal distributions, with no fear of ‘coming to the wrong conclusion’” (p. 7).

**Questionnaire Section I – Comfort Using Technology**

Section I requested participants to rate their comfort with using technology as part of their professional responsibilities, and to rate their expertise with various technology applications or tools.

Table 4.1 displays music teacher comfort with using technology as part of professional responsibilities from each of the four administrations of the questionnaire.
Table 4.1

Music Teacher Comfort with Using Technology

<table>
<thead>
<tr>
<th></th>
<th>Time 1 Mean (SD)</th>
<th>Time 2 Mean (SD)</th>
<th>Time 3 Mean (SD)</th>
<th>Time 4 Mean (SD)</th>
<th>Growth from Time 1 to Time 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 14 Comfort with Using Technology</td>
<td>4.14 (1.23)</td>
<td>4.43 (1.09)</td>
<td>4.79 (1.37)</td>
<td>4.79 (1.89)</td>
<td>.65</td>
</tr>
</tbody>
</table>

Note. 6-point Likert-type scale: Not Comfortable at All (1), 2, 3, 4, 5, Extremely Comfortable (6).

The analysis displayed in table 4.1 provides evidence of aggregate growth on this variable, and between each of the first three administrations of the questionnaire. Mean for Time 3 and Time 4 remained constant. A majority of the participants appear to have rated themselves comfortable using technology as part of their professional responsibilities across four questionnaire administrations. However, Time 4 showed greater variability of responses than did Time 3. This seems contrary to expectation, although may be explained by participants’ specific instructional role and time of response, or introduction of new technology. This variability will be further analyzed in chapter 5.

Table 4.2 displays music teachers’ reported expertise with various technology applications or tools.
Table 4.2

Music Teacher Level of Expertise with Technology Applications or Tools

<table>
<thead>
<tr>
<th></th>
<th>Time 1 Mean (SD)</th>
<th>Time 2 Mean (SD)</th>
<th>Time 3 Mean (SD)</th>
<th>Time 4 Mean (SD)</th>
<th>Growth from Time 1 to Time 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using Software</td>
<td>3.86 (1.23)</td>
<td>3.86 (1.40)</td>
<td>4.14 (1.30)</td>
<td>4.43 (.94)</td>
<td>.57</td>
</tr>
<tr>
<td>Using ITS Tools</td>
<td>3.64 (1.28)</td>
<td>3.86 (1.03)</td>
<td>4.29 (1.14)</td>
<td>3.93 (1.33)</td>
<td>.29</td>
</tr>
<tr>
<td>Searching The Web</td>
<td>4.93 (1.0)</td>
<td>4.64 (1.08)</td>
<td>5.21 (.70)</td>
<td>5.07 (.92)</td>
<td>.14</td>
</tr>
<tr>
<td>Web 2.0 Tools</td>
<td>2.21 (1.25)</td>
<td>2.43 (1.50)</td>
<td>2.43 (1.28)</td>
<td>3.00 (1.36)</td>
<td>.79</td>
</tr>
<tr>
<td>Music Technology</td>
<td>3.64 (1.74)</td>
<td>3.36 (1.69)</td>
<td>3.86 (1.88)</td>
<td>3.93 (1.33)</td>
<td>.29</td>
</tr>
</tbody>
</table>

Note. 6-point Likert-type scale: Novice (1), 2, 3, 4, 5, Expert (6).

The analysis displayed in Table 4.2 provides evidence of aggregate growth on all variables for this question across four administrations. With the exception of Web 2.0 tools, music teacher participants rated themselves somewhat expert with all technology applications or tools measured across four administrations. On the measure of Web 2.0 tools, participants rated their expertise closer to novice. This particular measure may be an area that holds potential for future growth, and will be further explored in chapter 5. Additionally, while increasing slightly, searching the Web remained relatively unchanged. This may possibly be due to the fact that the initial mean was quite high, and was consistently rated the closest to expert of all five factors. The standard deviation for this response
was also the lowest among all the factors in this section, indicating response stability.

**Questionnaire Section II – Frequency of Technology Use**

Section II requested participants to rate the frequency with which they engaged in various technology-based activities. Their responses were collected on a 7-point frequency scale: less than once a month (1), about once a month, a few times a month, less than once a week, about once a week, a few times per week, daily (7). Table 4.3 presents means across all four administrations for section II.

<table>
<thead>
<tr>
<th></th>
<th>Time 1 Mean (SD)</th>
<th>Time 2 Mean (SD)</th>
<th>Time 3 Mean (SD)</th>
<th>Time 4 Mean (SD)</th>
<th>Growth from Time 1 to Time 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use Technology To Gather Information</td>
<td>5.21 (1.76)</td>
<td>4.57 (2.17)</td>
<td>5.21 (1.89)</td>
<td>5.36 (1.50)</td>
<td>.15</td>
</tr>
<tr>
<td>Incorporate Technology Into Instruction</td>
<td>5.71 (1.38)</td>
<td>5.43 (1.79)</td>
<td>5.21 (1.85)</td>
<td>5.07 (1.59)</td>
<td>-.64</td>
</tr>
<tr>
<td>Collaborate with ITRT</td>
<td>2.07 (1.33)</td>
<td>2.14 (1.46)</td>
<td>2.14 (1.10)</td>
<td>2.50 (1.70)</td>
<td>.43</td>
</tr>
<tr>
<td>Incorporate Technology For Student Learning</td>
<td>3.93 (1.86)</td>
<td>3.00 (2.00)</td>
<td>3.79 (2.15)</td>
<td>3.50 (1.83)</td>
<td>-.43</td>
</tr>
<tr>
<td>Design Technology</td>
<td>1.93 (1.20)</td>
<td>2.07 (1.73)</td>
<td>2.07 (1.98)</td>
<td>2.14 (1.66)</td>
<td>.21</td>
</tr>
<tr>
<td>Activities For Student Collaboration</td>
<td>1.79 (1.67)</td>
<td>2.07 (1.82)</td>
<td>2.29 (2.05)</td>
<td>2.14 (1.75)</td>
<td>.35</td>
</tr>
<tr>
<td>Design Technology</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activities For Student Discussion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Table 4.3: Music Teacher Responses to the Question: How Often Do You Do the Following?*
<table>
<thead>
<tr>
<th>Activity</th>
<th>Mean 1</th>
<th>Mean 2</th>
<th>Mean 3</th>
<th>Mean 4</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use Technology Activities For Student Data Collection</td>
<td>2.00</td>
<td>2.07</td>
<td>2.29</td>
<td>2.14</td>
<td>.14</td>
</tr>
<tr>
<td>Provide Student Opportunities To Create</td>
<td>2.14</td>
<td>1.79</td>
<td>1.86</td>
<td>2.00</td>
<td>-.14</td>
</tr>
<tr>
<td>Use Technology To Communicate With Colleagues</td>
<td>6.21</td>
<td>6.43</td>
<td>6.50</td>
<td>6.36</td>
<td>.15</td>
</tr>
<tr>
<td>Use Technology To Communicate With Students</td>
<td>3.79</td>
<td>3.64</td>
<td>4.00</td>
<td>4.14</td>
<td>.35</td>
</tr>
<tr>
<td>Use Technology To Communicate With Parents</td>
<td>4.64</td>
<td>4.64</td>
<td>4.71</td>
<td>4.79</td>
<td>.15</td>
</tr>
<tr>
<td>Use Technology To Collaborate On Student Learning</td>
<td>5.29</td>
<td>4.86</td>
<td>4.36</td>
<td>5.07</td>
<td>-.22</td>
</tr>
<tr>
<td>Collect and Analyze Student Data</td>
<td>3.36</td>
<td>3.29</td>
<td>3.00</td>
<td>3.71</td>
<td>.35</td>
</tr>
<tr>
<td>Use Technology To Post Homework</td>
<td>4.07</td>
<td>3.86</td>
<td>3.50</td>
<td>4.36</td>
<td>.29</td>
</tr>
</tbody>
</table>

*Note. 7-point scale: Less than once a month (1), About once a month, A few times a month, Less than once a week, About once a week, A few times per week, Daily (7).*

Initial analysis of data indicates modest aggregate growth for most variables; however, while these data provide some evidence of increased frequency of music teacher use of various technologies for learning, the standard deviation for most variables is relatively high. Because high standard deviation indicates that scores are widely spread, Pearson product-moment correlations were employed to better understand the findings. Pearson correlations provided further support in determining the strength of the relationship between two variables. Results from these correlations are displayed and discussed later in
this chapter. In addition, responses to four of the questions in this section demonstrated negative growth. For two of these—“how often do you incorporate technology into instruction,” and “how often do you use technology to collaborate with colleagues and staff on student learning issues”—mean scores remained consistently high, about once per week on average. This second question is identified as an element of technology-based instruction least positively affected by ITRT training/support later in this chapter. Responses to two additional questions—“how often do you incorporate technology into students learning activities when planning lessons,” and “how often do you provide student opportunities to create and share presentations using technology”—remained consistently low, at a few times per month, and about once per month respectively. This might indicate some slight variation due to the particular curricular focus at the time of the response, but more importantly may indicate areas not influenced by ITRT training/support during the period researched. This will be further explored in chapter 5.

**Questionnaire Section III – Frequency of Student Technology Use**

Section III required participants to rate the frequency with which they provided technology-based activities for their students, either in or out of class. Their responses were collected on the following 7-point frequency scale: less than once a month (1), about once a month, a few times a month, less than once a week, about once a week, a few times per week, daily (7). Table 4.4 displays means across all four surveys for section III.
Table 4.4

Music Teacher Responses to the Question: How Often Do Your Students Use the Following for In- or Out-of-Class Assignments?

