Music Technology in the Classroom: Use, Accessibility, and Professional Development of Delaware K-12 Music Educators

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MUSIC TECHNOLOGY IN THE CLASSROOM:
USE, ACCESSIBILITY, AND PROFESSIONAL DEVELOPMENT OF
DELAWARE K-12 MUSIC EDUCATORS

By

Steven Scher

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MUSIC TECHNOLOGY IN THE CLASSROOM:
USE, ACCESSIBILITY, AND PROFESSIONAL DEVELOPMENT OF DELAWARE K-12 MUSIC EDUCATORS

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The purpose of this study was to determine how technology use of Delaware music teachers was affected by accessibility, previous technology background/experience, gender, grade level, and teaching specialty area. Professional development and perceived needs for training and access were examined to determine effects on use and integration. K-12 music teachers (N=53) in the state of Delaware completed an online measure to assess these factors. Results suggest a) technology access is not an indicator of technology use, b) access to recording equipment could be an indicator of overall technology use, c) teachers received training on use and operation of certain technologies, while application and implementation were often not included and desired, and d) previous training and experience is a strong predictor of technology use.
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Chapter One

Statement of the Problem

Introduction

Music and technology are often considered to complement each other. Recording technology throughout the 20th century, electronic instrument development in the 1960s, and instructional computing in the 1980s have all led to technology uses in the field of education (Kortlik & Redmann, 2005). As the Internet, content-specific computer programs, and assistive technology have continued to be utilized in the classroom, teachers of all content areas have benefited and utilized the advantages given to them by these innovations.

The music classroom, like many other content areas, can benefit from these technologies in various ways. Many technologies, like software designed for music instruction and simple recording devices, are widely available and relatively affordable. Other technologies can be used creatively and implemented to greatly change the instruction and learning that takes place in the classroom. For some schools, lack of funding for these technologies is the only preventative factor. In some cases, high access to these technologies still results in low use in the classroom (Cuban, Kirkpatrick, & Peck, 2001).

Accessibility only addresses one aspect of technology use in the classroom. Other key factors include prior knowledge, previous experience, and technology training, both through professional development and during teacher training (Tweed, 2013). There are many undergraduate programs that are now including technology education into their
curriculum, but most teachers in the field can only receive this training through in-service training sessions (Hornung, 2002).

As technology becomes more prevalent in home and personal use, many new teachers are already familiar with much of the technology available to them. Software such as GarageBand, websites such as YouTube, and hardware such as iPads, are commonplace knowledge that new teachers, and most importantly, students, have readily available and are comfortable using. This comfort of use by the instructors can make them more willing, and even more apt, to include their use into the classroom routine and into the curriculum.

While there are many studies on technology use in schools, they are usually looking at school-wide implementation and effectiveness, or perceptions of teachers, students, and administrators. These studies either examine school districts as a whole (Tweed, 2013), individual schools (Marcum, 2010), or specific subject content areas. As for music technology, there are many articles and studies done on the effectiveness of technology, uses of technology, and case studies on how they are integrated into classrooms.

As far as can be determined, there are no studies on the accessibility and use of technology among music teachers, across all grade levels and specific music content areas. There is also lack of attention on teacher training and technology professional development as it relates to implementation and self-efficacy. By looking at a range of variables, across a varied population of music teachers in a single state, conclusions can be drawn as to what factors affect technology use and what factors may be preventing its use. This may also have implications for school districts and teacher education programs
on how teachers can be more effectively trained and prepared for technology application and implementation.

**Purpose**

The purpose of this study was to determine use of technology by music teachers in K-12 Delaware schools. The goal of this study was to examine the current state of technology use in Delaware schools, and determine what factors contribute to its use in the music classroom. These factors include gender, previous training, grade level, and teaching specialty area. Relationships between personal and professional uses of technology were examined, as well as how training received impacts the actual implementation of instruction. Training needs of teacher and perceptions of what technology can be used in the music classroom also were addressed to determine if the lack of use was due to lack of knowledge, or lack of awareness of the technology itself.

The following research questions were used to address the purpose of this study:

1. What technology is made available to music teachers and how often do they utilize that technology in their classroom instruction?

2. How does accessibility and use of technology affect each other and in what ways do accessibility assist or prevent use of technology in the classroom?

3. What technology training do teachers feel they need in order to implement technology effectively in their classroom?

4. How does technology use differ as a function of years in the field, gender, previous training, grade level, and teaching specialty area?
Delimitations

The participants of this study (N = 53) were volunteers from the approximately two hundred K-12 music teachers in the state of Delaware. These teachers are currently teaching in public, private, or charter/magnet schools. All teachers must have a valid teaching certification, be currently employed, and actively teaching music in a classroom setting. All music teachers registered with the Delaware Music Educators Association (DMEA) were contacted via email, and asked to participate in this study. Participation was voluntary.
Chapter Two

Review of Literature

Purpose

The purpose of this study was to examine the use of technology by music teachers in K-12 Delaware schools, as determined by factors of accessibility, experience, professional development, grade level, and content area. The training needs of teachers were considered in regards to implementation into instruction.

Accessibility and Usage

It is often thought that an increase in accessibility to technology will directly lead to an increase in use. A study by Cuban, Kirkpatrick, and Peck (2001) found that this is not necessarily the case, and there are several additional factors that need to be considered. In order to examine the paradox of high accessibility and low use, this study looked at two high-tech schools in Silicon Valley, CA. They interviewed 21 teachers and 26 students at both schools, as well as examined teacher sign-up data for media centers and computer labs. They also compared at the ratio of students per computer and Internet access across the nation, state of California, and both high schools. Home use of computers was also closely examined to determine the effect of student and teacher self-efficacy.

The results of this study found that even with high access to technology, only those teachers who felt comfortable with their skills implemented it in their classroom. They found that they provided additional tools, more than an overhaul of educational
tactics. Some teachers went out of their way to increase integration, but not due to access, but rather their experience and personal interest.

These findings are confirmed in other studies that look at teacher perceptions of technology use. Mundy, Kupzynski, and Kee (2012) found that technological proficiency was a primary factor in whether or not a teacher would utilize technology in their classroom. The survey in this study was the 2010 and 2011 (upgraded) Teacher Pulse Survey (TPS) given to teachers who participated in the TeachUp! Program. This organization focuses on programs in need of training in educational technology in the classroom. The survey provided respondents from 44 school districts, with each of the individual teacher responses summed and averaged. The TPS results found that in schools where the teachers were trained, the students achieved much higher than those without training. Over 50% of the teachers that had computers reported using them for administrative purposes only, and not educational use. Half of the students reported only using technology more than once a week. Mundy et al. (2012) determined that lack of technology training and knowledge had a greater effect on actual use. The lack of confidence corresponded to teachers’ reluctance to integrate the technology into their classroom.

**Professional Development**

Teacher training and personal proficiency come up in several studies on educational technology use. This can come from new teachers growing up in a technological age, or pre-service training at the university level. A 2009 study by Allsopp, McHatton, and Cranston-Gingras looked at 13 undergraduate special education
majors who participated in a “laptop initiative.” This program was designed to systematically integrate laptop usage into instruction via software, web applications, etc. The study looked at the perception of proficiency of these students, through a Likert-type survey. The questions addressed both their comfort and their willingness to utilize technology in their future classrooms. A pretest was administered at the start of the first semester, and a posttest was administered at the close of each of the 4 semesters. The findings showed that students felt more comfortable with their skills in later posttests, and that their comfort directly correlated with their willingness to utilize the laptops in their classrooms. The attitudes of technology in teaching did not change significantly throughout, remaining positive during the duration of the study.

Very similar results can be found in short term studies of the same type. A one-week technology workshop was shown to have had the same results for current teachers as a four semester long pre-service training (Bauer, Reese, & McAllister, 2003). Two hundred three in-service teachers attending a summer music technology workshop took a pretest questionnaire, followed by 63 select respondents taking a posttest follow-up questionnaire. The authors found that teacher knowledge, teacher comfort, and frequency of use could be greatly improved through this in-service training.

Another study by Bauer (2013) used similar methods to track the professional development of 284 K-12 music educators across 17 separate locations in the US. Two measurement instruments were used in this study: the Concerns-Based Adoption Model–Levels of Use (CBAM-LoU) instrument and the researcher-designed Musical TPACK Questionnaire (MTPACK-Q). The teacher training program, called TPACK, was being tested as an effective tool to train teachers with little experience in music technology
classroom integration. The results found that a combination of technical, pedagogical, and content knowledge greatly contributed to teachers’ perceived comfort. Pre-service training (undergraduate curriculum) was greater in the younger participants, which may have contributed to a lower comfort level change than those teachers who have not had any technology coursework.

