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An Exploration of the Use of and the Attitudes Toward Technology in First-Year Instrumental Music

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AN EXPLORATION OF THE USE OF AND THE ATTITUDES TOWARD TECHNOLOGY IN FIRST-YEAR INSTRUMENTAL MUSIC

by

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AN EXPLORATION OF THE USE OF AND THE ATTITUDES TOWARD TECHNOLOGY IN FIRST-YEAR INSTRUMENTAL MUSIC

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The purpose of this study was to determine what technologies are used in first-year instrumental music and to examine factors that influence the attitudes of teachers, students, and parents toward the use of those technologies. Many devices, software, and applications have been developed to aid instrumental students in their learning. However, because of the unique format of most beginning programs, it is unclear what types of technology are actually being used and what attitudes prevail for those involved in using technology. Two researcher-designed questionnaires, the *Technology in Music Usage Questionnaire* (TMUQ) and the *Technology in Music Attitude Questionnaire* (TMAQ), were administered to a sample of teachers, students, and parents associated with first-year elementary instrumental music in a large, Midwestern urban school district. Results indicated that while most teachers use technology in class (87.0%), it is generally only used up to a third of the class period (75.0%). Supplemental materials found within traditional method books account for the majority of technologies used in class (82.6%) and assigned for practice (39.1%), though a considerable portion of teachers (69.6%) does not assign technology for practice. Multilevel linear modeling revealed that effort expectancies, facilitating conditions, and the teacher's technological experience significantly contributed to teacher attitudes toward technology. It was also discovered that performance expectancies and effort expectancies significantly contributed to student

and parent attitudes. Although all participants were found to have positive attitudes toward using technology, results of a one-way ANOVA revealed a significant difference between the attitude scores of teachers and students. Finally, bivariate correlations revealed no statistically significant relationships between the attitudes of participants and the time spent using technology either in class or in practice. Based on the results of the study, recommendations include the need for teacher selection of technologies to be individualized and voluntary. Professional development is necessary for teachers to become familiar with available resources and best practices for implementation. Future studies are needed to investigate whether the use of technology influences student achievement or motivation for participation in elementary instrumental music.

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I want to thank my beautiful daughters, Ellie and Brynn, for serving as patient reminders of the necessity for me to finish and achieve the goals I set for myself. Ellie, born six weeks before the start of school, and Brynn, born in the midst of dissertation writing, taught me the value of working efficiently. My reward after long days of teaching, writing, and attending classes, was always to come home to their sweet faces. They are my sources of strength and inspiration, giving balance to my life. I could not have done any of this without them.

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CHAPTER 1

INTRODUCTION TO THE STUDY

Statement of the Problem

Music educators are increasingly relying on various types of technology to facilitate the instruction and assessment of instrumental students both in class and for practice at home. Software, Internet-based programs and resources, and hardware such as computers, tablets, laptops, and mobile devices are becoming more prevalent and accessible in instrumental music settings. Muro (1997) asserted that technology is changing the instructional and performance practices of classroom music and can provide students with motivation for learning. In addition, studies have shown that incorporating technology in the classroom can increase the learning, achievement and motivation of students (Yu, Lai, Tsai, & Chang, 2010; Purcell, 2011). Music teachers use technology to facilitate multiple methods of learning, to save valuable class time, and to extend the reach of the instructor beyond the classroom walls—such as in practice environments.

However, while materials such as the assessment software, *SmartMusic*, contain a growing volume of repertoire geared toward the young instrumental student and appear to be readily available, it is uncertain whether or not teachers working with students who are in the beginning stages of learning to play their instruments are in fact applying and using these technologies as intended (Webster, 2011). Schools are increasingly allocating funds for the acquisition and application of technology for all subjects, so it is important to decipher how those involved with technology perceive its use. Furthermore, it is

estimated that the use of technologies such as social networking, online services, and tablet computers in music settings will continue to increase in the future (Criswell, 2010).