<table>
<thead>
<tr>
<th></th>
<th>Time 1 Mean (SD)</th>
<th>Time 2 Mean (SD)</th>
<th>Time 3 Mean (SD)</th>
<th>Time 4 Mean (SD)</th>
<th>Growth from Time 1 to Time 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Applications For Assignments</td>
<td>3.43 (2.65)</td>
<td>3.21 (2.69)</td>
<td>3.79 (2.58)</td>
<td>3.43 (2.24)</td>
<td>0.00</td>
</tr>
<tr>
<td>Music Technology</td>
<td>2.29 (2.02)</td>
<td>2.64 (2.06)</td>
<td>3.21 (2.36)</td>
<td>3.00 (2.08)</td>
<td>0.71</td>
</tr>
<tr>
<td>Computer Applications To Analyze Data</td>
<td>2.57 (2.17)</td>
<td>3.43 (2.59)</td>
<td>3.07 (2.46)</td>
<td>2.64 (1.98)</td>
<td>0.07</td>
</tr>
<tr>
<td>Computer or Web for Presentations</td>
<td>2.00 (1.84)</td>
<td>2.79 (2.15)</td>
<td>3.00 (2.39)</td>
<td>2.43 (2.03)</td>
<td>0.43</td>
</tr>
<tr>
<td>Internet for Research</td>
<td>2.86 (2.25)</td>
<td>2.93 (2.16)</td>
<td>3.57 (2.50)</td>
<td>3.93 (2.27)</td>
<td>1.07</td>
</tr>
<tr>
<td>Music Software To Learn New Skills</td>
<td>3.07 (2.02)</td>
<td>2.57 (1.70)</td>
<td>3.14 (2.35)</td>
<td>3.36 (2.21)</td>
<td>0.29</td>
</tr>
<tr>
<td>Software or Web to Study</td>
<td>2.21 (1.76)</td>
<td>2.21 (1.37)</td>
<td>2.57 (1.70)</td>
<td>2.57 (1.79)</td>
<td>0.36</td>
</tr>
<tr>
<td>Technology Tools - ITS</td>
<td>3.50 (2.28)</td>
<td>3.00 (2.15)</td>
<td>2.71 (2.13)</td>
<td>3.93 (2.27)</td>
<td>0.43</td>
</tr>
<tr>
<td>Asynchronous Tools</td>
<td>1.14 (.53)</td>
<td>1.64 (1.15)</td>
<td>1.14 (.36)</td>
<td>1.36 (1.08)</td>
<td>0.22</td>
</tr>
<tr>
<td>Web-based Resources for Collaboration</td>
<td>2.14 (1.70)</td>
<td>1.79 (1.31)</td>
<td>1.71 (1.38)</td>
<td>1.64 (1.45)</td>
<td>-.50</td>
</tr>
<tr>
<td>Web-based Resources to Correspond with Experts</td>
<td>2.43 (2.24)</td>
<td>2.36 (1.95)</td>
<td>2.00 (1.71)</td>
<td>2.57 (2.10)</td>
<td>.14</td>
</tr>
</tbody>
</table>

Note. 7-point scale: less than once a month (1), about once a month, a few times a month, less than once a week, about once a week, a few times per week, daily (7).
As in section II, initial analysis of aggregate mean data collected for most of these variables indicated modest increases. Additionally, these data provided some evidence of growing student use of various technologies for learning in the music classroom that are considered essential in a twenty-first century learning environment in the fields of education and music education (Fadel & Lemke, 2003; Ho, 2004). There is fairly high variability of responses for these measures, as indicated by their standard deviation measurements. Chapter 5 will provide an opportunity to explore potential reasons for this variability. Additionally, reported means from one area decreased. For the question “how often do your students use Web-based resources to collaborate on assignments,” the reported mean began as about once per month and decreased to less than once per month by the end of the study. This is specifically identified later in this chapter as one of five elements of technology-based instruction least positively affected by ITRT training/support.

While frequency growth was reported across most areas surveyed in both Section II (teacher use of technology) and Section III (student use of technology), it is apparent from the data displayed that music teachers in this study used technology with somewhat more frequency than their students did on the factors measured. This is in keeping with the findings in recent scholarship on the subject (Dorfman, 2008). Increasing frequency of technology use for both teachers and students would support the value of the ITRT professional development model, as the ultimate goal for the ITRT role is increased technology integration.
and use for both groups in this context. This will be further considered in Chapter 5.

**Questionnaire Section IV – Level of Support**

Section IV asked music teacher participants to rate the level of support they received from various members of the school community or outside professional development providers on a 6-point Likert-type scale ranging from poor (1) to outstanding (6). Table 4.5 presents mean score ratings for five identified sources with the potential to offer support for technology integration.

**Table 4.5**

Responses to: Please Rate the Level of Support that You Have Received for Incorporating Technology into Teaching and Learning Activities from the Following

<table>
<thead>
<tr>
<th>Source</th>
<th>Time 1 Mean (SD)</th>
<th>Time 2 Mean (SD)</th>
<th>Time 3 Mean (SD)</th>
<th>Time 4 Mean (SD)</th>
<th>Growth from Time 1 to Time 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>The ITRT</td>
<td>4.07 (1.14)</td>
<td>4.21 (1.47)</td>
<td>4.57 (1.09)</td>
<td>4.29 (1.64)</td>
<td>.22</td>
</tr>
<tr>
<td>Other Teachers at School</td>
<td>3.43 (1.74)</td>
<td>3.64 (1.78)</td>
<td>3.79 (1.05)</td>
<td>4.00 (1.36)</td>
<td>.57</td>
</tr>
<tr>
<td>The Principal</td>
<td>3.14 (1.61)</td>
<td>3.64 (1.95)</td>
<td>3.43 (1.45)</td>
<td>3.79 (1.85)</td>
<td>.65</td>
</tr>
<tr>
<td>Students</td>
<td>3.43 (1.22)</td>
<td>3.64 (1.78)</td>
<td>3.79 (1.63)</td>
<td>4.00 (1.47)</td>
<td>.57</td>
</tr>
<tr>
<td>Other Professional Developers</td>
<td>3.43 (1.45)</td>
<td>3.36 (1.82)</td>
<td>3.79 (1.25)</td>
<td>4.00 (1.41)</td>
<td>.57</td>
</tr>
</tbody>
</table>

Note. 6-point Likert-type scale: Poor (1), 2,3,4,5, Outstanding (6).

Music teachers participating in this study rated the support they received from the ITRT for incorporating technology into teaching and learning to be
greater than from other sources of support in each of the administrations of the questionnaire. While the ITRT support rating response demonstrated little growth across each administration, it was consistently the highest mean reported across the five sources of support.

A brief appraisal of Time 1 data, representing pre-ITRT interactions for the purposes of this study, yielded the following baseline data:

- 64% of participants reported that they felt comfortable or extremely comfortable (by selecting 4, 5, or 6 as their response) using technology as part of their professional responsibilities at the beginning of this study. The mean response for this question was 4.14 as reported on a 6-point Likert-type scale.

- Prior to surveyed interactions with the ITRT, a majority of participants (57% -79%) expressed a level of expertise with using technology applications and tools across most of the specific areas surveyed. Specific analysis will follow, however means for these areas ranged from 3.64 to 4.9 as reported on a 6-point Likert-type scale. This may reflect a school culture of expected instructional technology use, and will be further examined in chapter 5.

- The single area researched in which participants expressed an initial lack of expertise with technology applications or tools was with Web 2.0 tools, expressed as podcasting or blogging. For this area there was a reported mean of 2.21 on a 6-point Likert-type scale.
Data from Time 1 will be further reviewed during this chapter, and explored in Chapter 5.

**ITRT Interaction Data**

The four sections presented above served, in questionnaire administration Time 1, to collect pre-study technology comfort and usage baseline data. Administration Times 2, 3, and 4 collected data across the same four categories as Time 1, providing for comparative data with responses collected after current interactions with the ITRT. Additional data were collected during administrations of Time 2, 3, and 4 by the inclusion of two ongoing ITRT interaction sections: section V and section VI. It is likely that many or all participants may have, at some point, contacted the ITRT prior to Time 1 data collection. However, to ensure that each participant was responding to questions in Sections V and VI specific only to their most recent interactions with the ITRT, no Time 1 data was collected for these two sections.

**Questionnaire Section V – Frequency of Contact and Planning**

Section V required participants to rate the frequency with which they contacted the ITRT, and the frequency with which they planned lessons with the ITRT. Additionally, a free response item was provided in this section to allow study participants to provide specific details of lessons planned collaboratively during their most recent interactions with the ITRT. These free response items were provided in order to collect corroborating data for reported areas of growth, as well as to provide additional information regarding instructional technology use by teacher and student. Answers to free response items are
displayed later in this chapter.

To collect data for the questions, “how often do you contact the ITRT,” and “how often do you plan lessons with the ITRT,” a 7-point frequency scale was used: less than once a month (1), about once a month, a few times a month, less than once a week, about once a week, a few times per week, daily (7). Table 4.6 presents means for frequency of contacting the ITRT, and for planning lessons with the ITRT.

Table 4.6

<table>
<thead>
<tr>
<th></th>
<th>Time 2 Mean (SD)</th>
<th>Time 3 Mean (SD)</th>
<th>Time 4 Mean (SD)</th>
<th>Growth from Time 1 to Time 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact</td>
<td>3.00 (1.84)</td>
<td>3.14 (1.99)</td>
<td>3.00 (2.22)</td>
<td>0.00</td>
</tr>
<tr>
<td>Plan Lessons</td>
<td>1.64 (1.15)</td>
<td>1.36 (.74)</td>
<td>2.00 (1.75)</td>
<td>.36</td>
</tr>
</tbody>
</table>

Note. 7-point scale: Less than once a month (1), About once a month, A few times a month, Less than once a week, About once a week, A few times per week, Daily (7).

During the course of the study participants contacted the ITRT a few times per month. Also during the course of the study the frequency with which music teachers planned lessons with the ITRT grew from less than once per month to about once per month by the time questionnaire Time 4 was administered. There is variability in standard deviation that might be explained by the instructional assignment and time of year, such as band directors rehearsing marching routines in the fall, or choral directors preparing for concerts. This will be investigated more fully in chapter 5.
Questionnaire Section VI - Level of Agreement

Section VI asked participants to rate their level of agreement with a number of statements specific to technology integration, technology usage, and confidence with technology use after their most recent interactions with the ITRT. To collect response data on these items, the following 4-point Likert-type scale was used: strongly disagree (1), disagree, agree, strongly agree (4). Means and mean growth data from administration Time 2, 3, and 4 are displayed in Table 4.7.

Table 4.7

Music Teacher Level of Agreement after Most Recent ITRT Interaction

<table>
<thead>
<tr>
<th>Statement</th>
<th>Time 2 Mean (SD)</th>
<th>Time 3 Mean (SD)</th>
<th>Time 4 Mean (SD)</th>
<th>Growth from Time 2 to Time 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have a better understanding of how to integrate technology than I did before working with the ITRT</td>
<td>3.21 (.58)</td>
<td>3.14 (.53)</td>
<td>3.29 (.73)</td>
<td>.08</td>
</tr>
<tr>
<td>I am more likely to integrate technology in my classroom than I was before working with the ITRT</td>
<td>3.21 (.70)</td>
<td>3.00 (.68)</td>
<td>3.14 (.77)</td>
<td>-.07</td>
</tr>
<tr>
<td>The more I work with the ITRT, the more likely I am to integrate technology in my classroom</td>
<td>3.14 (.77)</td>
<td>3.07 (.62)</td>
<td>3.14 (.77)</td>
<td>0.00</td>
</tr>
<tr>
<td>I use technology more frequently in the music classroom than I did before working with the ITRT</td>
<td>3.07 (1.00)</td>
<td>3.14 (.58)</td>
<td>3.07 (.95)</td>
<td>.07</td>
</tr>
<tr>
<td>The knowledge and skills of the ITRT are a major factor in the likelihood of my use of technology in my classroom</td>
<td>3.00 (.78)</td>
<td>3.00 (.68)</td>
<td>3.14 (.77)</td>
<td>.14</td>
</tr>
<tr>
<td>After working with the ITRT, I want to learn more about using technology for teaching and learning</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
After working with the ITRT, I feel more confident in my ability to use technology for teaching and learning.