Dorfman (2013) suggests making technology a methods course, rather than a techniques course, for undergraduate music education majors. He finds that many technology courses teach skills and proficiency with specific technologies, rather than teaching concepts. Additionally, faculty can infuse technology assistance into their instruction, providing even low level modeling for their students. Distributing materials through electronic means, using presentation software for lecture, and designing lesson plans that involve rich technology integration are some ways students can be exposed to technology application at the pre-service level.

Upon examining in-service training, there are three factors related to professional development that can inform training needs (Bauer, 2014). First, professional development needs and preferences are related to specific teaching responsibilities. It is necessary to receive training on pertinent knowledge and skills that are applicable. Second, training needs may vary according to the stage in the teacher’s career, as veteran teachers may be looking for additional topics to enhance their instruction. Third, extended professional development training is more effective than short-term sessions, and has a greater chance to effect change in their teaching practices.

Bauer also finds that personal networks and personal experiences are more valuable training endeavors for teachers, as it allows them to seek out specific areas of
interests, have a personal stake in the technology, and are more comfortable learning from social/distant learning workshops, such as MOOCs and Google+ Communities.

**Measuring Effectiveness and Perceptions**

Professional development and self-efficacy play major roles in whether or not a teacher will choose to use the technology they have available to them. The measures of its effectiveness, and the perceptions of usefulness in context, are equally as important. In 2003, Hogarty, Lang, and Kromrey looked to develop an instrument to measure teachers’ perceptions of technology use in the classroom. They considered multiple domains, including integration, teachers’ personal use, teacher confidence and comfort, computer support by the school, interest and attitudes toward use, and student access. They developed both a paper and web version of the survey to determine if that had an impact on the reliability of the measure.

The initial instrument was sent to 16 high schools, 23 middle schools, and 82 elementary schools in a large southeastern school district. Eighty percent of the faculty received the paper version and 20% received the web version of the survey. The number of respondents was 2,156, about 35% of the mailing. The instrument showed acceptable levels of reliability, .74-.92, and found no statistical difference between the paper and web version of the survey. There was a much higher return rate from the paper submission, .39 as opposed to .10 in web form.

Assessment of integration and use is often the focus of technology studies. A 1987 article by Charles Mojkowski looked at the need for technology assessment to address application and should include its impact on the curriculum. The measure used by
Mojkowski examined learning outcomes, technology as a means of differentiated instruction, effect on productivity of students and teachers, and replication. There is also a major focus on whether or not the technology has appropriate training programs, supporting materials, up-to-date inventory (accessibility), and consistent frequency of student performance monitoring.

Integration of technology-based assessment tools can measure the effectiveness of the tools themselves. Classroom capture systems, such as those with video and audio capabilities, have not been studied extensively, but preliminary evidence has found that there are several benefits to both students and teachers (Ford, Burns, Mitch, & Gomez, 2012). Fifty-two undergraduate students from Loyola Marymount University were exposed to Classroom Capture Technology (CCT) and 49 student participants were not. Questionnaires were distributed to measure studying habits, perceived learning outcomes, course attendance, etc.

The study found that using recordings of class as a pedagogical tool was effective for a lecture-based course. Students perceived the course as more challenging and in turn, utilized the resources made available to them by the CCT. There were small but meaningful relationships found between CCT and increased perceptions that learning outcomes were effectively addressed.

Impact and Effectiveness

A 2011 study by McCabe and Meuter looked at the effectiveness of classroom technologies and student perceptions of these technologies. A series of surveys were administered to 195 business students at a school in California taking courses utilizing
the Blackboard CMS tool. Several courses were included in this study from across the school. The paper survey contained 7-point Likert-style scale questions that focused on the Blackboard tools and their frequency of use. In addition, the students were asked questions that address the “Seven Principles of Good Practice in Undergraduate Education” and individual learning styles.

The results of the study revealed answers to several different aspects of the research study. Faculty did not always utilize student-preferred tools, and therefore, students felt less impacted by the use of Blackboard over what their expectations were going into the course. Students expected the technology to facilitate learning, but only in cases where the correct technologies were implemented to enhance motivation or benefit their learning style. In regards to the Seven Principles, Blackboard was inconsistent with what students felt was important and applicable, although they initially expected increased learning effects. Student perceptions of overall use of technology in their learning was predicated on their expectations, and desired outcomes being enhanced directly by that technology; whether or not it was being used for the sake of classroom technology implementation.

A 1994 study by Anita Ambardar, looking at technology usage, examined student performance enhancements, instructional practices, and factors that influence teacher implementation of technology in the classroom. This study involved 14 teachers and 418 students ranging from first through seventh grade. The school district was in an urban (low social economic status) environment, which had access to computers. The case study was on an instructional program implemented to specifically test the research questions of the study. The three phases of the program were teacher training, in-class
demonstration of techniques they could implement, and observation by the researchers during teacher implementation.

Ambardar (1994) found that the use of technology in the reading/writing increased their performance, but largely due to motivational factors. The author found the students were excited to use the computers to write, which led to them putting in greater effort while writing. The experience of the teachers did not play a role in the effectiveness of the instructional program, but the teaching style played a significant role in the integration of technology into instruction. The factors the teachers considered most important in future technology integration was proper training, time for preparation, and technical assistance.

**Technology Integration in the Classroom**

Over the last several decades, inclusion of technology in the classroom has been a focus of educators and administrators. Planning lessons around available technology, utilization resources to differentiate learning, and providing alternative tools for students has grown into a research subject of its own. A 1990 article by Bruce Barker examined computer use in the classroom, teacher training, and implications for distance learning. At the time of the article, topics such as electrical needs and facility planning were an issue that required attention and accommodation. While these constraints do not apply to today’s classroom, there are many valid observations that hold true today.

At the time, computer instruction was predominantly programming skills taught to students, and he proposed the use of the computer as a teaching tool for other fields. Using computers as an assistive instructional tool is a practical application of classroom
computer use that is dependent on the teacher’s ability to properly implement the technology into lessons. Utilizing the appropriate software and hardware, with consideration to availability and quality, can help educators facilitate instruction and promote higher order thinking skills.

Computer-aided learning can be used in a variety of ways, with different software and hardware developments addressing a wide field of skills. Reese (1995) found that MIDI technology was useful among younger students, as the need for advanced performance skills and knowledge of notation was greatly reduced. He found that with the reduced need for advanced skills, larger numbers of students were able to take a composition course, focusing on the initial stages of composing original, popular style music. Teaching melody, harmony, rhythm, form, and tone color could be achieved through controlling the MIDI instruments, rather than focusing on the advanced skills required for traditional compositions. These technologies were used as a means of teaching musical understanding and composition, rather than how the systems operate technically.

Computer use as a means for distance learning has been developing and continues to develop as a major function of educational technology. Online learning and teleconferencing allow for live delivery of instruction as well as the ability to include audio and video interaction between students. At the time Barker wrote the article, the Internet and satellite technologies were just beginning to gain popularity, and were not as easy to access for educational use. In today’s computer and Internet age, these tools are widely available and have the same level of implication as they did in the early 1990s.
Buzzard, Crittenden, Crittenden, and McCarty (2011) examined multiple research studies that identified a mismatch in educational technology preference between faculty and students in higher education. The participants of this study were 765 students and 308 instructors from a variety of high education fields. The study’s primary research questions included technology preference differences between faculty and students, and perceptions of technology use, support, and effectiveness. In answering the first research question, it was determined that faculty members prefer course-learning technology such as CMS and other Web 2.0, while most students prefer traditional instructional technology. This resulted in a high level of student preference in majors such as engineering and business, and less in the fine arts and humanities.

Perceptions of technology use and effectiveness were similar between both groups. 61% of the instructors perceived that at least 75% of the students used instructional technology effectively. Likewise, 65% of the student respondents thought that at least 75% of the instructors used instructional technology effectively. Both students and faculty respondents were considered eager and willing to learn and teach with a wide variety of digital technologies. These include Websites, CMS, telecommunication, interactive digital content, and multimedia.