The first year of instrumental music study may be the most critical for students in terms of building motivation to continue with the program, retention, and developing quality technique and routines. Moore (2009) suggested that students in elementary ensembles, such as band and orchestra, face challenges that students in middle and high school environments do not. Limited rehearsal space, pull-out schedules where students meet less frequently for shorter periods of time, the difficulty of learning a new instrument, and the often complex teaching assignments and schedules of instructors are examples of some of the hurdles that may be unique to elementary instrumental students. Those who decide to quit participating in instrumental music during the early stages may do so because of loss of interest or lack of parental support (Boyle et al.,1995). Scheduling conflicts, peer relationships, and classroom management concerns are also potential hazards for retention (Poliniak, 2012). Because it may already be a difficult challenge for many students to learn to play an instrument, do students and teachers feel the use of supportive technology helps or hinders students' musical growth during this crucial time period? Are teachers given adequate training in the use of classroom technologies and are they in turn providing adequate training for their students to be able to use the technologies? Because parents are such important factors in the early musical development of students, do they feel comfortable providing technological assistance for students who are asked to use technology at home in practice environments?

According to Alexiou-Ray, Wilson, Wright, and Peirano, "attitudes of students, school personnel, and parents toward technology use within schools are an important and

often overlooked component of successful curriculum integration of technology" (2003, p. 58). Although there are a growing number of technological resources available for young instrumental students, it may be beneficial to know what resources teachers of first-year instrumental band and orchestra are using in class and are assigning for use at home. Teachers' attitudes regarding technology use for first-year students may be a factor affecting these instructional decisions. In addition, it may be important to determine the attitudes of first-year students regarding assigned technology to see if it is creating the desired interest or effect. Also, because teachers heavily rely upon parental support to maximize the effectiveness of at-home practice, it is important to determine the attitudes of the parents toward the assigned technology. Finally, by determining the relationship of attitudes toward technology use among teachers, students, and parents, music educators can use this information to guide the selection and use of technologies in first-year instrumental music settings, ultimately increasing the potential for their students to succeed.

Purpose of the Study

The purpose of this study was to determine what technologies are being used in first-year instrumental music settings and to examine factors that influence the attitudes of teachers, students, and parents toward the use of those technologies.

Research Questions

The following questions were addressed in this study:

1. What kinds of technologies selected for first-year instrumental music are being used in class and for practice outside of class and to what extent are these technologies being used?

2. To what extent do performance expectancies, effort expectancies, social influences, facilitating conditions (such as instructional time and class format, availability of technology, technology training, and parental support), and teachers' experience (with professional teaching as well as technology) contribute to one's attitude toward technology in first-year instrumental music settings?

3. Are there any statistically significant differences in attitude among teachers, students, and parents toward using technology in first-year instrumental music settings?

4. Is there a statistically significant relationship between attitude toward technology use and technology use (in class and assigned for practice outside of class) and if so, what is the nature and strength of the relationship?

Definition of Terms

Music Technology: This research explores technology that is being used by participants in the context of elementary instrumental music. Rees (2011) proposed a working definition of music technology he claims could be used across time and trends to be the "tools and techniques for music production, performance, education, and research" (p. 154).

Selected Technology: For the purposes of this study, *selected technology* is defined as any electronic tool, device, software, program, or application chosen by the school or teacher intended for the instruction or assessment of instrumental music.

First-Year Instrumental Music: The *first year of instrumental music* study is the student's primary exposure to instruction in instrumental band or orchestra in a public school setting, typically when the student is in fourth grade (orchestra) or fifth grade (band).

Attitude: An *attitude* is defined as an individual's positive or negative feeling about performing the target behavior or in this case, using technology in first-year music settings (Venkatesh, 2013; Fishbein & Ajzen, 1975). Venkatesh, Morris, Davis, and Davis (2003) also supply the following definitions for performance expectancy, effort expectancy, social influence, and facilitating conditions.