<table>
<thead>
<tr>
<th></th>
<th>3.07</th>
<th>3.21</th>
<th>3.21</th>
<th>.14</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(.73)</td>
<td>(.58)</td>
<td>(.70)</td>
<td></td>
</tr>
</tbody>
</table>

Note. 4-point Likert-type scale: Strongly Disagree (1), Disagree (2), Agree (3), Strongly Agree (4).

As displayed in table 4.7, while slight variations by administration exist, survey participants consistently agreed with each of the statements in section VI across each of three administrations (Time 2, Time 3, and Time 4).

Across the majority of data collected in this study, results suggesting growth were evident. In order to address factors that may have influenced growth across areas where a consistent pattern of increasing means was evidenced, correlations between various sets of survey data were conducted across multiple areas of response, and will be presented in the context of addressing the research questions.

Responses to the Research Questions

To address the first research question, “does technology integration training/support provided by Instructional Technology Resource Teachers (ITRTs) influence teachers’ degree of comfort with using technology for music education,” means and Pearson product-moment correlations (r) were employed to measure the extent of relationships between several of the questionnaire items as they related to comfort. As shown in Table 4.1, mean growth of music participants’ comfort using technology as part of professional responsibilities grew slightly over the course of the data collection period. Participants reported increased comfort across interaction questionnaire administrations at Times 2, 3, and 4. Music teachers in this study also reported that they felt more confident in
their ability to use technology after working with the ITRT (Table 4.8).

To further address the first research question, a Pearson product-moment correlation \( r \) was used with constructed variables for music teacher comfort using technology and influence of ITRT training/support. These variables were constructed from questionnaire items as displayed below. Pearson product-moment correlations linearly demonstrate the strength of a relationship between two variables. The correlation coefficient is a number that represents in what direction (positive or negative) and to what degree (how closely) the variables relate. For this research question, a Pearson correlation was used to measure the extent to which ITRT interactions were correlated with the participants' comfort using technology. In order to create an overall music teacher comfort with technology use variable, means from the following questionnaire items were input into SPSS:

- How comfortable do you feel using technology as part of your professional responsibilities?
- After working with the ITRT, I feel more confident in my ability to use technology for teaching and learning

That variable was then correlated with an ITRT training/support influence variable constructed by inputting means from the following questionnaire items into SPSS:

- I have a better understanding of how to integrate technology than I did before working with the ITRT
• I am more likely to integrate technology in my classroom than I was before working with the ITRT

• The more I work with the ITRT, the more likely I am to integrate technology in my classroom

• I use technology more frequently in the music classroom than I did before working with the ITRT

The relationship between these two constructed variables—perceived comfort using technology and perceived influence of the ITRT—was investigated using a Pearson product-moment correlation. There was a medium, positive correlation between the two variables ($r(12) = .58, p < .05$), with increasing levels of comfort with using technology for music education associated with ITRT training/support influence. This relationship was statistically significant. Based on this significant correlation, the growth in music teacher comfort with using technology was positively correlated to training/support they received from the ITRT at a level beyond chance.

In order to address the second research question, “does contact with the ITRT influence teachers’ tendency to engage in certain technology-based activities/behaviors,” participant level of agreement responses to the statement, “I am more likely to integrate technology in my classroom than I was before working with the ITRT,” were reviewed. A 4-point Likert-type scale was used: strongly disagree (1), disagree, agree, strongly agree (4). Distribution of participant agreement responses per questionnaire administrations, as well as mean and standard deviation data are displayed in Table 4.8.
Table 4.8

Responses to: I am More Likely to Integrate Technology in My Classroom than I Was Before Working with the ITRT

<table>
<thead>
<tr>
<th>Time</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>0.0% (0)</td>
<td>14.3% (2)</td>
<td>50.0% (7)</td>
<td>35.7% (5)</td>
<td>3.21 (.70)</td>
</tr>
<tr>
<td>3</td>
<td>0.0% (0)</td>
<td>21.4% (3)</td>
<td>57.1% (8)</td>
<td>21.4% (3)</td>
<td>3.00 (.68)</td>
</tr>
<tr>
<td>4</td>
<td>0.0% (0)</td>
<td>21.4% (3)</td>
<td>42.9% (6)</td>
<td>35.7% (5)</td>
<td>3.14 (.77)</td>
</tr>
</tbody>
</table>

Note. 4-point Likert-type scale: Strongly Disagree (1), Disagree (2), Agree (3), Strongly Agree (4).

A majority of participants agreed or strongly agreed with this statement. In addition, a Pearson product-moment correlation coefficient ($r$) was computed to assess the relationship between a constructed variable measuring music teachers’ tendency to engage in technology-based activities, and a constructed variable measuring the influence of contact with the ITRT variable (formulated as ITRT Training). The overall music teacher technology-based activities variable was created using means data from the following questionnaire items:

- Use technology to gather information for my lessons (e.g., search the Web, databases)
- Incorporate technology into my instruction
- Work collaboratively with the ITRT in planning and reviewing lessons that involve the use of technology
- Incorporate technology into my students' learning activities when planning lessons
- Design activities that require students to use technology to collaborate with peers and/or outside experts on assignments
- Design student activities that use technology for discussing ideas and reflecting on learning experiences
- Design student activities that use technology for collecting, manipulating, and analyzing data (i.e., spreadsheets, databases)
- Provide student opportunities to create and share presentations using technology
- Use technology to communicate with colleagues and staff for administrative purposes
- Use technology to communicate with students
- Use technology to communicate with parents
- Use technology to collaborate with colleagues and staff on student learning issues
- Collect and analyze student data using technology
- Use technology to post homework and other class information for student or parent access (Edline)

The overall ITRT influence variable was created using means data from the following questionnaire items:
The relationship between teacher-perceived tendency to engage in technology-based activities and perceived influence of the ITRT was investigated using a Pearson product-moment correlation. There was a medium, positive correlation between the two variables \( r(12) = .56, p < .05 \), with increasing levels of music teachers' tendency to engage in technology-based activities associated with ITRT training/support. The correlation was used to examine the extent of ITRT interactions on frequency of the participants' tendencies to engage in technology-based activities. The correlation was statistically significant. As evidenced by this significant relationship, music teacher tendency to engage in technology-based activities were positively correlated to ITRT training influence.

In order to answer the third research question, "does the frequency of
contact with the ITRT increase teachers' likelihood of integrating technology in their classrooms,” participant level of agreement with the statement, “I am more likely to integrate technology in my classroom than I was before working with the ITRT,” data were again used. As displayed in Table 4.8, a majority of participants agreed or strongly agreed with this statement. In addition, participant level of agreement responses with the statement, “The more I work with the ITRT, the more likely I am to integrate technology in my classroom,” were reviewed. Distribution of participant responses per questionnaire administrations, as well as mean and standard deviation are displayed in Table 4.9.

Table 4.9

<table>
<thead>
<tr>
<th>Time</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.0%</td>
<td>21.4% (3)</td>
<td>42.9% (6)</td>
<td>35.7% (5)</td>
<td>3.14 (.77)</td>
</tr>
<tr>
<td>Time 3</td>
<td>0.0%</td>
<td>14.3% (2)</td>
<td>64.3% (9)</td>
<td>21.4% (3)</td>
<td>3.07 (.62)</td>
</tr>
<tr>
<td>Time 4</td>
<td>0.0%</td>
<td>21.4% (3)</td>
<td>42.9% (6)</td>
<td>35.7% (5)</td>
<td>3.14 (.77)</td>
</tr>
</tbody>
</table>

Note. 4-point Likert-type scale: Strongly Disagree (1), Disagree (2), Agree (3), Strongly Agree (4).

It appears evident from response means and the distribution of responses that a majority of participants agreed or strongly agreed that frequency of interactions with the ITRT increased their likelihood of integrating technology in their classrooms.
In order to answer the fourth research question, "what elements of technology-based instruction are most and least positively affected by the ITRT training/support," technology-based instruction was considered to be technology activities engaged in by teachers and students. A comparison of means growth and accompanying correlation strength was conducted across music teacher technology-based activities and teacher-provided technology-based activities for students. To begin addressing the first part of the research question, "what elements are most positively affected by ITRT training/support," Table 4.10 displays mean data, growth data, as well as correlation data for all activities that demonstrated growth between constructed teacher and student technology-based activity data and the constructed ITRT training influence variable:

- I have a better understanding of how to integrate technology than I did before working with the ITRT
- I am more likely to integrate technology in my classroom than I was before working with the ITRT
- The more I work with the ITRT, the more likely I am to integrate technology in my classroom
- I use technology more frequently in the music classroom than I did before working with the ITRT
- The knowledge and skills of the ITRT are a major factor in the likelihood of my use of technology in my classroom
- After working with the ITRT, I feel more confident in my ability to use technology for teaching and learning

Table 4.10

Mean Growth Across Technology-based Activities and Pearson Product-moment Correlations with ITRT Training Influence