A 2005 study by Kotrlik and Redmann examined technology integration by adult basic education (ABE) teachers with respect to impact on learners and teachers, integration in the teacher-learning process, barriers to integration, teacher and student technology anxiety, and effectiveness. The population of the study included 311 ABE teachers in secondary teaching positions in a Louisiana school system. There were 102 respondents who participated in this study.
The instrument used was a survey based on the Kotrlik-Redmann Technology Integration Model (2002). The model includes four levels: exploration, experimentation, adoption, and advanced integration. The instrument contained three multi-item scales: Technology Integration Scale, Barriers to the Integration of Technology Scale, and the Perceived Teaching Effectiveness Scale.

The results of this study found that ABE teachers are not experimenting with the use of technology in part due to lack of integration into the curriculum, and no formal assessment techniques. Implementation into the classroom is higher than integration into the curriculum, so teachers will only do what they know works from experience. Anxieties and lack of comfort with technology are the primary barriers for integration. They feel their teaching style is effective regardless of whether or not they have integrated technology into their classroom.

Mixed perceptions of effectiveness of technology integration are common among popular technologies arising today. One such example is interactive whiteboards, like the SMART Board. An article by Karin Nolan (2008) outlines common uses and teacher concerns about SMART Board use in the music classroom. She found that SMART Boards could be used for student accommodations with visual and hearing disabilities through use of controlling volume, increasing font size, and allowing students to interact kinesthetically. One issue with computer use in the classroom is the wide variety of distractions that can be disruptive to learning in younger students. The interactive whiteboard brings the advantages of the chalkboard, single-window attention span and adds the elements of computer software and Internet access. They also allow for a large range of motivational and creative tools that are easily assessed by the teacher.
Some additional concerns that Nolan found teachers have with interactive whiteboards included cost, free space, and a perceived lack of technology skills. The teachers need understanding of how to set up and troubleshoot the board, as well as have a technical understanding of how to interact with the computer from the board. This implies an understanding of the computer software as well. An additional concern found was teachers’ hesitation to eliminate live musical experiences from the classroom. While some teachers found this to be true, others noted that they do not feel technology replaces musical experiences or quality instruction, but rather enhances them as a supplemental tool.

**Research in Technology Integration**

The use of technology in the classroom can come in a variety of applications. Access, and even training, on computers and different software, is not enough for teachers to begin implementation into the classroom. Training on relevant applications and methods for implementation are needed to prepare teachers to begin using the technology available to them.

Hickey (1997) found that computers could be used as a practical tool for student motivation. Optimal conditions of activity freedom and guided instruction allow teacher’s to use computers as a motivational tool. Hickey examined two 11-year-old boys in the setting of a music composition and improvisation class. They were given a synthesizer and a computer program to record their playing, in which their process of composition and final product could be examined. Hickey found that because the students were attracted to the technology, their motivation and willingness to try new things allowed
them to be more productive and engaged. The two boys had very different learning needs, and the flexibility of the computer/synthesizer allowed differentiated instruction, as well as very different products, to take place in the same classroom.

This flexible and engaging quality of computers allows students to be more creative and perform in new ways (Savage, 2006). Utilizing technology to impact the creative process can facilitate student learning and the output of artistic products. Introducing new technologies alone will not effect a meaningful educational change, but rather it needs to have practical applications in context of the instruction. Savage’s study, which examined the effects of Information and Communication Technologies (ICT) on students between the age of 11 and 16, found that the compositional process and ability to record and examine the product permitted students to engage with their music making on a much deeper level.

In addition to composition benefits, a 2007 examination of literature (Webster) revealed there are other several areas in which computer-based technology can influence music instruction. Internet use has a variety of applications such as supplemental online resources, web-based instruction, and distance learning. While the majority of computer use among teachers was for administrative purposes, music teachers in the UK were found to be using them for composing and performing on a regular basis.

This study also revealed uses for technology that are geared towards evaluation of performance and development of music listening skills. Recordings of rehearsals, performances, and home practice could provide a technological support system for traditional music practices. Computer-assisted instruction such as Interactive Guitar,
Digital Conducting System, and Smart Music provide intelligent accompaniment and evaluation tools.

Tobias (2010) examined musical engagement and learning of secondary students in a songwriting and technology class. This course focused on composing, performing, and recording original music. By examining this specific class, the study was able to look at curricular and pedagogical decisions regarding not just what the students learn, but how it is taught. Teachers with music technology content knowledge alone will not affect the impact of the technology on learning. Rather, a fundamental change in the way we utilize it for instruction in the music classroom is needed in order to address contemporary forms of musical engagement. Additional outcomes of the study include how involvement of technology directly impacts the level of student engagement, and therefore student productivity and creativity.

**Implications for the Study**

The literature suggests several ideas that were closely examined in this study. Several of those studies have examined the same variables, and their relationship to technology use and integration. This line of research is not new, but has never been done specifically in the music education domain. Additionally, impact and effectiveness have been examined outside of the domain as well, with a focus on similar factors to this study. The literature also suggests that pre-service and in-service training varies widely among both music and non-music education students and teachers, alike. Its’ effects on self-efficacy and perceived knowledge/experience are directly related to use and integration.
Chapter Three

Method

Purpose

The purpose of this study was to examine the use of technology by music teachers in K-12 Delaware schools, as determined by factors of accessibility, experience, professional development, grade level, and content area. Perceptions of training needs are considered in regards to implementation into instruction.

Research Questions:

1. What technology is made available to music teachers and how often do they utilize that technology in their classroom instruction?

2. How does accessibility and use of technology affect each other and in what ways do accessibility assist or prevent use of technology in the classroom?

3. What technology training do teachers feel they need in order to implement technology effectively in their classroom?

4. How does technology use differ as a function of years in the field, gender, previous training, grade level, and teaching specialty area?

Participants

The participants of this study (N = 53) were volunteers from the approximately two hundred K-12 music teachers in the state of Delaware. These teachers are currently teaching in public, private, or charter/magnet schools. All teachers must have a valid
teaching certification, be currently employed, and actively teaching music in a classroom setting.

All music specialty areas were included, including instrumental, vocal, general, theory, and technology. Teachers could fall into multiple specialty areas, as well as teach more than one grade level. Of the 53 participants, 23 teach elementary school, 13 teach middle school, 11 teach high school, and 17 teach at multiple grade levels. The age of the teacher, grade level they teach, and subject areas were all factors measured in an effort to determine correlations to technology use in the classroom.

All music teachers registered with the Delaware Music Educators Association (DMEA) were contacted via email, and asked to participate in this study. Participation was voluntary. Additionally, social networking was used to supplement distribution and increase the response rate.

**Measures/Instrumentation**

The primary measure for this study was a questionnaire given to the participants via an online form. The survey covered four major factors, plus teacher demographics. These factors are 1) accessibility, 2) use, 3) technology background/experience, and 4) perceived needs/professional development in the field of classroom technology. An inventory of technologies accessible followed by a Likert-type scale measuring frequency of usage make up the access and use sections of the questionnaire. A scale of previous experience is used to measure both personal and professional experience with each of the technologies, followed by free response questions in regards to professional development experiences and needs.
Development of the Measure

Demographic Information. This section of the questionnaire is intended to gather information on the participants to determine factors that might contribute to, affect, or correlate to technology use in the classroom. There are four questions in this section, looking at demographics more than personal information about the teacher. Years of teaching experience by given ranges and gender are the questions that pertain most specifically to the participants’ personal lives. The other two questions, more pertinent to their teaching situations, ask about grade levels and which subject content area they teach. Both of these questions have multiple answers that could apply.

Accessibility. In this section of the questionnaire, there is a single, check-box list question. This question asks what items of technology are made available to the teacher for use in their classroom/school. The question specifically asks for any item that could be accessed, not just what they currently access on a regular basis. The importance of this question to this study lies in the availability of these technologies, not just in their use. It is important to differentiate between what technology is being used because of availability versus desire to use, and what technology isn’t being used because of a lack of availability versus disinterest in its use.

Technology Use. Technology use has been broken down into three possible categories: computers, music software, and equipment. Each item from the Accessibility section has been organized within each category. In each of these subcategories, a Likert-type scale is used to measure the amount of use in the classroom, if any. Each item will
be separately rated with the following scale degrees: 1) never, 2) infrequently, 3) sometimes, 4) often, and 5) daily. Included in the survey is a legend, which defines each term more specifically by a range of days used.