Performance Expectancy: A *performance expectancy* is the degree to which an individual believes that using the technology can help attain gains in job performance.

Effort Expectancy: Effort expectancy is defined as the degree of ease associated with the use of the technology, or the perceived ease of use.

Social Influence: Social influence is described as the degree to which an individual perceives that important others believe that he or she should use the technology.

Facilitating Condition: A *facilitating condition* is the degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the technology, or the perception of external control.

Professional Experience: A teacher's *professional experience* indicates the acquired number of years of professional teaching experience, particularly working with first-year band or orchestra students.

Technological Experience: A teacher's *technological experience* is the amount of time the teachers spend using technology and the number of years of experience they have in working with technology.

Delimitations of Study

This study was restricted to fourth and fifth grade elementary school instrumental band and orchestra students in their first year of study in a large Midwestern urban school district, their parents, and their instrumental music directors. Participating instrumental music teachers were responsible for selecting a convenience sample of student and parent participants. In addition, factors that may impact one's attitude toward using technology in a school music environment but were not considered in the scope of this study include gender and age. Further, because it was assumed that students and parents have had minimal to no experience working with technologies that are used for the purposes of instrumental music instruction, the number of years of technological experience acquired by students and parents were not addressed in this study. Finally, the study was constrained to examine classroom and assigned technologies that were reported solely by teacher participants.

Basic Assumptions

In examining the technological practices of teachers, students, and parents involved in first-year elementary instrumental music as well as their attitudes toward the use of technology, the following assumptions were made:

1) In this study, the *first year* of instrumental music represented the student's primary exposure to band or orchestra in an educational setting in a large Midwestern

urban school district. Students in this category were receiving their beginning instruction in grade 4 or 5 in an elementary school building.

2) An *instrumental music setting* implied band or orchestra instruction at the 4th or 5th grade level in an elementary school building (homogeneous or heterogeneous groups) under the direct supervision of the instructor as well as in the student's practice environment.

3) The data collection for this research was conducted during the month of November because it was a mid-point in the fall semester when students and teachers had established classroom and practice routines. In addition, students had sufficient time to enroll in class, obtain their instruments, and participate in the program. Furthermore, conducting the survey in November prior to the holiday break, when students are more likely to discontinue their participation in instrumental music during their first year, may have generated the largest possible number of respondents. Therefore, it was assumed that students in this study were participating in band or orchestra during the fall semester of their first year of instrumental music.

4) This study also assumed that the technology was selected and assigned by the school or teacher and was already in use.

5) Finally, it was assumed that students and parents have had minimal to no prior experience working with technology in instrumental music before becoming involved in first-year band or orchestra.

Theory

The *Unified Theory of Acceptance and Use of Technology* (UTAUT)

The theoretical framework used in this study was derived from a combination of factors resulting from the experiences and observations of the researcher working in the field of music education, particularly as an elementary instrumental band instructor, as well as from the *Unified Theory of Acceptance and Use of Technology* (UTAUT) developed by Venkatesh, Morris, Davis, and Davis (2003) (see Figure 1). Factors considered in the UTAUT that may contribute to determining one's intent and use of technology include performance expectancy, effort expectancy, social influence, facilitating conditions, gender, age experience, and voluntariness of use.