<table>
<thead>
<tr>
<th></th>
<th>Mean Growth</th>
<th>Correlation Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Time 1</td>
<td>Time 2</td>
</tr>
<tr>
<td></td>
<td>(SD)</td>
<td>(SD)</td>
</tr>
<tr>
<td>N = 14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students Use the</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internet for Research</td>
<td>2.86 (2.25)</td>
<td>2.93 (2.16)</td>
</tr>
<tr>
<td>Students Use Music</td>
<td>2.29 (2.02)</td>
<td>2.54 (2.06)</td>
</tr>
<tr>
<td>Technology for</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Composing and Creating</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students Use the ITS to</td>
<td>3.50 (2.28)</td>
<td>3.00 (2.15)</td>
</tr>
<tr>
<td>Aid in Learning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students Use Computer</td>
<td>2.00 (1.84)</td>
<td>2.79 (2.15)</td>
</tr>
<tr>
<td>or Web-based Applications for Presentations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher Works</td>
<td>2.07 (1.02)</td>
<td>2.14 (1.46)</td>
</tr>
<tr>
<td>Collaboratively with the</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ITRT to Plan Technology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lesson</td>
<td>1.79 (1.67)</td>
<td>2.07 (1.81)</td>
</tr>
<tr>
<td>Teacher Designs Student</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activities using</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technology for</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discussion</td>
<td>2.21 (1.76)</td>
<td>2.21 (1.37)</td>
</tr>
<tr>
<td>Students Use Software</td>
<td>3.36 (1.95)</td>
<td>3.29 (2.01)</td>
</tr>
<tr>
<td>or Websites to Study</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher Collects and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analyzes Student Data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using Technology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activity</td>
<td>Mean</td>
<td>Standard Deviation</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>--------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Teacher Uses Technology to Communicate with Students</td>
<td>3.79</td>
<td>(2.12)</td>
</tr>
<tr>
<td></td>
<td>3.64</td>
<td>(2.56)</td>
</tr>
<tr>
<td></td>
<td>4.00</td>
<td>(2.45)</td>
</tr>
<tr>
<td></td>
<td>4.14</td>
<td>(1.99)</td>
</tr>
<tr>
<td></td>
<td>.36</td>
<td></td>
</tr>
<tr>
<td>Students Use Music Software to Learn or Practice</td>
<td>3.07</td>
<td>(2.02)</td>
</tr>
<tr>
<td></td>
<td>2.57</td>
<td>(1.70)</td>
</tr>
<tr>
<td></td>
<td>3.14</td>
<td>(2.35)</td>
</tr>
<tr>
<td></td>
<td>3.36</td>
<td>(2.20)</td>
</tr>
<tr>
<td></td>
<td>.29</td>
<td></td>
</tr>
<tr>
<td>Teacher Uses Technology to post Class Information</td>
<td>4.07</td>
<td>(1.98)</td>
</tr>
<tr>
<td></td>
<td>3.86</td>
<td>(2.28)</td>
</tr>
<tr>
<td></td>
<td>3.50</td>
<td>(2.44)</td>
</tr>
<tr>
<td></td>
<td>4.36</td>
<td>(2.10)</td>
</tr>
<tr>
<td></td>
<td>.29</td>
<td></td>
</tr>
<tr>
<td>Teacher Designs Technology Activities for Students to Collaborate</td>
<td>1.93</td>
<td>(1.20)</td>
</tr>
<tr>
<td></td>
<td>2.07</td>
<td>(1.73)</td>
</tr>
<tr>
<td></td>
<td>2.07</td>
<td>(1.98)</td>
</tr>
<tr>
<td></td>
<td>2.14</td>
<td>(1.66)</td>
</tr>
<tr>
<td></td>
<td>.21</td>
<td></td>
</tr>
<tr>
<td>Students Use Asynchronous Tools</td>
<td>1.14</td>
<td>(.53)</td>
</tr>
<tr>
<td></td>
<td>1.64</td>
<td>(1.15)</td>
</tr>
<tr>
<td></td>
<td>1.14</td>
<td>(.36)</td>
</tr>
<tr>
<td></td>
<td>1.36</td>
<td>(1.08)</td>
</tr>
<tr>
<td></td>
<td>.21</td>
<td></td>
</tr>
<tr>
<td>Students Use Web-based Resources to Correspond</td>
<td>2.43</td>
<td>(2.24)</td>
</tr>
<tr>
<td></td>
<td>2.36</td>
<td>(1.95)</td>
</tr>
<tr>
<td></td>
<td>2.00</td>
<td>(1.70)</td>
</tr>
<tr>
<td></td>
<td>2.57</td>
<td>(2.10)</td>
</tr>
<tr>
<td></td>
<td>.14</td>
<td></td>
</tr>
<tr>
<td>Teacher Uses Technology to Communicate with Colleagues</td>
<td>6.21</td>
<td>(1.12)</td>
</tr>
<tr>
<td></td>
<td>6.43</td>
<td>(.94)</td>
</tr>
<tr>
<td></td>
<td>6.50</td>
<td>(.94)</td>
</tr>
<tr>
<td></td>
<td>6.36</td>
<td>(1.15)</td>
</tr>
<tr>
<td></td>
<td>.14</td>
<td></td>
</tr>
<tr>
<td>Teacher Designs Student Activities that Use Technology for Analysis</td>
<td>2.00</td>
<td>(1.75)</td>
</tr>
<tr>
<td></td>
<td>2.07</td>
<td>(1.64)</td>
</tr>
<tr>
<td></td>
<td>2.29</td>
<td>(2.20)</td>
</tr>
<tr>
<td></td>
<td>2.14</td>
<td>(1.56)</td>
</tr>
<tr>
<td></td>
<td>.14</td>
<td></td>
</tr>
<tr>
<td>Teacher Uses Technology to Gather Information for Lesson</td>
<td>2.57</td>
<td>(2.17)</td>
</tr>
<tr>
<td></td>
<td>3.43</td>
<td>(2.59)</td>
</tr>
<tr>
<td></td>
<td>3.07</td>
<td>(2.46)</td>
</tr>
<tr>
<td></td>
<td>2.64</td>
<td>(1.85)</td>
</tr>
<tr>
<td></td>
<td>.14</td>
<td></td>
</tr>
<tr>
<td>Teacher Uses Technology to Communicate with Parents</td>
<td>4.64</td>
<td>(1.95)</td>
</tr>
<tr>
<td></td>
<td>4.64</td>
<td>(2.17)</td>
</tr>
<tr>
<td></td>
<td>4.71</td>
<td>(2.16)</td>
</tr>
<tr>
<td></td>
<td>4.79</td>
<td>(1.85)</td>
</tr>
<tr>
<td></td>
<td>.14</td>
<td></td>
</tr>
<tr>
<td>Students Use Computer Applications to Analyze Data</td>
<td>2.57</td>
<td>(2.17)</td>
</tr>
<tr>
<td></td>
<td>3.43</td>
<td>(2.59)</td>
</tr>
<tr>
<td></td>
<td>3.07</td>
<td>(2.46)</td>
</tr>
<tr>
<td></td>
<td>2.64</td>
<td>(1.98)</td>
</tr>
<tr>
<td></td>
<td>.07</td>
<td></td>
</tr>
</tbody>
</table>

Note. 7-point scale: Less than once a month (1), About once a month, A few times a month, Less than once a week, About once a week, A few times per week, Daily (7).

*Correlation is significant at the 0.05 level (2-tailed).
In order to identify those variables most positively affected from the data as displayed, the following criteria were employed:

- Correlation strength: .45 or over
- Significance: \( p < .05 \)
- Growth: .14 or over
- Standard Deviation: \( \sim 2.00 \) or under, evaluated after other factors

Values for these criteria were arrived at as follows:

**Correlation Strength**

Cohen (1988) provides the following values for determining the strength of a correlation relationship: small – \( r = .10 \) to .29, medium – \( r = .30 \) to .49, and large – \( r = .50 \) to 1.0. A value of .45 was identified by the researcher as a minimum value to identify medium to strong relationships within the data results.

**Statistical Significance**

For the purposes of the criteria utilized for this research question, a significance level of \( p < .05 \), standard in the social sciences, was chosen.

**Mean Growth**

The minimum positive mean growth criterion was set at .14, as it represented the mode for growth data.

**Standard Deviation**

Standard deviation (SD) represents how much variation individual datum exhibit from the mean. In normally distributed data, 68\% of the values are considered to be within one (1.0) standard deviation of the mean; 34.1\% of the will fall above and 34.1\% will fall below the mean. Ninety-five percent of the
values will fall within two (2.0) standard deviations of the mean. As a majority of response variables had fairly high (between 1 and 3) standard deviations, 2.0 SD was selected as the criterion threshold; however, it was necessary to make a determination in context with the other criteria, identifying factors of most affected (by ITRT training/support) by allowing, in two cases, slightly higher incidences of standard deviation as long as the factor met each of the other three criteria. Based on the selected combination of factors, Table 4.11 displays elements of technology-based instruction most positively affected by the ITRT training/support organized by correlation strength.

Table 4.11

Elements of Technology-based Instruction Most Positively Affected by ITRT Training

<table>
<thead>
<tr>
<th>N = 14</th>
<th>Mean</th>
<th>Growth</th>
<th>Correlation Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Time 1 (SD)</td>
<td>Time 2 (SD)</td>
<td>Time 3 (SD)</td>
</tr>
<tr>
<td>Teacher Works Collaboratively with the ITRT to Plan Technology Lesson</td>
<td>2.07 (1.02)</td>
<td>2.14 (1.46)</td>
<td>2.14 (1.09)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student Use of Computer or Web-based Resources to Correspond</td>
<td>2.43 (2.24)</td>
<td>2.36 (1.95)</td>
<td>2.00 (1.70)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher Designs Student Activities To Discuss Ideas and Reflect on</td>
<td>1.79 (1.67)</td>
<td>2.07 (1.81)</td>
<td>2.29 (2.05)</td>
</tr>
<tr>
<td>Learning Experiences</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. 7-point scale: Less than once a month (1), About once a month, A few times a month, Less than once a week, About once a week, A few times per week, Daily (7). *Correlation is significant at the 0.05 level (2-tailed).
From the data displayed, it is positively and strongly correlated but perhaps unsurprising that music teachers increased the frequency of planning lessons that incorporate technology with the ITRT. It is also important to note that while a majority of the three elements presented show significant growth, all are engaged in only slightly more than once per month by music teachers. These data may well be affected by the makeup of the sample (elementary and secondary music teachers), as secondary music teachers meet with students every day or every other day, while elementary music teachers meet with students only once per week. It is possible to consider the positive growth trend shown in Table 4.11 to be even more noteworthy in light of that schedule.

To begin addressing the second part of the research question, those elements least positively affected by ITRT training/support, Table 4.12 displays items demonstrating no growth and net loss mean data, as well as correlation data between constructed teacher and student technology-based activity data and the constructed ITRT training influence variable as previously presented on page 64.
Table 4.12

No Means Growth or Net Loss Across Technology-based Activities and Pearson Product-moment Correlations with ITRT Training

<table>
<thead>
<tr>
<th>Activity Description</th>
<th>Time 1 (SD)</th>
<th>Time 2 (SD)</th>
<th>Time 3 (SD)</th>
<th>Time 4 (SD)</th>
<th>Mean Growth</th>
<th>Correlation Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students Use Computer Applications to Prepare Assignments</td>
<td>3.43 (2.65)</td>
<td>3.21 (2.69)</td>
<td>3.79 (2.58)</td>
<td>3.43 (2.24)</td>
<td>0.00</td>
<td>.235</td>
</tr>
<tr>
<td>Teacher Provides Student Opportunities to Create and Share Presentations using Technology</td>
<td>2.14 (1.56)</td>
<td>1.79 (1.37)</td>
<td>1.86 (1.70)</td>
<td>2.00 (1.52)</td>
<td>-.14</td>
<td>.522</td>
</tr>
<tr>
<td>Teacher Use of Technology to Collaborate with Colleagues on Student Learning Issues</td>
<td>5.29 (1.93)</td>
<td>4.86 (2.35)</td>
<td>4.36 (2.17)</td>
<td>5.07 (1.90)</td>
<td>-.22</td>
<td>.232</td>
</tr>
<tr>
<td>Teacher Incorporates Technology into Student Learning Activities</td>
<td>3.92 (1.86)</td>
<td>3.00 (2.00)</td>
<td>3.79 (2.15)</td>
<td>3.50 (1.83)</td>
<td>-.42</td>
<td>.499</td>
</tr>
<tr>
<td>Student Use of Web-based Resources to Collaborate on Assignments</td>
<td>2.14 (1.70)</td>
<td>1.79 (1.31)</td>
<td>1.71 (1.38)</td>
<td>1.64 (1.45)</td>
<td>-.50</td>
<td>.189</td>
</tr>
<tr>
<td>Teacher Incorporates Technology into Instruction</td>
<td>5.71 (1.38)</td>
<td>5.43 (1.79)</td>
<td>5.21 (1.85)</td>
<td>5.07 (1.59)</td>
<td>-.64</td>
<td>.378</td>
</tr>
</tbody>
</table>

Note. 7-point scale: Less than once a month (1), About once a month, A few times a month, Less than once a week, About once a week, A few times per week, Daily (7).
To identify the variables least positively affected by ITRT training/support, the following criteria were employed:

- Correlation Strength: .29 or under
- Significance: $p > .05$
- Growth: .14 or under
- Standard Deviation: ~ 2.00 or over, evaluated after other factors

Values for these criteria were arrived at as follows:

**Correlation Strength**

Per the values provided by Cohen (1988), .10 - .29 represents small correlation strength. Elements in this category (least affected) had no more than small correlation strength.