**Teacher Technology Background/Experience.** This category is measured by a dual Likert-type scale, which presents teachers’ personal and professional technology experiences side-by-side. Each item/area of technology is rated on a 3-point scale for both personal and professional use. 1) No experience, 2) little experience, and 3) above average experience are the three defined levels, and can be ranked in the personal and professional columns. These variables will allow their previous experiences, to be quantified but still differentiated based on the type of experience.

**Teacher Technology Needs and Development.** This section of the survey contains three, open answer questions meant to determine teacher perceptions of needs in regards to technology training and the effectiveness/availability of professional development. The first question asks what professional development the teacher feels they need; the second asks what previous training they have had. Both of these questions are intended to gauge the current state of professional development and how it can, or should be, changed to adequately train our teachers in music technology. These questions provide a clear picture of what professional development teachers have participated in, and in what areas they feel they need additional training.

The third question asks what technologies they would like to implement in their classrooms given appropriate funding. This is intended to be an extension of the
accessibility section of the questionnaire. Through content analysis, this question will be compared to the first section responses to determine if there are any items they wish to use but have no access to. This question provides further insight into the question of accessibility from the standpoint of teachers’ perceived needs.

**Procedures**

The data collection for this study was administered via an electronic questionnaire. An email with a link to the online form was sent to all members of DMEA through the organization’s listserv. In addition, the link was distributed through social networking, targeted at known Delaware music teachers. A request to forward the link to coworkers and friends who fit the limitations of this study was included in the social network distribution. This request was also included in the initial email as well as an automated “thank you” response upon completion of the survey. The issuance of the questionnaire adhered to and complied with all IRB mandates.

**Data Analysis**

To answer the first research question regarding technology use, a descriptive analysis of all variables was conducted to determine the most to least used and accessible technologies. This data will be gathered from the *Accessibility* and *Use* sections of the survey.

To answer the second research question addressing how accessibility relates to use, a correlational analysis was conducted to determine relationship between accessibility and use of technology by teachers in the classroom. This was supplemented
by a content analysis to determine what items, if any, affect one another from each variable.

To answer the third research question, a descriptive analysis was performed on the Teacher Technology Needs and Development section of the survey. A content analysis of all open responses of needs was completed. The variables include training needs as well as accessibility needs. These were compared to the accessibility variable from the Accessibility section of the survey. (Kortlik & Redmann, 2005)

In order to answer the fourth research question, a regression procedure was performed on all demographic information and technology use. Each variable from the research question was extracted and examined to the best combination of variables to predict technology use among the participants.
Chapter 4
Results and Discussion

Purpose

The purpose of this study was to determine use of technology by music teachers in K-12 Delaware schools. The goal of this study was to examine the current state of technology use in Delaware schools, and determine what factors contribute to its use in the music classroom. These factors include age, gender, previous training, comfort level, and teaching specialty area. Relationships between personal and professional uses of technology were examined, as well as how training received impacts the actual implementation of instruction. Training needs of teacher and perceptions of what technology can be used in the music classroom also was addressed to determine if the lack of use is due to lack of knowledge, or lack of awareness of the technology itself.

Research Questions:

1. What technology is made available to music teachers and how often do they utilize that technology in their classroom instruction?
2. How does accessibility and use of technology affect each other and in what ways do accessibility assist or prevent use of technology in the classroom?
3. What technology training do teachers feel they need in order to implement technology effectively in their classroom?
4. How does technology use differ as a function of years in the field, gender, previous training, grade level, and teaching specialty area?
Results

To answer the first research question, descriptive statistics were used to determine the accessibility of technology to music teachers, and how often those technologies were actually implemented in their classroom instruction (See Table 1). Access to classroom computers among participants was 75.5% while less than half had access to computer labs or iPads. Despite the fact that teachers may not all have regular access to computers of some kind, 100% of the participants reported having access to the Internet in some form. Internet access being readily available to all, not all services were equally available. This could be the result of lack of firewall permissions or subscriptions. YouTube access and Google Docs were only for two-thirds of the participants. Projectors, presentation software, and notation software were among the most commonly accessible technologies, while recording equipment varied greatly. Approximately 65% of teachers had access to multiple pieces of sound/recording equipment. Microphones access by 64.2% implies almost all who had any sound equipment had microphones as well, while only 17% could utilize them for recording with digital audio workstations.

A secondary analysis of overall access among teachers of different grade levels revealed that of high school teachers had more access to technology than both elementary and middle school teachers, as well as those who teach at multiple levels. A one-way ANOVA was calculated on overall access, and the analysis was significant, $F(4,46) = 2.866, p = .033$. 
Table 1

Areas of Technology Access

<table>
<thead>
<tr>
<th>Technology</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internet Access</td>
<td>53</td>
<td>100</td>
</tr>
<tr>
<td>Projector</td>
<td>41</td>
<td>77.4</td>
</tr>
<tr>
<td>Classroom Computer</td>
<td>40</td>
<td>75.5</td>
</tr>
<tr>
<td>Presentation Software</td>
<td>39</td>
<td>73.6</td>
</tr>
<tr>
<td>Music Notation Software</td>
<td>37</td>
<td>69.8</td>
</tr>
<tr>
<td>YouTube Access (firewall permission)</td>
<td>36</td>
<td>67.9</td>
</tr>
<tr>
<td>Sound/Speaker System</td>
<td>35</td>
<td>66.0</td>
</tr>
<tr>
<td>Google Docs/Google Drive</td>
<td>35</td>
<td>66.0</td>
</tr>
<tr>
<td>Microphones</td>
<td>34</td>
<td>64.2</td>
</tr>
<tr>
<td>SMART Board</td>
<td>25</td>
<td>47.2</td>
</tr>
<tr>
<td>Class Website</td>
<td>25</td>
<td>47.2</td>
</tr>
<tr>
<td>Computer Lab</td>
<td>22</td>
<td>41.5</td>
</tr>
<tr>
<td>iPads/iPods/Tablets</td>
<td>21</td>
<td>39.6</td>
</tr>
<tr>
<td>Video Cameras</td>
<td>20</td>
<td>37.7</td>
</tr>
<tr>
<td>Digital Tuner</td>
<td>20</td>
<td>37.7</td>
</tr>
<tr>
<td>Recording Equipment</td>
<td>19</td>
<td>35.9</td>
</tr>
<tr>
<td>Mixer</td>
<td>18</td>
<td>34.0</td>
</tr>
<tr>
<td>ELMO</td>
<td>18</td>
<td>34.0</td>
</tr>
<tr>
<td>MIDI Keyboards</td>
<td>17</td>
<td>32.1</td>
</tr>
<tr>
<td>Video Editing Software</td>
<td>16</td>
<td>30.2</td>
</tr>
<tr>
<td>Smart Music</td>
<td>9</td>
<td>17.0</td>
</tr>
<tr>
<td>Digital Audio Workstations</td>
<td>9</td>
<td>17.0</td>
</tr>
<tr>
<td>Oscilloscope</td>
<td>1</td>
<td>1.9</td>
</tr>
<tr>
<td>Harmony Director</td>
<td>1</td>
<td>1.9</td>
</tr>
</tbody>
</table>
Table 2