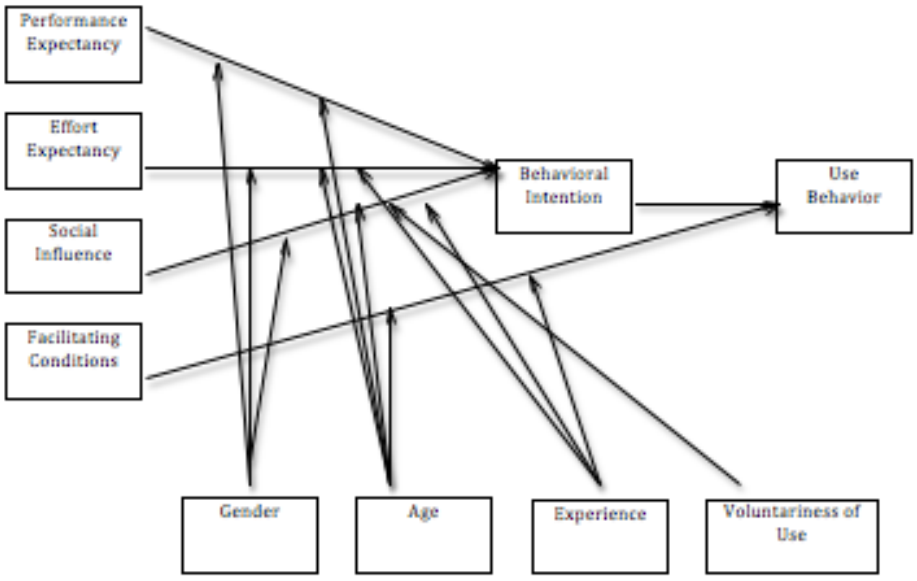

Figure 1: Unified Theory of Acceptance and Use of Technology (UTAUT). Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, *27*(3), 425–478.

Although the UTAUT does not overtly depict attitude, preceding technology use and acceptance models upon which the UTAUT was based, such as the *Technology*

Acceptance Model (TAM) designed by Davis (1989), include attitude as a predictor of the intention to use technology. Subsequent models, such as the *Technology Acceptance Model 2* (TAM2) (Venkatesh & Davis, 2000), consider attitude to be resolved into the underlying belief structure within technology adoption constructs, though it is excluded as an explicit construct. While the role of attitude in technology acceptance models is debated (Dishaw & Strong, 1999; Ursavas, 2013), a 2013 study of pre-service teachers conducted by Ursavas found that attitude has significant correlations with other variables in technology acceptance and significantly contributes to the overall variance in one's behavioral intention to use technology.

Theoretical Model of Study

Because the UTAUT considers the use of technology by adults in the workplace, the model was adapted for this study in order to reflect the use of technology for instrumental music instruction in an educational setting by adults as well as elementary aged students. One major change made in the theoretical model for this study was that behavioral intention, as shown in the UTAUT model, was replaced with the attitudes of teachers, students, and parents (see Figure 2). Because intention only examines internal motivations to use the technology, prolonged usage behavior, as may be the case in educational settings, may be habitual, or routine actions, and therefore not the outcome of premeditated thoughts (Venkatesh, Morris, & Ackerman, 2000). Though shown to be a significant and strong predictor of technology use in alternative acceptance models (as discussed in Chapter 2), attitude was omitted from the UTAUT because the authors believed that attitude would not have a direct or interactive influence on intention to use technology due to the strong relationships that exist between performance expectancy and

intention as well as effort expectancy and intention (Venkatesh, Morris, Davis, & Davis, 2003).