**Significance**

A value of $p > .05$ is generally considered non-significant. By selecting a threshold of $p > .05$, the researcher intended to demonstrate weak causality.

**Mean Growth**

The maximum positive mean growth criterion was set at .14, as it represented the mode for growth data.

**Standard Deviation**

As a majority of response variables had fairly high standard deviations, 2.0 SD was selected as the criterion threshold; however, it was necessary to make a determination in context with the other criteria, to identify elements least positively affected by ITRT training/support by allowing, within cases, slightly lower incidences of standard deviation as long as the element met each of the
other three criteria. Based on this combination of factors, Table 4.13 displays elements of technology-based instruction that were least positively affected by the ITRT training/support organized by correlation strength.

Table 4.13

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Growth</th>
<th>Correlation Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Time</td>
<td>Time</td>
<td>Time</td>
</tr>
<tr>
<td></td>
<td>1 (SD)</td>
<td>2 (SD)</td>
<td>3 (SD)</td>
</tr>
<tr>
<td>Students Use Computer Applications to Prepare Assignments</td>
<td>3.43 (2.65)</td>
<td>3.21 (2.69)</td>
<td>3.79 (2.58)</td>
</tr>
<tr>
<td>Teacher Use of Technology to Collaborate with Colleagues on Student Learning Issues</td>
<td>5.29 (1.93)</td>
<td>4.86 (2.35)</td>
<td>4.36 (2.17)</td>
</tr>
<tr>
<td>Student Use of Web-based Resources to Collaborate on Assignments</td>
<td>2.14 (1.70)</td>
<td>1.79 (1.31)</td>
<td>1.71 (1.38)</td>
</tr>
</tbody>
</table>

Note. 7-point scale: Less than once a month (1), About once a month, A few times a month, Less than once a week, About once a week, A few times per week, Daily (7).

Variables in Table 4.13 have an average mean much higher than variables in Table 4.12. However, standard deviations for these items are generally much higher than displayed for items in Table 4.12, and a lack of statistical significance and weak correlation strength is quite obvious for items presented in Table 4.13.
Thus these three variables were determined to be those elements least positively affected by ITRT training/support during the scope of this study.

In summary, the following were the elements of technology-based instruction determined to be most positively affected by the ITRT training/support:

- Teachers working collaboratively with the ITRT in planning and reviewing lessons that involve the use of technology;
- Student use of Web-based resources to correspond with experts, authors, or others (e.g., email, other online resources);
- Teachers designing student activities that use technology for discussing ideas and reflecting on learning experiences.

The following were the elements of technology-based instruction determined to be least positively affected by the ITRT training/support:

- Student use of computer or Web-based applications to prepare assignments/papers (e.g., word processing);
- Teacher use of technology to collaborate with colleagues and staff on student learning issues;
- Student use of Web-based resources to collaborate on assignments (e.g., email, wikis, shared drives, etc.).

One questionnaire item quite pertinent to the focus of this study bears mentioning. The item, “teacher incorporating technology into instruction,” actually decreased across four administrations of the questionnaire. However, it did not meet the established criteria to be regarded as an activity least positively affected by the ITRT training/support.
affected by ITRT training/support. Additionally, while decreasing, the mean for this item remained consistently above 5.0, representing teacher use of technology for instruction on average of once per week. This will be further discussed in chapter 5.

**Additional Lesson and Activity Data**

An opportunity to provide a description of specific music technology lessons or technology activities planned with the ITRT was made available to participants in questionnaire administrations Time 2, 3, and 4 as part of Section V. This free response item provided some corroborating evidence to participant responses regarding technology-based activities and behaviors that they and their students engaged in during the course of this study. While some music teachers provided specific music lesson descriptions, others described technology enhanced instructional activities that the ITRT had supported related to their instructional duties, while other participants reported no lessons planned with the ITRT during that period. An itemized list of teacher responses to the question, “please describe the lesson or activity you developed with the ITRT,” organized by questionnaire administration is available in Appendix C. Table 4.14 displays music teacher responses to the question, “please describe the lesson or activity you developed with the ITRT,” organized into three categories: no lesson planned, lessons or activities that include music technology or music software, and lessons or activities that included instructional technology for purposes other than music instruction such as communicating with parents, creating videos, or creating materials.
Table 4.14

Results by Category of Percentage of Participating Teachers Describing Specific Lessons Planned or Activities Addressed with the ITRT

<table>
<thead>
<tr>
<th>Lesson/Activity Planned</th>
<th>Time 2</th>
<th>Time 3</th>
<th>Time 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Lesson Planned w/ITRT</td>
<td>21.4% (3)</td>
<td>28.6% (4)</td>
<td>21.4% (3)</td>
</tr>
<tr>
<td>Music Technology or Software</td>
<td>42.9% (6)</td>
<td>28.6% (4)</td>
<td>42.9% (6)</td>
</tr>
<tr>
<td>Other Instructional Technology</td>
<td>35.7% (5)</td>
<td>42.9% (6)</td>
<td>35.7% (5)</td>
</tr>
</tbody>
</table>

From these results, between 71% (10) and 78% (11) of the respondents developed either music lessons or other technology related activities with the ITRT across each of the three administrations when such interactions occurred. As displayed in Table 4.6, music teachers contact the ITRT a few times per month, and these planning sessions occur about once per month. From the specific descriptions provided by survey participants, some level of regular engagement in music technology lessons and technology-based activities was reported.

While statistically significant results were not individually obtained for many of the items analyzed in this chapter, participant descriptions of technology-based lessons and activities they engaged in, and the role of the ITRT in supporting those activities were consistently, positively, and sometimes significantly reported or correlated throughout the study. Moderate usage and an increase in frequency of music technology and other technology-based activities were reported throughout the study, and ITRT support for those
activities was positively reported as well. Based on the reported means growth and significant correlation strength for many areas researched, further research would seem to be warranted and will be addressed in chapter 5.
CHAPTER 5: SUMMARY, FINDINGS, AND RECOMMENDATIONS FOR FURTHER RESEARCH

The Instructional Technology Resource Teacher (ITRT) is a specific role in Virginia that provides professional development to teachers for technology integration. The position of ITRT is mandated by the Commonwealth of Virginia’s Standards of Quality. The purpose of this study was to determine whether music teachers perceived the ITRT model as an effective professional development process to increase their comfort with using technology, and whether interactions with the ITRT influenced their tendency to engage in certain technology-based activities or behaviors in music classrooms. The findings presented herein are based on the analysis of data as reported in the Survey of Music Teacher Perceptions Regarding Technology Integration located in Appendices A and B. Specific findings for each of the areas researched are interpreted and discussed in detail, with findings and recommendations following.

Summary

Data from this study provided positive and often significant results across each of the four questions researched. Beginning with music teachers’ degree of comfort with using technology for music instruction through specific technology-based activities, study results provided new and promising data when researching this professional development model that was targeted at increasing those very factors. Among those specifically researched were factors contributing to the perceived efficacy of ITRT training/support to increase music educators’ comfort with technology use and, as a result, the likelihood of integrating
instructional technology into the classroom. Results established that participants perceived that the ITRT model of support positively affected their comfort with technology use, as well as their increased likelihood of using technology for music instruction.

The integration of technology in the classroom is considered critical to 21st-century learning (Partnership for 21st Century Skills, 2003; Saltpeter, 2004; Ho, 2004). As such, increasing the use of technology by teachers and students is the goal of many professional development models (Partnership for 21st Century Skills, 2009; Shaw, 1997), and was a fundamental consideration specific to music education when developing this study. In addition, and as discussed in chapter 2, much literature has focused on factors that affect the integration of technology, and the need for effective staff development to support it (Johnson, 2006; Hixon & Buckenmeyer, 2009). It was anticipated that due to the peer-to-peer nature of the ITRT interactions with the music teacher, and the specific focus on music classroom activities, the ITRT model of staff development would be shown to be an effective means of bringing music teachers to a level of comfort with instructional technology that was positively correlated with greater frequency of technology use in music instruction. Specific technology-based activities were investigated to determine if collaboration with the ITRT influenced an increase in their classroom use. Supporting data showed growth across certain technology-based activities in classroom practice. While results for particular items in this area of investigation were mixed, data indicated that technology usage increased within specific activities. For those specific activities, statistically significant
results positively correlated with their increased use were obtained. Other activities were less affected, although still evidenced positive growth. Yet other activities appeared unaffected by ITRT training/support.

Overarching themes that emerged are addressed within this chapter; findings for each of the research questions are interpreted in detail in the following section. Specific examination of areas of mixed results are conducted, with potential interpretations presented. Implications for this study and for further research are presented following those examinations.

**Findings by Research Question**

1. Does technology integration training/support provided by Instructional Technology Resource Teachers (ITRTs) influence teachers’ degree of comfort with using technology for music education?

Participant responses for this variable increased .65 in reported means from Time 1 (4.14) to Time 4 (4.79) on a 6-point Likert-type scale. A Pearson product-moment correlation ($r$) using a constructed teacher comfort variable with a constructed ITRT training influence variable was employed to further address the research question. The result of the correlation suggested a medium, positive correlation between the two variables ($r(12) = .58, p < .05$), with increasing levels of comfort with using technology for music education associated with ITRT training influence. This correlation was statistically significant; therefore, it can be concluded with confidence that technology integration training provided by Instructional Technology Resource Teachers is positively correlated with this group of teachers’ degree of comfort with using
technology for music education.

This finding supports the work of researchers such as Leh (2000) and Schrum (1999), who found that professional development can increase teacher comfort levels with technology. Leh (2000) studied a technology integration course in which 68 in-service teacher participants reported increased comfort levels, confidence, and attitude toward technology within the provided timeframe regardless of emphasis on technology integration. Participants felt that they could apply what they learned in the course to both their current and future classes. One positive attribute of ITRT support is the on-demand nature of sustained support that the model provides, allowing teachers to continue to increase their comfort with instructional technology over time. Unlike workshops and other time-bound professional development, the ITRT model continues to provide the just-in-time support suggested by researchers such as Bauer et al. (2003), Moore and Griffin (2007) and others who have identified this factor as critical to sustained use of technology in the classroom. ITRTs are available every day to support teacher instructional technology needs, are experienced in integration and have current best practice models to share with teachers. This is the major difference between this model and most other professional development opportunities as presented in chapter 2.