Frequency of Technology Use

<table>
<thead>
<tr>
<th>Technology</th>
<th>Mean</th>
<th>Never</th>
<th>Infrequently</th>
<th>Sometimes</th>
<th>Often</th>
<th>Daily</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Computers</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SMART Board</td>
<td>232.4</td>
<td>15.1</td>
<td>11.3</td>
<td>20.8</td>
<td>32.1</td>
<td>20.8</td>
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<tr>
<td>Class Website</td>
<td>160.4</td>
<td>35.8</td>
<td>7.5</td>
<td>22.6</td>
<td>28.3</td>
<td>5.7</td>
</tr>
<tr>
<td>Presentation Software</td>
<td>151.2</td>
<td>26.4</td>
<td>20.8</td>
<td>34</td>
<td>13.2</td>
<td>5.7</td>
</tr>
<tr>
<td>Google Docs</td>
<td>117.1</td>
<td>41.5</td>
<td>22.6</td>
<td>17</td>
<td>15.1</td>
<td>3.8</td>
</tr>
<tr>
<td>YouTube</td>
<td>103.6</td>
<td>62.3</td>
<td>1.9</td>
<td>17</td>
<td>7.5</td>
<td>11.3</td>
</tr>
<tr>
<td>ELMO</td>
<td>79.3</td>
<td>56.6</td>
<td>15.1</td>
<td>22.6</td>
<td>3.8</td>
<td>1.9</td>
</tr>
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<td>Video Editing</td>
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<td>58.5</td>
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<td>13.2</td>
<td>3.8</td>
<td>3.8</td>
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<td>Projector</td>
<td>71.8</td>
<td>66</td>
<td>15.1</td>
<td>5.7</td>
<td>7.5</td>
<td>5.7</td>
</tr>
<tr>
<td>Class Computer</td>
<td>66.1</td>
<td>67.9</td>
<td>15.1</td>
<td>3.8</td>
<td>9.4</td>
<td>3.8</td>
</tr>
<tr>
<td>Computer Lab</td>
<td>38</td>
<td>86.8</td>
<td>5.7</td>
<td>0</td>
<td>5.7</td>
<td>3.8</td>
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<tr>
<td>iPads/Tablets</td>
<td>3.8</td>
<td>98.1</td>
<td>0</td>
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<td>0</td>
<td>0</td>
</tr>
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<td>100</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Music Software</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notation Software</td>
<td>284.8</td>
<td>18.9</td>
<td>1.9</td>
<td>11.3</td>
<td>11.3</td>
<td>56.6</td>
</tr>
<tr>
<td>DAWs</td>
<td>118</td>
<td>54.7</td>
<td>11.3</td>
<td>11.3</td>
<td>7.5</td>
<td>15.4</td>
</tr>
<tr>
<td>Harmony Director</td>
<td>113</td>
<td>56.6</td>
<td>7.5</td>
<td>13.2</td>
<td>11.3</td>
<td>11.3</td>
</tr>
<tr>
<td>Smart Music</td>
<td>75.4</td>
<td>62.3</td>
<td>15.1</td>
<td>11.3</td>
<td>7.5</td>
<td>3.8</td>
</tr>
<tr>
<td><strong>Equipment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MIDI Keyboard</td>
<td>332.3</td>
<td>3.8</td>
<td>5.7</td>
<td>7.5</td>
<td>20.8</td>
<td>62.3</td>
</tr>
<tr>
<td>Microphones</td>
<td>211.2</td>
<td>28.3</td>
<td>3.8</td>
<td>18.9</td>
<td>26.4</td>
<td>22.6</td>
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<td>Mixer</td>
<td>179.4</td>
<td>24.5</td>
<td>24.5</td>
<td>15.1</td>
<td>18.9</td>
<td>17</td>
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<tr>
<td>Digital Tuner</td>
<td>168</td>
<td>50.9</td>
<td>1.9</td>
<td>3.8</td>
<td>15.1</td>
<td>28.3</td>
</tr>
<tr>
<td>Video Camera</td>
<td>137.7</td>
<td>52.8</td>
<td>5.7</td>
<td>15.1</td>
<td>3.8</td>
<td>22.6</td>
</tr>
<tr>
<td>Recording Equipment</td>
<td>128.2</td>
<td>41.5</td>
<td>20.8</td>
<td>13.2</td>
<td>17</td>
<td>7.5</td>
</tr>
<tr>
<td>Oscilloscope</td>
<td>49.2</td>
<td>77.4</td>
<td>5.7</td>
<td>9.4</td>
<td>5.7</td>
<td>1.9</td>
</tr>
<tr>
<td>Sound/Speaker System</td>
<td>47.1</td>
<td>66</td>
<td>22.6</td>
<td>9.4</td>
<td>1.9</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 2 presents music teacher technology use. Approximately 65% of those with access to digital audio workstations do in fact use them to some extent, while 22.6% of them only using it often or daily. MIDI keyboards are used by almost all of those who
have access to them, and largely on a regular basis. Additionally, less than half of the teachers use programs like Smart Music and Harmony Director at all. Of those who do, 11.3% use Smart Music and 22.6% use Harmony Director frequently. Assistive devices like tuners and oscilloscopes are only used by half of the participants, and only 28.3% use them daily as a part of their instruction. Despite iPad access by 39.6% of teachers, only 1.9% uses them in their classroom “sometimes.” Computers, which over three-quarters of the participants have some access to, are only used by one-third of teachers, of which the top 13.2% are using them on a regular basis.

To answer the second research question, a correlation between accessibility and use was examined at a variety of levels (See Table 3). Overall access and use were assessed, as well as separating both factors into recording equipment and other technology categories.

Table 3
Correlations* Among Access and Use of Technology Variables

<table>
<thead>
<tr>
<th></th>
<th>Overall Use</th>
<th>Recording Equipment Access</th>
<th>Recording Equipment Use</th>
<th>Other Technology Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Access</td>
<td>.71</td>
<td>.87</td>
<td>.55</td>
<td>.68</td>
</tr>
<tr>
<td>Overall Use</td>
<td>.70</td>
<td>.70</td>
<td>.78</td>
<td>.95</td>
</tr>
<tr>
<td>Recording Equipment Access</td>
<td>.46</td>
<td>.46</td>
<td>.71</td>
<td>.56</td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.01 level (2-tailed).
For overall technology use in the classroom, all correlations obtained very strong coefficients with the predictor variables. The correlations varied in strength from a high of $r = .95$ with other technology use, .78 with recording equipment use, and .71 and .70 for overall access and recording equipment access, respectively. The strongest correlation with overall access was for recording equipment access (.87), followed by .68 and .55 for other technology use. Those with access to Smart Music and MIDI Keyboards correlated strongest with overall use, with .57 and .59, respectively. Recording equipment access correlated with recording equipment use at .46, while other technologies correlated at .71.

The third research question addresses teacher technology training needs. A content analysis was performed on free response questions (See Table 4). The most sought after training by teachers was how to implement technology in the classroom, and how to apply the other technology training they have received. Over twenty-four percent of teachers found they were lacking skills in application and implementation understanding, rather than the need for more information about specific technologies. Many teachers have found they are lacking in specific skills that they feel they need to be trained on in order to begin implementation into their classroom.
Table 4

Perceived Technology Training Needs by Teachers

<table>
<thead>
<tr>
<th>Technology</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application and Implementation</td>
<td>13</td>
<td>24.5</td>
</tr>
<tr>
<td>General Music Technology</td>
<td>7</td>
<td>13.2</td>
</tr>
<tr>
<td>Recording/Audio Production</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recording Technology</td>
<td>11</td>
<td>20.8</td>
</tr>
<tr>
<td>GarageBand</td>
<td>5</td>
<td>9.4</td>
</tr>
<tr>
<td>Sound System Operation</td>
<td>5</td>
<td>9.4</td>
</tr>
<tr>
<td>MIDI Keyboards and Sequencing</td>
<td>1</td>
<td>1.9</td>
</tr>
<tr>
<td>Music Education Software/Hardware</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notation Software</td>
<td>9</td>
<td>17.0</td>
</tr>
<tr>
<td>iPad and Apps</td>
<td>8</td>
<td>15.1</td>
</tr>
<tr>
<td>Smart Music</td>
<td>5</td>
<td>9.4</td>
</tr>
<tr>
<td>Educational Technology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal Website Development</td>
<td>4</td>
<td>7.6</td>
</tr>
<tr>
<td>SMART Board Implementation</td>
<td>2</td>
<td>3.8</td>
</tr>
<tr>
<td>Video Editing Software</td>
<td>2</td>
<td>3.8</td>
</tr>
<tr>
<td>Social Media Integration</td>
<td>2</td>
<td>3.8</td>
</tr>
</tbody>
</table>

Of the specific technologies, recording skills was the area where most teachers felt a deficit in training. Approximately 21% were interested in overall recording skills, while GarageBand use and better understanding of sound system operation were sought after by 9.4%, each. MIDI keyboards and sequencing training were only mentioned by 1.9% of teachers for this question, although additional teacher interest may be hidden in the general music technology and digital audio workstation interest.
Seventeen percent of teachers feel they need additional training in notation software, but largely the implementation of the software into the curriculum, more so than actual operation of the program. Many teachers found they wanted to utilize notation software to teach composition, but didn’t have the implementation skills or experience. A similar pattern was found with iPads and apps. Approximately 15% of teachers felt they didn’t have adequate training on the implementation and application of iPad apps into their lessons. This desire for implementation training over operation can be found in teachers’ need for further training on SMART Boards and social media integration.