Although significant, the growth reported for this question was relatively small. It is possible that this small growth was due to a pre-existing level of comfort with the great number of technology resources available (ITS) within each classroom. These tools had been available for four years at the time of this
study, and various training opportunities had been available throughout that period. This limited growth might also be due to the potential for previous ITRT influence also available in the school division prior to this study, or to a combination of both of these factors. Teachers consistently contacted the ITRT a few times per month throughout this study. How often they may have done so prior to this study is unknown. It is recommended that additional research be conducted to explore these areas further.

2. Does contact with the ITRT influence teachers' tendency to engage in certain technology-based activities/behaviors?

To begin investigating this question, participant responses were reviewed to the questionnaire item, “I am more likely to integrate technology in my classroom than I was before working with the ITRT.” A majority (78.6%) of participants agreed (42.9%) or strongly agreed (35.7%) with this statement on a 4-point Likert-type scale across three questionnaire administrations, Time 2 through Time 4. To more specifically investigate this question, a Pearson product-moment correlation coefficient ($r$) was computed to assess the relationship between a constructed variable of music teachers' tendency to engage in certain technology-based activities with a constructed influence of contact with the ITRT variable. There was a moderate, positive correlation between the two variables ($r(12) = .56, p < .05$), with increasing levels of music teachers' tendency to engage in technology-based activities/behaviors associated with ITRT training/support. The correlation was statistically significant. Therefore, contact with the ITRT was positively correlated with teachers'
tendency to engage in technology-based activities/behaviors.

This finding supports the aforementioned work done by Wozney, Venkatesh, and Abrami (2006), Zhao and Frank (2003), and Leh (2000), who found that training can raise comfort levels, and that raising comfort levels can result in greater technology use in the classroom. Further, this finding supports the research of Kopcha (2010), who investigated a model in which mentors provided just-in-time support, modeling, and apprenticeship that were conducted in teachers’ classrooms. Data from that study demonstrated significant growth in classroom technology integration. Consistent with those findings, growth in classroom technology integration was reported and positively correlated with ITRT and teacher interactions in the present study. Additionally, and not insignificantly, the ITRT model is not subject to the criticisms that Kopcha identified, namely that “mentoring models of technology integration have been criticized because they place too high a demand on school resources such as time, money, and teacher support” (p. 187). These issues have inherently been addressed by the ITRT staffing that exists for teacher support. The ITRT model provides sustained teacher support resulting in growth in classroom technology use without increasing burden on staff or financial resources.

3. Does the frequency of contact with the ITRT increase teachers’ likelihood of integrating technology in their classrooms?

As evidenced by results in research question number 2, music teacher contact with the ITRT is positively correlated with teachers’ tendency to engage
in technology-based behaviors. To investigate whether the frequency of such contact influenced teachers’ likelihood of integrating technology, participants were asked to rate their agreement using a 4-point Likert-type scale with the statement, “The more I work with the ITRT, the more likely I am to integrate technology in my classroom.” A majority (78.6%) of respondents agreed (42.9%) or strongly agreed (35.7%) with this item across three questionnaire administrations (Time 2 - Time 4). Therefore, participants perceived that the frequency of contact with the ITRT did increase teachers’ likelihood of integrating technology in their classrooms. This finding supports the work of researchers such as Blocher, Armfield, Sujo-Montes, Tucker, and Willis (2011), as the ITRT model of support appeared to connect teacher comfort with technology and sustained opportunity to integrate its use, resulting in increased likelihood for technology-based activities in the classroom over time. Blocher et al. (2011) found that technology professional development that is sustained and contextually based resulted not only in increased technology use by teachers, but also by their students. Over time, teachers in the Blocher et al. study changed their practice to integrate more technology and provide greater opportunity for student use of technology.

Music teachers in the present study reported a greater likelihood of integrating technology into their classrooms. While these results are quite positive, additional research is necessary to investigate whether such findings for this specific relationship can be replicated.
4. What elements of technology-based instruction are most and least positively affected by the ITRT training/support?

To investigate this research question, mean and mean growth data collected across four questionnaire administrations, Time 1 – Time 4, were reviewed. In addition, a Pearson product-moment correlation coefficient (r) was computed to assess the relationship between ITRT training/support with each of twenty-five specific technology-based activities. Criteria were developed to rank technology-based activities in order to determine which were most and least positively affected by ITRT training/support. These criteria were factors of mean growth, standard deviation, significance, and correlation strength (r). A detailed description of the criteria utilized and support for their use is found in chapter 4.

It is noted that in general a majority of these activities showed fairly high standard deviations, and quite a few had fairly low mean scores. This necessitated a process of analysis that relied on combining strongest correlation strength with statistical significance, indicated below by an *, with positive mean growth to identify elements most positively affected. Based on these measures, the elements of technology-based instruction most positively affected were:

- Teachers working collaboratively with the ITRT in planning and reviewing lessons that involve the use of technology (*r(12) = .61, p < .05);
- Student use of Web-based resources to correspond with experts, authors, or others such as email, and other online resources* (*r(12) = .58, p < .05);
- Teachers designing student activities that use technology for discussing ideas and reflecting on learning experiences* (*r(12) = .54, p < .05).
To identify elements least positively affected by ITRT training/support, the criteria were used to identify weakest correlation strength with non-significance and little or no mean increase. A detailed description of the criteria utilized and support for their use is found in chapter four. Based on these measures, the elements least positively affected were:

- Student use of computer applications to prepare assignments such as word processing ($r(12) = .24$, $p > .41$);

- Teacher use of technology to collaborate with colleagues and staff on student learning issues ($r(12) = .23$, $p > .42$);

- Student use of Web-based resources to collaborate on assignments such as email, wikis, and shared drives ($r(12) = .19$, $p > .51$).

All of these activities had very minimal, no, or negative mean growth, and correlations did not approach statistical significance. Results from each of the four areas of investigation collected through the research questions will be fully discussed in the next section.

**Discussion**

Music teachers in this study rated themselves comfortable with technology use, and near expert with many of the technology applications and tools investigated in section I from the very beginning of the study. Given that response, the positive, statistically significant correlations between influence that ITRT interactions provide in perceived comfort with using technology for music education points to its strong efficacy in this area, even within a population claiming a high comfort rating. As discussed in chapter 2,
technology is one of the critical factors in its use (Price et al. 2002; Leh, 2000). Since training/support provided by the ITRT was positively correlated with increased teacher comfort with technology with participants who reported fairly high levels of comfort with technology, it would seem valuable to research whether the ITRT model may be even more effective with teachers whose comfort level is initially lower. It was beyond the scope of this study to investigate whether comfort level affected the instructional value that teachers place on its use, another factor critical to technology integration (Russell, Bebell, O'Dwyer, & O'Connor, 2003).

While this study did research growth in teacher-provided opportunities for students to use technology, it did not investigate teacher or student preferences for technology use, explore quality of student technology-based assignments or presentations, nor, as stated previously, investigate teacher beliefs about the importance of instructional technology in education. Research has shown that successful professional development increases teachers' knowledge and skills, changes their attitudes and beliefs, or both (Desimone, 2011). Future investigation of the ITRT model should explore these factors.

In addition to comfort, it would appear from this study that contact with the ITRT had a positive impact on teachers' tendencies to engage in certain technology-based activities and behaviors. Data showed that the more frequently those interactions occurred, the more likely teachers were to integrate technology in their classrooms. This finding is consistent with findings in studies by Blocher, Armfield, Sujo-Montes, Tucker, and Willis (2011), and Parsad, Lewis, and Farris
In those studies, job-embedded professional development, which allowed time for teachers to collaborate with one another, was shown to be efficacious in producing instructional change. However, while certain significant results were obtained, and although teachers rated themselves to be near expert with certain technology applications or tools such as software applications and searching the Web, data from this study showed mixed results specific to certain classroom technology-based activities and behaviors. While some increased frequency of usage was evident with certain technology-based activities, these activities were still engaged in on a reported average of only once per month. Specifically, teachers and students engaged in the following behaviors, from the survey questions, a reported average of once per month.

Teacher Behaviors once per month:

- work collaboratively with the ITRT in planning and reviewing lessons that involve the use of technology;
- design student activities that use technology for discussing ideas and reflecting on learning experiences;
- design activities that require students to use technology to collaborate with peers and/or outside experts on assignments;
- design student activities that use technology for collecting, manipulating, and analyzing data (i.e., spreadsheets, databases).

Student Behaviors once per month:

- use web-based resources to correspond with experts, authors, or others (e.g., email, other online resources);
• use web-based resources to collaborate on assignments;
• use asynchronous learning tools (discussion boards, blogs, etc.);
• use software of websites to study for tests;
• use computer or Web-based applications to produce class presentations.

Some of these less frequent activities (i.e., providing for student use of asynchronous learning tools, Web-based resources, and technology for discussing ideas and reflecting on learning experiences) appeared to align with the low mean participants reported regarding their expertise with Web 2.0 tools. Comfort with the use of Web 2.0 tools, as previously reported, was the only item that did not receive a near expert rating in section I of this study. For that item, the highest reported mean reached was 3.00 at Time 4 on a six-point Likert-type scale, reflected a rating of limited expertise somewhat closer to novice than to expert. Means for engagement in some of the activities noted above increased slightly as a result of the ITRT training/support. However, determining whether these areas might be engaged in more frequently if music teachers felt a greater level of expertise with Web 2.0 tools was beyond the scope of this study. Thus, these activities coupled with interactions focused on increased Web 2.0 skills for teachers would seem to warrant further study. This is addressed in the recommendations section to follow.

Certain of the activities least positively affected by ITRT training/support, such as teacher use of technology to collaborate with colleagues on student learning issues, had means much higher than did many of the elements most affected, such as teacher designed student activities using technology for
discussing ideas and reflecting on learning experiences. These least affected activities may already have been regular features of classroom activity, and therefore evidenced little or no change. If this were the case, it could explain why it was not an area focused on during teacher and ITRT interactions. For instance, teachers reported using technology to communicate with parents on a weekly basis. While this item showed a mean growth of only .14, it may be that parent communication was deemed sufficient, and simply not considered necessary more often than that which was reported by the teacher. A similar interpretation may be applied to certain other low growth, higher means items, such as using technology to communicate with students: less than once per week, or incorporating technology into instruction: about once per week. Additionally, as mentioned in chapter 4, the item, “teacher incorporating technology into instruction,” actually decreased across four administrations of the questionnaire. This item did not meet the established criteria to be regarded as an activity least positively affected by ITRT training/support. However, while decreasing, the mean for this item remained consistently above 5.0, representing teacher use of technology for instruction on average of once per week. This mean is one of the highest for all items researched herein, and as such may again represent an area already in regular classroom practice prior to the current study.

Data from the free response question in which participants provided specific lesson information showed that approximately one-third of time spent collaboratively (35.7%) was focused on areas with relatively high reported means involving communication tools for activities such as communicating with
parents and communicating with students. Two details cannot be known within the parameters of this study: whether these activities previously experienced an increased usage due to interactions with the ITRT prior to this study, and whether teachers chose to focus their attentions on activities with which they felt most comfortable.

**Limitations**

There were several limiting factors in the implementation of this study. The small sample size ($N = 14$) and relative homogeneity of the sample negated any potential for generalizability to a greater population. Limiting factors also included the participants’ instructional assignments, which varied greatly. Assignments spanned elementary schools through high schools, and roles varied by curricular focus, ranging from general to AP music for some, and from choral to instrumental instruction for others. This may well have had an impact on survey data.

The professional responsibilities of each participating music teacher required certain foci during different times of the year. For instance, at certain times choral directors focus on staging and choreographing performances, and at certain times band directors rehearse marching routines. Such exigencies could have had an impact across many of the technology-based activities researched, which may have had far less curricular utility during particular periods. Thus, certain technology-based activities may have been far more appropriate within the curriculum and to certain grade levels during certain times of the year than at others. This may have been a contributing factor to the higher standard deviation
seen in many of the technology-based activities reported on the questionnaire. This possibility is addressed in the recommendations for further study section of this chapter.

Limitations due to frequency of meeting with students may also have been a contributing factor to higher standard deviation for certain items, as elementary music classes meet only once per week, while secondary classes meet daily or every other day. Controlling for these and other factors in future studies would strengthen results in support of using the ITRT to increase technology integration in music classrooms.

Another limitation is inherent with the way in which data was collected, namely that data which is self-reported may not be trustworthy. As Blocher, et al. (2011), stated, “there are many reasons why a participant may not give an accurate self-report, not the least of which might be an error in self-assessment” (p.168). While the scope of this study did not include observations, future research in this area should include classroom observations in addition to questionnaire responses.

Implications

Question number 1, “Does technology integration training/support provided by Instructional Technology Resource Teachers (ITRTs) influence teachers’ degree of comfort with using technology for music education,” yielded significant positive results. Teacher–ITRT interactions increased music teacher comfort with technology. Research has shown that teacher comfort with technology is a fundamental component of increasing technology use in the
classroom. Price et al. (2002) found that raising comfort levels can result in greater technology use in the classroom. Implications for this area researched include an opportunity for schools to increase teacher comfort with technology, potentially leading to change in practice and greater technology integration for music teaching and learning, by adopting a model similar to that used by the ITRT in the present study.

Question number 2, "Does contact with the ITRT influence teachers' tendency to engage in certain technology-based activities/behaviors," yielded significant positive results. Increases in activities such as providing opportunities for student use of technology to collaborate and correspond with experts, as well as teachers using technology to communicate with colleagues were reported. This demonstrated increase supports the work of Blocher et al. (2011), Schrum (1999) and other studies that demonstrated an increase of technology integration as a result of targeted professional development. In addition, teachers provided more frequent opportunities for students to use technology in other ways, such as using Web-based resources to collaborate with one another on assignments, correspond with experts, using asynchronous learning tools, and resources to create presentations. While that frequency was limited to only once per month on average, it was still observed. Implications for this area of investigation point to increasing opportunities for technology-based behaviors by music teachers as contact and interaction with the ITRT continues in the future. Additional implications include the potential for greater student use of technology in their learning supported by their teacher.
Question number 3, “Does the frequency of contact with the ITRT increase teachers’ likelihood of integrating technology in their classrooms,” yielded many implications for contact with the ITRT increasing teachers’ likelihood of integrating technology in their classroom. As teachers reported an increased likelihood of integrating technology as a result of frequency of ITRT contact imply greater integration, implications for greater technology use by both teachers and students in the future would seem founded. This, too, would be consistent with studies by Blocher et al. and others. Christensen (2002) found that “training appears to foster meaningful use by teachers in the classroom, which, in turn, fosters student computer enjoyment and later a perception of importance of computers” (p. 431). Additionally, there may be implications to consider providing opportunities for even greater frequency of ITRT–teacher contact to support this outcome. Implications for increased student achievement exist as well. Each of these outcomes—greater frequency of ITRT contact, and greater likelihood of technology integration—should be researched to see if a rise in student achievement specific to music learning results as technology use increases.

When considered in a broad context of which instructional elements might be most desirable, the specific outcomes of question number 4, “What elements of technology-based instruction are most and least positively affected by the ITRT training/support,” had many implications. These include identifying areas on which to increase instructional focus such as those areas least affected, as well as other areas that might be continually targeted even within areas most affected
by the ITRT training/support, particularly if such were considered of great instructional value. Beyond the elements researched here, implications for focusing greater emphasis on areas that arose as needing further research would seem warranted, Web 2.0 tools chief among them. From these implications for practice, using the ITRT model to specifically target areas of technology integration for music teachers that are most desirable such as the use of classroom technology by students for creating and collaborative learning, and the use of Web 2.0 tools by teachers to engage students for similar learning purposes have potential to result in measurable achievement outcomes. If the result of greater levels of integration were increased student achievement, requiring teachers to take advantage of ITRT support opportunities would seem a logical consequence. Opportunities for greater integration of technology-based activities that yield higher student achievement are entirely consistent with the purpose of the ITRT model.

In addition to the factors investigated in this study, further research may yield implications for policy. At the time of this study, Virginia was the only state to have legislated the ITRT position. If future research replicates the findings from this study, other states may choose to adopt and implement a similar model of peer-to-peer staff development for technology integration. This would yield not only positive instructional results, but may potentially serve to reduce wasted time, effort, and resources.

While limited in scope and generalizability, this study contributed to the literature on effective professional development models, and specifically to the
literature on professional development support for technology integration, and to the literature on professional development for music instruction that integrates technology in support of 21st-century goals for learning. Outcomes for implications from this study include the possibility for greater engagement and learning opportunities for music students due to greater use of instructional technologies provided by their teachers as a result of teacher and ITRT interactions. As previously discussed, Dexter, Anderson, and Ronnkvist (2002), found that quality technology support influences teacher use of instructional technology. Findings from this study were consistent with studies such as Dexter et al., Jacobsen and Lock (2004), and others that have found sustained, peer-to-peer, targeted professional development to be among the most effective models for improvement of teaching and learning. Further determining the efficacy of the ITRT model and the potential for increased student achievement as a result provide a compelling area to pursue in future research.

**Recommendations for Further Study**

The mixed results of this study make it difficult to draw strong conclusions about its contribution to the literature in the area of professional development to increase classroom technology integration. Therefore, it is recommended that further research to replicate and extend this study be conducted. Suggestions for future research topics are as follows:

- Conduct confirmatory factor analysis of the instrument to determine its general usefulness beyond face validity.
- Replicate this study with a larger sample across multiple school divisions.
This would allow for comparisons across school settings with varying levels of technology, technological infrastructure and technology support.

• Replicate this study controlling for specific instructional roles; general classroom music, choral music, strings, or band. This would allow for exploration of specific efficacy of ITRT training/support by instructional category.

• Design research that focuses ITRT training/support on specific areas where teachers feel less comfortable or skilled. Target areas from the current study that were most affected by ITRT influence but still demonstrated lowest means.

• Interview teachers or include questionnaire items in order to determine whether the ITRT model increases teacher beliefs about the instructional value of technology and its use.

• Include independent observations of activities reported in questionnaires and interviews to determine whether corroborating data exists.

• Analyze lesson plans developed with the ITRT to determine whether focus areas reflect greater integration over time, and to determine what types of technology-based activities receive the greatest attention.

• Investigate technology activities determined to be most desirable for music instruction as identified in local, state, or national objectives. Based on the literature presented in support of this study, these will likely include Web 2.0 resources as well as specific music applications.
- Include research focus on appropriateness of specific technology activities as determined by the curriculum during certain times of the year.

- Investigate music student perceptions of effective use of technology in their classrooms to determine how engaged they are regarding this aspect of their learning. Look for coherence or dissonance with teacher perceptions of what is most effective.

- Investigate how Music Learning Activity Types developed by Bauer, Harris, and Hofer (2012) might be utilized by music teachers with technology integration support from ITRTs.
Survey of Music Teacher Perceptions Regarding Technology Integration

Please click in the box below the rating that best reflects your response.

Section I

How comfortable do you feel using technology as part of your professional responsibilities?

<table>
<thead>
<tr>
<th>Not comfortable at all</th>
<th>Extremely comfortable</th>
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<td>1</td>
<td>2</td>
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Please rate your level of expertise with the following technology applications or tools:

Computer software applications (i.e., Word, Excel, AppleWorks, Power Point, Photoshop, etc.)

<table>
<thead>
<tr>
<th>Novice</th>
<th>Expert</th>
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<td>1</td>
<td>2</td>
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ITS tools (i.e., document camera, LCD projector, Interwrite tablet, digital camera, etc.)

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<tr>
<th>Novice</th>
<th>Expert</th>
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<td>1</td>
<td>2</td>
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Searching the Web or other databases

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<tr>
<th>Novice</th>
<th>Expert</th>
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<tbody>
<tr>
<td>1</td>
<td>2</td>
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</table>

Web 2.0 tools (podcasting, blogging, etc.)

<table>
<thead>
<tr>
<th>Novice</th>
<th>Expert</th>
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Music Technology (notation software, sequencing, recording, downloading music)

<table>
<thead>
<tr>
<th>Novice</th>
<th>Expert</th>
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### Section II

**How often do you do the following?**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Less than once a month</th>
<th>About once a month</th>
<th>A few times a month</th>
<th>Less than once a week</th>
<th>About once a week</th>
<th>A few times per week</th>
<th>Daily</th>
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<tbody>
<tr>
<td>Use technology to gather information for my lessons (e.g., search the  web, databases)</td>
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<tr>
<td>Incorporate technology into my instruction</td>
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<td>Work collaboratively with the ITRT in planning and reviewing lessons that involve the use of technology</td>
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<tr>
<td>Incorporate technology into my students' learning activities when planning lessons</td>
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<tr>
<td>Design activities that require students to use technology to collaborate with peers and/or outside experts on assignments</td>
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<tr>
<td>Design student activities that use technology for discussing ideas and reflecting on learning experiences</td>
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<tr>
<td>Design student activities that use technology to reflect on learning experiences</td>
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<tr>
<td>technology for collecting, manipulating, and analyzing data</td>
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<td>(i.e., spreadsheets, databases)</td>
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<tr>
<td>Provide student opportunities to create and share presentations</td>
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<tr>
<td>using technology</td>
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<tr>
<td>Use technology to communicate with colleagues and staff for</td>
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<td>administrative purposes</td>
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<tr>
<td>Use technology to communicate with students</td>
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<tr>
<td>Use technology to communicate with parents</td>
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<tr>
<td>Use technology to collaborate with colleagues and staff on student</td>
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<td>learning issues</td>
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<tr>
<td>Collect and analyze student data using technology</td>
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<tr>
<td>Use technology to post homework and other class information for</td>
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<tr>
<td>student or parent access (Edline)</td>
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</tbody>
</table>
Section III

How often do your students use the following for in-class and/or out-of-class assignments?