In order to address research question four, about how technology use differs as a function of years in the field, gender, previous training, grade level, and teaching specialty area, a simultaneous multiple regression procedure was conducted. A one-way ANOVA was calculated on technology use. The analysis was significant, $F(10,42) = 7.552, p = .000$. Because some teachers in the sample taught at multiple levels and multiple classroom settings, variables for each setting were included in the analysis (See Table 5).
Table 5

Regression Analysis Summary for Technology Use by Years Teaching, Gender, Previous Training/Experience, Grade Level, and Classroom Setting

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>Std. Error</th>
<th>ß</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years Teaching</td>
<td>.86</td>
<td>.90</td>
<td>.10</td>
<td>.35</td>
</tr>
<tr>
<td>Gender</td>
<td>4.26</td>
<td>2.90</td>
<td>.15</td>
<td>.15</td>
</tr>
<tr>
<td>Previous Training/Experience</td>
<td>.71</td>
<td>.17</td>
<td>.46</td>
<td>.00</td>
</tr>
<tr>
<td>Grade Level Taught</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elementary School</td>
<td>- .71</td>
<td>5.64</td>
<td>-.026</td>
<td>.90</td>
</tr>
<tr>
<td>Middle School</td>
<td>1.52</td>
<td>5.71</td>
<td>.055</td>
<td>.79</td>
</tr>
<tr>
<td>High School</td>
<td>7.69</td>
<td>5.03</td>
<td>.26</td>
<td>.13</td>
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<tr>
<td>Multiple Levels</td>
<td>-5.54</td>
<td>6.78</td>
<td>-.19</td>
<td>.42</td>
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<tr>
<td>Classroom Setting</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classroom Music</td>
<td>7.65</td>
<td>5.47</td>
<td>.13</td>
<td>.17</td>
</tr>
<tr>
<td>Ensemble Music</td>
<td>4.83</td>
<td>6.95</td>
<td>.08</td>
<td>.49</td>
</tr>
<tr>
<td>Music Technology</td>
<td>15.81</td>
<td>5.04</td>
<td>.34</td>
<td>.00</td>
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</tbody>
</table>

Using Keith’s (1999) rules of thumb regarding magnitudes of beta weights, strong effects (above .25) were obtained between technology use, and the predictors of Previous Training/Experience (standardized beta of .46), followed by Music Technology class (.34), and High School Grade Level (.26). Moderate effects were obtained for Multiple Grade Levels (.19), Gender (.15), and Classroom Music (.13). Ensemble Music (.08), Middle School Grade Level (.06), and Elementary School Grade Level (.03) obtained a small but meaningful effect.

Only two predictors, Previous Training/Experience and Music Technology Class, were statistically significant predictors of technology use. The strong beta weight for high school grade level, however, suggests that the lack of additional statistically
significant findings may be due to the small sample size, and other beta weight results suggest non-significant trends predicting technology use among the sample that may be subject to replication using a larger sample.

Table 6
Correlations Among Grade Level and Access and Use Variables

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Elementary School</td>
<td>-.18</td>
<td>-.22</td>
<td>-.19</td>
<td>-.02</td>
<td>-.12</td>
<td>-.28*</td>
</tr>
<tr>
<td>Middle School</td>
<td>.09</td>
<td>-.29*</td>
<td>-.03</td>
<td>-.16</td>
<td>.14</td>
<td>-.31*</td>
</tr>
<tr>
<td>High School</td>
<td>.39**</td>
<td>.52**</td>
<td>.40**</td>
<td>.24</td>
<td>.32*</td>
<td>.57**</td>
</tr>
<tr>
<td>Multiple Levels</td>
<td>.12</td>
<td>-.13</td>
<td>.08</td>
<td>-.04</td>
<td>.15</td>
<td>-.16</td>
</tr>
</tbody>
</table>

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

A secondary analysis of access and use by grade level revealed strong correlations between High School level and both access and use. High School was a strong predictor of Overall Access (.39), Recording Equipment Access (.40) and Non-Recording Equipment Access (.32). A strong correlation also exists between High School and Overall Use (.52) and Non-Recording Equipment Use (.57). Middle School had a less strong, but significant, correlation to Overall Use (-.29) and Non-Recording Equipment Use (-.31). A similar relationship was found between Elementary School and Non-
Recording Gear (-.28). No significant relationships were found among those teachers who teach multiple grade levels.

**Discussion**

Without access to technology, it cannot be used. For without access to desired resources, a teacher, whether interested or not, will not be able to utilize what they do not have. It is evident that access to technology does not always imply use. Many teachers have resources at their disposal, but due to a variety of factors, may not choose to integrate them into their classroom.

One hundred percent of teachers have access to the Internet, but less than half use the resources made available by access to it each day. Almost all teachers have at least a classroom computer, but only a third use it at all, and just 13.2% use it regularly. This paradox between high access and low use has be found in many studies, including those by Cuban, Kirkpatrick, & Peck by (2001) and Mundy, Kupczynski, & Kee (2012). Both studies revealed that despite high access rarely led to widespread and frequent use. Mundy, Kupczynski, & Kee found that less than half the teachers in their study used computers more than once a week, similar to the data revealed in this study (32.1%). This tells us that having computers in each classroom does not mean teachers will actually utilize them.

As for software, most of the teachers are using their computers in conjunction with SMART Boards and projectors to project presentation software, music notation software, Smart Music, and less often, YouTube. Music notation software is the most often used piece of software by Delaware music teachers, with 56.6% using it daily.
Many teachers have access to some form of recording equipment, and for those who do, they tend to use them in some fashion. The ability to implement these technologies often leads to actual implementation. There is a high usage rate of all recording equipment, from microphones to MIDI keyboards, and despite the lower access percentages, those who can, will utilize them to some degree. In contrast, access programs such as Smart Music and Harmony Director does not correlate highly with use of those programs. Many teachers who have access to this software lack the training, experience, or efficacy to implement them into their instruction.

As expected, overall technology use is highly correlated with access. While general technology access resulted in a correlation of .71, recording equipment correlated similarly at .70. Correlation with non-recording technologies is substantially higher, at .95. This high level of correlation, coupled with the usage data, implies that there is a greater use of non-recording technologies when available, than those found with just recording equipment availability. Recording equipment, while often available to teachers, is not used as frequently. One factor in this is the lack of training in recording and associated skills.

Approximately 20% of teachers said they felt they needed training in recording skills specifically, while just under half of all participants implied professional development needs that related to this equipment. Many teachers have access to computer labs, MIDI technology, GarageBand and other DAWs, and sound equipment, but lack the training to utilize them. Often, schools will have this equipment, but teachers do not have enough experience using them to feel comfortable implementing them. Additionally,
teachers might have access to equipment that they do not know can be used for their interests, and therefore, don’t even know they need the training on this equipment.

Johnson-Martin (2012) found that there was no significant relationship between technology training and level of implementation. Contrary to the findings of this study, Johnson-Martin found that in order to effect change in level of use, training must address their perceived efficacy as well as their attitudes. Training alone will not increase use. Teachers’ motivation and beliefs regarding the use of the technology has a strong significant relationship to technology use. Duhon found common findings in a similar study performed in 2010.

As revealed in the third research question, additional training on technology was not needed, but rather how to implement them and in what ways they can be utilized in preexisting curriculum. Software such as GarageBand and music notation software are often taught in professional development, and teachers feel they understand the software. They lack the training in how to apply these skills to their lessons, and in what ways they can bring these technologies to their students in context of course material. iPad apps and notation software are the most often in-service trained technologies, while application and implementation of these are among the highest needs perceived by teachers. These findings differ from a 2013 study (Tweed) where training on technology implementation did not translate to significant levels of implementation in the classroom. In that study, professional development quality was examined, and found that programs are needed that combine integration techniques combined with self-efficacy support.

The results found by answering the fourth research question revealed that both previous training/experience and teachers who teach a music technology class were more
likely to utilize technology in the classroom. Additionally, teaching at the high school level was a strong indicator of technology use while middle and elementary school only had a small, but meaningful, effect. Both access and use of all technologies were greater in high schools, except for recording equipment access. There was low access to all technologies in middle and elementary schools, but significant use of the non-recording technologies available was found. Overall, use of recording technology was low, despite high schools having significant access.

Tweed (2013) found that gender had no significant effect on technology use, while this study found that there was a moderate (standardized *beta* of .15) effect. This predictor is not nearly as strong as other factors.