<table>
<thead>
<tr>
<th>Activity</th>
<th>Less than once a month</th>
<th>About once a month</th>
<th>A few times a month</th>
<th>Less than once a week</th>
<th>About once a week</th>
<th>A few times per week</th>
<th>Daily</th>
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</thead>
<tbody>
<tr>
<td>Computer applications to prepare assignments/papers (e.g., word processing)</td>
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<tr>
<td>Music technology for recording, composing, creating multimedia, etc.</td>
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<tr>
<td>Computer applications to analyze data or keep records (e.g., spreadsheets)</td>
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<tr>
<td>Computer or web-based applications to produce class presentations</td>
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<tr>
<td>The Internet or other databases to research information or find materials for assignments</td>
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<tr>
<td>Music software to learn or practice new skills</td>
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<tr>
<td>Software or websites to study for tests</td>
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<td>Technology tools to aid in learning (e.g., ITS tools)</td>
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<tr>
<td>Asynchronous learning tools (discussion boards, blogs, etc.)</td>
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<tr>
<td>Web-based resources to collaborate on assignments (e.g., email, wikis, shared drives, etc.)</td>
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<tr>
<td>Web-based resources to correspond with experts, authors, or others (e.g., email, other online resources)</td>
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</tbody>
</table>
Section IV

Please rate the level of support have you received for incorporating technology into your teaching and learning activities from the following:

The ITRT

<table>
<thead>
<tr>
<th>Poor</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Outstanding</th>
<th>6</th>
</tr>
</thead>
</table>

Other teachers at your school

<table>
<thead>
<tr>
<th>Poor</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Outstanding</th>
<th>6</th>
</tr>
</thead>
</table>

Your principal

<table>
<thead>
<tr>
<th>Poor</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Outstanding</th>
<th>6</th>
</tr>
</thead>
</table>

Your students

<table>
<thead>
<tr>
<th>Poor</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Outstanding</th>
<th>6</th>
</tr>
</thead>
</table>

Other professional development providers

<table>
<thead>
<tr>
<th>Poor</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Outstanding</th>
<th>6</th>
</tr>
</thead>
</table>

Thank you for your participation in this research!
APPENDIX B
Survey of Music Teacher Perceptions Regarding Technology Integration Posttest

Section V
Please respond to the following:

<table>
<thead>
<tr>
<th></th>
<th>Less than once a month</th>
<th>About once a month</th>
<th>A few times a month</th>
<th>Less than once a week</th>
<th>About once a week</th>
<th>A few times per week</th>
<th>Daily</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often do you contact the ITRT?</td>
<td></td>
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<tr>
<td>How often do you plan lessons with the ITRT?</td>
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<tr>
<td>Please describe the lesson or activity you developed with the ITRT</td>
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</tbody>
</table>

Section VI
Please rate your level of agreement with the following statements, based only on your most recent interactions with the ITRT:

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have a better understanding of how to integrate technology than I did before working with the ITRT</td>
<td></td>
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</tr>
<tr>
<td>I am more likely to integrate technology in my classroom than I was before working with the ITRT</td>
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</tr>
<tr>
<td>The more I work with the ITRT, the more likely I am to integrate technology in my classroom</td>
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<tr>
<td>I use technology more frequently in the music classroom than I did before working with the ITRT</td>
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</tr>
<tr>
<td>The knowledge and skills of the ITRT are a major factor in the likelihood of my use of technology in my classroom</td>
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</tr>
<tr>
<td>After working with the ITRT, I want</td>
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</tr>
</tbody>
</table>
to learn more about using technology for teaching and learning

After working with the ITRT, I feel more confident in my ability to use technology for teaching and learning

Thank you for your continued participation in this research.
APPENDIX C

Music Teacher Descriptions of Lessons or Activities Developed with the ITRT

Time 2

- Help with using technology in the classroom.
- A composition activity with fifth graders using I, IV, and V chords in Finale software.
- Help with using technology in the classroom.
- With a previous ITRT, I worked on getting music examples saved with PowerPoint so I could post on Edline. Students who missed class could then go on Edline and complete the listening assignments completed in class. The ITRT also helped with Quizdom activities.
- Did not plan a lesson (reported by three participants during time 2).
- Using websites and software for music reading practice, theory and analysis.
- Guitar assignment using school iPods. Students listen to the song and then try to learn it by ear. Putting listening curriculum on Edline.
- Working on using an iPad for importing music scores!
- iPad keyboarding lesson.
- Posted music to Edline for at home practice.
- No lessons but TONS of help with Edline page(s).
- Music Research.
- I have not even tried to plan a lesson with an ITRT. I am overwhelmed by how much there is to learn, but I am using technology for all my lessons every day - the lessons are on PowerPoint with the sound files and I operate most of it with the wireless keyboard.

Time 3

- I did a keyboard lesson with the iPads for my general music class. Students very much enjoyed the experience to the point that almost all 6th graders heard about the activity.:)
- Did not plan a lesson.
- My ITRT has helped in any area that does not pertain to musical reading or expertise. She has tried to help me with Finale and Audacity but we both became very discouraged quickly.
- Began iFad project for next year with PDFs.
- Composition using Finale.
- Did not plan a lesson.
- Recording with camera.
• Use of music technology used weekly with my students.
• We created a photo story using pictures taken on our class trip and music the class performed.
• Will soon be working with the ITRT on a listening/notation assignment using the iPod cart for guitar classes.
• I have requested help with Quizdom setup.
• She has helped me a great deal with iTunes and Edline. I use those all the time to make my lessons, but I have not written a lesson with her.
• Did not plan a lesson.
• Did not plan a lesson.

Time 4

• Photo story using background music of students performing.
• Did not plan a lesson.
• Using iPods to teach guitar students how to transcribe music.
• Numerous: recording music, converting recordings through audacity, using document camera to record, posting recordings for instructional use/review, etc.
• I have not developed a lesson with the ITRT. If I want to do something or I can't figure out how to do something, I have asked specific questions.
• Video Webcast.
• I did not plan a lesson, but she has helped me a great deal with my iTunes that I use every single day with every single class.
• My guitar students are using the school iPods to transcribe and then perform a song of their choice.
• We had each student create a Photo story using pictures from a class trip and music from a recording in which the class performed.
• Composing using Finale.
• We created an iPad piano lesson. Students were learning to play the keyboard and played multiple pieces on the iPad keyboard app. It was a huge success.
• ITRT has been helpful troubleshooting issues. We have discussed Quizdom preps and she helped with transferring on-line videos to RealPlayer so they can be saved for make up work.
• Finding materials for General Music classes, use of iPod apps, SharePoint calendar possibilities for next-year, communication with parents, etc.
• Creating a music notation piece PDF.
IRB File # 2062E
Title: “Music Teacher Perceptions of a Model of Technology Training and Support in Virginia”

January 18, 2010

Mr. Lee Welch
Doctoral Student
College of Fine Arts
School of Music

Mailing Address:
3917 Blue Ridge Court
Williamsburg, VA 23188

Dear Mr. Welch:

The Charles River Campus Institutional Review Board has completed its review of your research protocol referenced above. Expedited approval was granted in accordance with Federal Regulations 63 FR 60364 (7) and 45 CFR 46, a copy of which you received in the standard IRB application kit. I am enclosing originals of the consent form and recruitment material for this project. They have been stamped for your current use in keeping with IRB procedures (also enclosed).

This approval is valid for one year, effective the date of this letter. Any changes or modifications to the protocol as now approved must be reported to and acted on by the IRB prior to implementation. Please call me at 617/353-4365 if you have any questions or if I can be of further assistance.

Sincerely,

Ed Szukutak, CRC-IRB

Enclosures

cc: Professor Jay Dorfman, CFA
INFORMED CONSENT FORM

Title of Project: Music Teacher Perceptions of a Model of Technology Training and Support in Virginia

Purpose
We would like permission to enroll you as a participant in a research study. The purpose of the study is to learn more about your perceptions of the Instructional Technology Research Teacher (ITRT) model in supporting your professional development needs. By better understanding these factors, better means to support the technology needs of music educators may become evident. The Principal Investigator, Lee Welch, is a Doctoral student at Boston University and the project is being completed for his dissertation research.

Procedures
If you volunteer to participate in this study, we would ask you participate by completing online questionnaires four times during the 2009-2010 school year. The initial questionnaire consists of thirty-two questions on issues related to your use of technology in your role as a music teacher. The follow-up questionnaire consists of the same thirty-two questions plus an additional ten questions specific to your interactions with the ITRT. You are asked to complete this questionnaire three weeks after the completion of your interactions with the ITRT. It should take you no more than ten minutes to complete the questionnaire each time.

Risks and Discomforts
There are no known risks associated with participation in the study.

Benefits
This study will contribute toward the understanding of the efficacy of the ITRT model for music instruction. No other benefits from participating in this study will be promised or presumed.

Compensation
You will not receive any compensation for participating in this study.

Confidentiality
Your answers to research questions will be submitted anonymously, and will not be disclosed, unless required by law or regulation. The information you provide will be published only in aggregated form (for example, tables of information). No identifiable information will be included in any presentation or publication.
The signed consent forms will be kept separate from the research data.

Voluntary Participation
Your participation in this research is purely voluntary. Refusing to participate or discontinuing participation will involve no penalty or loss of benefits to which you are otherwise entitled. Should you discontinue participation, you can request that all data previously collected be destroyed. You may refuse to answer any item on the questionnaire.

Contacts
If you have questions regarding this research, either now or at any time in the future, please feel free to ask them. The Principal Investigator – Lee Welch at 737-365-4897 or at balladeer@cox.net will be happy to answer any questions you may have. Questions may also be addressed to the faculty advisor – Professor Jay Dorfman at 617-353-3350 or at jdorfman@bu.edu. You may obtain further information about your rights as a research subject by calling David Berndt, the coordinator of the Boston University Institutional Review Board for Human Subjects Research at 617-353-4365 or at dberndt@bu.edu.

Agreement to Participate
I have read this consent form. All my questions have been answered. I agree to participate in this study. I have been given a copy of this form.

Name of Subject

Signature of Subject Date

Person Obtaining Consent Date
Sample email request for volunteers – Lee Welch

Subject: seeking volunteers for Music Education Doctoral study

Dear Music Educator,

My name is Lee Welch, and I am a doctoral student at Boston University. I am seeking volunteers to participate in a research project, which is being completed as part of my dissertation research. The purpose of the study is to learn more about your perceptions of the Instructional Technology Research Teacher (ITRT) model in supporting your professional development needs. By better understanding these factors, better means to support the technology needs of music educators may become evident.

Complete details of what your participation will entail are included in the Informed Consent Form, which is attached to this email. Briefly, however, you will be asked to respond to an online questionnaire four times during the current school year. Responses to the questionnaire will be entirely anonymous; no personal information will be collected or shared.

If you agree to participate in this study, please sign the attached Informed Consent Form and return it to me via interoffice (PONY) mail, or if you choose you may send it to me at the following address:

Lee Welch
3917 Blue Ridge Court
Williamsburg, VA 23188

I thank you very much for your consideration and support of this research. Please contact me should you have any questions – my contact information is included on the attached form.

Sincerely,

Lee A. Welch
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VITA