These conclusions were drawn based on the analysis of data available. Due to the small sample size, the strength of some findings may be obscured by non-significant *betas*. Additionally, some latent correlations may exist but are not revealed due to insufficient data. This could also result in other non-significant correlations.
Summary

The population used in this study was two hundred K-12 music teachers in the state of Delaware. Participants ($N = 53$) came across multiple grade levels, specialty areas, and differing years of experience. These teachers teach in public, private, or charter/magnet schools. All teachers are currently employed, and actively teaching music in a classroom setting.

The primary measure for this study was a questionnaire given to the participants via an online form. The survey covered four major factors, plus teacher demographics. These factors are 1) accessibility, 2) use, 3) technology background/experience, and 4) perceived needs/professional development in the field of classroom technology. An inventory of technologies accessible followed by a Likert-type scale measuring frequency of usage make up the access and use sections of the questionnaire. A scale of previous experience was used to measure both personal and professional experience with each of the technologies, followed by free response questions in regards to professional development experiences and needs.

Conclusions

The purpose of this study was to determine how technology use of Delaware music teachers was affected by a variety of factors. One of the major factors examined was accessibility to technology. The data from this study suggests that access is not an
indicator of use, and that there is no significant relationship between the two factors.

Logic dictates that you cannot use technology if you do not have access to the resources.

This statement is true, and the findings from this study support that notion. Conversely, just because a teacher has access to technology, does not ensure they are going to use it.

The evidence from this research suggests that access does not determine or predict usage.

However, this study found that access to recording equipment could be an indicator of overall technology use. This implies that those teachers with access to recording equipment, such as microphones, DAWs, and sound systems, are more likely to use these items, as well as additional technology in their classrooms. Teachers who have purchased this equipment, or already have it in inventory in their school, are likely to have a supportive environment for technology use, and even previous experience utilizing it. The majority of teachers who have access to DAWs and MIDI keyboards use them on a regular basis, while less than half use software such as Smart Music and Harmony Director. There is a strong relationship between overall access and overall use, and recording equipment access and overall use, yet access to recording equipment has a low relationship to recording equipment use, itself.

Another major factor examined in this study was the current trends in music technology professional development as well as perceived training needs of teachers. The results of this study found that teachers received training on use and operation of certain technologies, while application and implementation were often not included. Overall, teachers found that they have adequate training on software, such as GarageBand and music notation software, but often lack the skills or knowledge of how to incorporate them into their instruction. Software is the most common subject of training, while
implementation of the software was the most desired. Hardware, such as recording and sound system equipment, had the least amount of training, while the desire for operation of these technologies was highly wanted.

The data in this study suggests that previous training and experience is a strong predictor of technology use, despite alternative findings in other studies. Teachers, with previous experience with technology, both personally and professionally, are more likely to utilize technology in their classrooms. Professional development training alone may not indicate use, as many teachers do not find their training to inform implementation techniques. For training and experience to effect a change in implementation habits, comfort and self-efficacy must be present.

**Implications for Future Research**

A limitation for the generalizability for this study was the small sample size. There are approximately 200 certified K-12 music educators in the state of Delaware, and only 53 volunteered to participate in this study. This was partially due to the difficulty in contacting and following up with the teachers. With more time and resources, a paper version of this questionnaire could be administered in conjunction with the online survey to achieve a greater level of participation. In doing so, the likelihood of teachers receiving the questionnaire would increase, and could be followed up with on a more personal level. Emails were sent from the administration of the Delaware Music Educators Association (DMEA), as well as the investigator, in addition to social networking. The social networking yielded a far superior response rate, indicating a possible focal point of distribution in the future as well.
In addition to a larger sample size, supplementing factor investigation with self-efficacy measures, age, and a more detailed breakdown of accessed and used technologies could provide more information and a broader picture of the current state of technology use in the schools.

This study could also be replicated on a larger scale, with a regional or national scope. Given a more reliable distribution and data gathering methodology, more states could be included, and additional factors measured, such as socioeconomic status, school budgets, state-level professional development opportunities, and national conferences/workshops.

**Implications for Practice**

There is a dichotomy between access and use of technology in the Delaware music teacher’s classroom. Resources like YouTube and Google Docs are very accessible by teachers, but rarely used in the classroom. Computers and video cameras are also very available, but do not get utilized nearly as much as they could be. In fact, computer use is very low among teachers, despite almost all having access to them.

Without proper training on these technologies, teachers are not likely to take advantage of them in the classroom. Proper training does not include the occasional professional development workshop on teaching how to write music in Sibelius; but rather, methods on how to implement music notation software into a general music class to aide in teaching composition. Furthermore, many teachers feel they do not have issues of access, but of what to do with all of the technology they do have. Technology training
can better serve the music educator by addressing their specific needs: application and implementation.

Another implication of this study is that recording technology access and use, both lead to further use of overall technology. Those teachers who have recording and sound equipment tend to use it, and other technology, more often than teachers who have access to other hardware and software. Many teachers who have SMART Boards use their interactive white board often, but do not branch out into other areas of technology, even with high access. Teachers that utilize MIDI keyboards, in turn use DAWs, microphones, sound systems, etc. Often, they are more inclined to use other technologies that compliment this curriculum and line of teaching.

These results can suggest and inform further policy for both technology purchasing and training. If the goal of the administration is to utilize pre-existing technology, or to justify further purchases, it is clear that certain technologies are being used more often than others. The purchase of, and training for, recording equipment may lead to a more frequent overall use of technologies.

The data from this research has found that many resources are being under utilized in the classroom. While trends to include programs like Smart Music, Harmony Director, and GarageBand into the curriculum are on the rise, teachers in the state of Delaware seem to be behind the curve. Even the inclusion of computers into regular classroom instruction is minimal. Professional development the teachers are receiving is not making more teachers use technology, but instead leave them not knowing what to do with the resources they learn about.
It is also evident that high school teachers are more inclined to utilize technology because they have more ready access to the equipment and resources they desire. The high schools are the first to receive new equipment. Increasing access for elementary and middle schools could result in a greater implementation of technology in the classroom. Because many of the existing technologies are geared for younger students, such as SMART Board programs, iPad apps, and software like Groovy Music, it would make sense to get these technologies in the hands of teachers of all grade levels, along with appropriate implementation training.

Teacher training is currently focused on content knowledge and tool competency. The perceived needs of music teachers include implementation and application training, as pertaining to their specific classroom settings. It is important that training be focused on how the teacher can implement technology into their instruction. Given the proper pedagogical tools, currently accessible technologies may be utilized and applied to enhance and supplement current instructional techniques.
References


Marcum, C. E. (2010). Teacher and administrator perceptions of technology use in two West Virginia middle schools. Doctoral dissertation. Received from ProQuest Dissertations and Theses. (UMI 3448195)


Tweed, S. (2013). Technology implementation: Teacher age, experience, self-efficacy, and professional development as related to classroom technology integration. Doctoral dissertation. Received from ProQuest Dissertations and Theses. (UMI 3570301)
Technology Use in the Music Classroom Questionnaire

DEMOGRAPHIC INFORMATION

Gender
- □ Male
- □ Female

Years of teaching experience
- □ 5 and below
- □ 6-10
- □ 11-15
- □ 16-20
- □ 21 and above

What grade level do you currently teach? (check all that apply)
- □ Elementary School (K-5)
- □ Middle School (6-8)
- □ High School (9-12)

What subject(s) do you currently teach? (check all that apply)
- □ Instrumental Ensemble
- □ Vocal Ensemble
- □ General Music
- □ Music Theory
- □ Music Technology/Audio Production
- □ Music Appreciation
- □ Other Ensemble (Guitar/Recorder/etc)

ACCESSIBILITY

Which of the following do you have access to in your classroom/school? Check all that you could gain access to in your classroom/school. (check all that apply)
- □ Music Notation Software (Sibelius/Finale/etc)
- □ SmartMusic
- □ Harmony Director
- □ Digital Audio Workstations (ProTools/Logic/GarageBand/Audacity)
- □ MIDI Keyboards
- □ Microphones
- □ Recording Equipment
- □ Mixer
- □ Sound/Speaker System
- □ Digital Tuner
- □ Oscilloscope
- □ Class Website
- □ Classroom Computer
- □ Computer lab (desktop/laptop)
- □ Internet access
- □ YouTube access (firewall permission)
- □ Presentation Software (PowerPoint/Keynote/Prezi)
- □ Google Docs/Google Drive
- □ Video Editing Software (Windows Movie Maker/iMovie/Final Cut)
- □ SMARTboard
- □ Projector
- □ ELMO
- □ Video Cameras
- □ iPads/iPods/Tablets
TECHNOLOGY USE

Place an X in the appropriate column on the chart that best describes the frequency of use for each of the following technologies in your classroom.

Never = 0 times a year
Infrequently = 1-2 times a year
Sometimes = 1-2 times a month
Often = 1-2 times a week
Daily = 3+ times a week

### Computers

<table>
<thead>
<tr>
<th>Technology</th>
<th>Never</th>
<th>Infrequently</th>
<th>Sometimes</th>
<th>Often</th>
<th>Daily</th>
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</thead>
<tbody>
<tr>
<td>Classroom Computer</td>
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<tr>
<td>Computer Lab</td>
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<tr>
<td>iPads/iPods/Tablets</td>
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<tr>
<td>Class Website</td>
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<td></td>
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<tr>
<td>Internet access</td>
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<tr>
<td>YouTube access</td>
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<tr>
<td>Google Docs/Google Drive</td>
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<tr>
<td>Presentation Software (PowerPoint/Keynote/Prezi)</td>
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<tr>
<td>Video Editing Software (Windows Movie Maker/iMovie/Final Cut)</td>
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<tr>
<td>SMARTboard</td>
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<tr>
<td>ELMO</td>
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### Music Software

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<thead>
<tr>
<th>Software</th>
<th>Never</th>
<th>Infrequently</th>
<th>Sometimes</th>
<th>Often</th>
<th>Daily</th>
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</thead>
<tbody>
<tr>
<td>Music Notation Software (Sibelius/Finale)</td>
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<tr>
<td>Digital Audio Workstations (ProTools/Logic Pro/GarageBand/Audacity)</td>
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<tr>
<td>SmartMusic</td>
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<tr>
<td>Harmony Director</td>
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<tr>
<td>iPad apps (music education specific)</td>
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### Equipment

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<tr>
<th>Equipment</th>
<th>Never</th>
<th>Infrequently</th>
<th>Sometimes</th>
<th>Often</th>
<th>Daily</th>
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</thead>
<tbody>
<tr>
<td>Microphones</td>
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<tr>
<td>Recording Equipment</td>
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<tr>
<td>Mixer</td>
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<tr>
<td>Sound/Speaker System</td>
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<tr>
<td>MIDI Keyboards</td>
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<tr>
<td>Video Cameras</td>
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<tr>
<td>Digital Tuner</td>
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<td>Oscilloscope</td>
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</table>
**TEACHER TECHNOLOGY BACKGROUND/EXPERIENCE**

Comparing your personal and professional use of technology, circle your self perceived experience in the following areas of technology.

<table>
<thead>
<tr>
<th>Personal Use</th>
<th>No Experience</th>
<th>Little Experience</th>
<th>Above Average Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Website</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>YouTube</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Google Docs/Google Drive</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Presentation Software</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>(PowerPoint/Keynote/Prezi)</td>
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<tr>
<td>iPad/Tablet</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Video Editing Software</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>(Windows Movie Maker/iMovie/Final Cut)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Video Cameras</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<tr>
<td>Music Notation Software</td>
<td>1</td>
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<td>3</td>
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<tr>
<td>(Sibelius/Finale)</td>
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<tr>
<td>Digital Audio Workstations</td>
<td>1</td>
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<td>3</td>
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<tr>
<td>(ProTools/Logic/GarageBand/Audacity)</td>
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<tr>
<td>Recording Equipment</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Sound Systems</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>MIDI Keyboards</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Professional Use</td>
<td>No Experience</td>
<td>Little Experience</td>
<td>Above Average Experience</td>
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<td>3</td>
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</tbody>
</table>
TEACHER TECHNOLOGY NEEDS AND DEVELOPMENT

Through in-service training and/or professional development, what training do you feel you need to increase your awareness and ability in the field of educational and/or music technology?

_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________

What in-service training programs, workshops, courses, professional development seminars have you taken to increase your knowledge and awareness of music technology?

_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________

Given appropriate funding, what technology would you like to include in your classroom that you currently do not have available to you?

_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
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_________________________________________________________________________
APPENDIX B

EMAIL CORRESPONDENCE
Email Correspondence

The following email was sent to Delaware K-12 music educators.

Hello Music Teachers,

My name is Steve Scher, and I am an alumnus of the University of Delaware, where I received my B.M. in Music Education. I am currently working on my Masters in Music Education at the University of Miami Frost School of Music. For my masters thesis, I am doing a research study called *Music Technology in the Classroom: Use, Accessibility, Self-Efficacy, and Professional Development of Delaware K-12 Music Educators*. As it says in the title, I am looking into the current state of technology in music classrooms, and what factors may affect teachers' use of that technology.

Please continue reading, **ONLY** if you are a **K-12 music teacher in the state of Delaware**. This study is looking solely at **K-12 music teachers in the state of Delaware**.

The study will consist of a brief 10 minute survey that can be filled out by following this link: https://www.formstack.com/forms/?1685396-oe5qRDaKNZ

I would appreciate if you could take the time to participate in this study, which will hopefully have implications that can/will directly impact you and your classroom. To ensure the best results, I am hoping to achieve maximum coverage of K-12 music teachers throughout the state. One way to make this exposure possible would be if you could **please forward this email** to all coworkers in your school, district, and any other music teacher friends you have that are currently teaching in the state of Delaware. In doing so, please invite them to **pass this survey along** to their coworkers and friends.

Thank you very much for your participation in my research study, and look forward to seeing the results!
APPENDIX C

INFORMED CONSENT FORM
University of Miami
CONSENT TO PARTICIPATE IN A RESEARCH STUDY
Music Technology in the Classroom:
Use, Accessibility, Self-Efficacy, and Professional Development of Delaware K-12 Music Educators

The following information describes the research study in which you are being asked to participate. Please read the information carefully. If you agree to participate, return of the questionnaire will be considered your consent to participate.

PURPOSE OF STUDY:
You are being asked to participate in a research study. The purpose of this study is: to determine what factors influence the use of technology in music classrooms. This can include access to equipment, teacher knowledge, previous training with technology, and classroom specific needs.

You are being asked to be in the study because: this study is focused on K-12 music teachers in the state of Delaware, and you fit those parameters.

PROCEDURES:
• All participants must be K-12 music teachers in the state of Delaware.
• The study will consist of a single questionnaire, taking approximately 10-15 minutes to fill out. There will be no follow up questionnaire, or further involvement upon completion of the questionnaire. Please either mail the completed questionnaire in the included, pre-paid postage envelope, or complete the questionnaire online at http://goo.gl/UEtmUk
• Questions will pertain to technology use, accessibility, self-efficacy, previous training, and professional development.
• No personal information, other than basic demographics, will be asked for, or used, at any point in the study.

RISKS AND/OR DISCOMFORTS:
We do not anticipate you will experience any personal risk or discomfort from taking part in this study.

BENEFITS:
No benefit can be promised to you from your participation in this study. The study is expected to benefit future policy regarding technology training for teachers and implementation in the classroom in the state of Delaware by examining existing levels of use and desired use by teachers. This can also reveal gaps between teachers’ interest in technology use and proper training.
CONFIDENTIALITY:
No names, or other personal identification will be used at any point in this study. Participants will remain unnamed and anonymous throughout the duration of the study, and only the data provided in the questionnaire will be used. This data is only accessible by the investigators of this study, Steven Scher and Dr. Stephen Zdzinski.

COMPENSATION:
There will be no compensation for your participation in this research study.

RIGHT TO DECLINE OR WITHDRAW:
Your participation in this study is voluntary. You are free to refuse to participate in the study or withdraw your consent at any time during the study.

CONTACT INFORMATION:
Steven Scher, (516) 238-0251 or Dr. Stephen Zdzinski, (305) 284-6658, will gladly answer any questions you may have concerning the purpose, procedures, and outcome of this project. If you have questions about your rights as a research subject you may contact Human Subjects Research Office at the University of Miami, at (305) 243-3195 or hsro@med.miami.edu.

PARTICIPANT AGREEMENT:
I have read the information in this consent form and agree to participate in this study. I have had the chance to ask any questions I have about this study. Please keep a copy of this for your personal records. Return/completion of the questionnaire is considered your consent to participate.