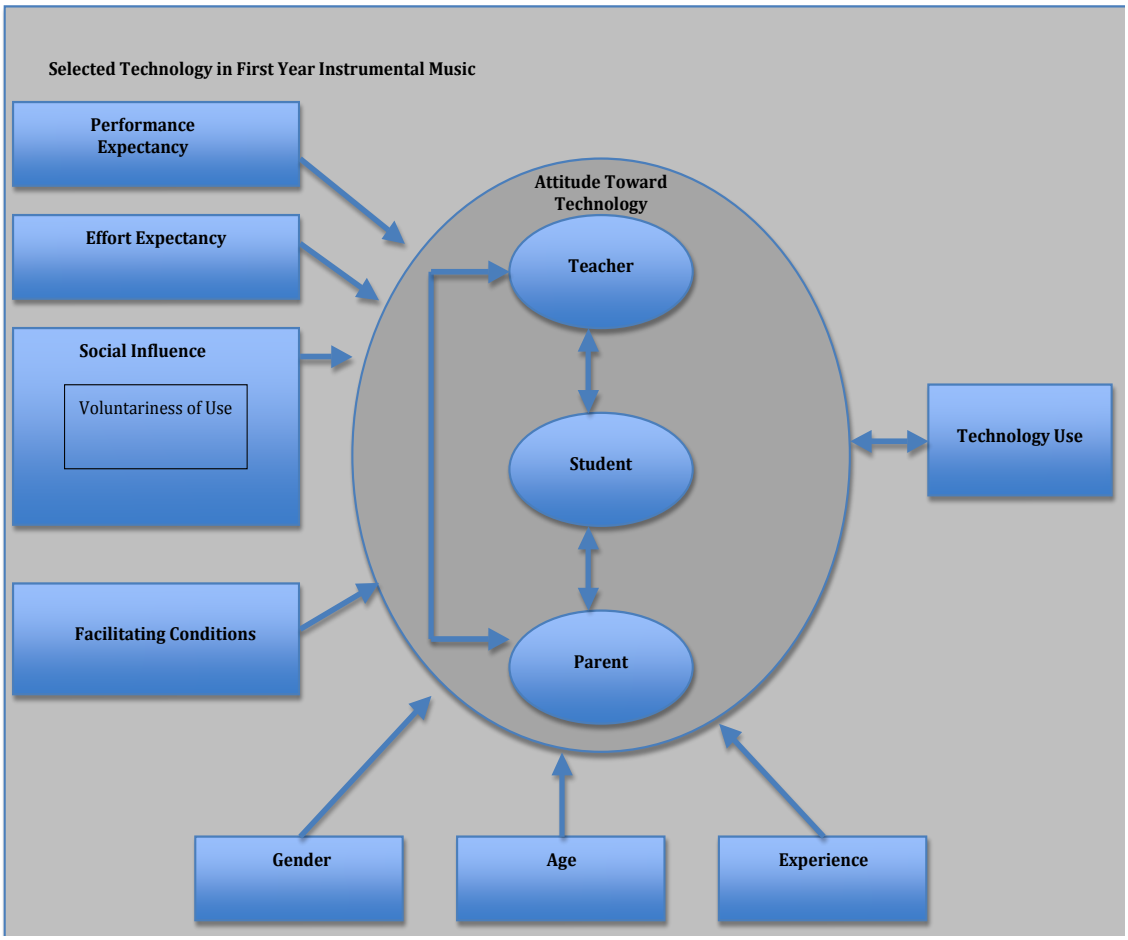

Figure 2: Gilbert Theoretical Model of Attitude Toward Technology Use in First-Year Instrumental Music

Davis, Bagozzi, and Warshaw (1989) defined the behavioral intention to use technology as the degree to which a person has formulated conscious plans to perform or not perform some specified future behavior. Use behavior is the actual use of the technology in question. This study assumed that the technology selected and assigned by the school or teacher was already in use and therefore aimed to determine the participants' positive or negative feelings towards using it in class and for practicing

outside of class. The attitudes of teachers, students, and parents toward the use of technology in instrumental music as well as the relationship between attitude and the use of technology were the primary interests of this particular study.

Although many studies reveal a positive relationship between the attitudes of teachers and technology use (Naaz, 2012; Avidov-Ungar & Eshet-Alkakay, 2011), some indicate a variety in teacher attitudes (Ifenthaler & Schweinbenz, 2013). Celik and Yesilyurt (2013) found that factors such as perceived self-efficacy and anxiety predict teachers' attitudes toward using educational technology. Because music instructors may be responsible for selecting the technology to be used in class and for practicing outside of school, the attitudes of teachers toward technology may be the most influential of all the participants. Studies also indicate generally positive attitudes among students toward technology use (Maria, Persa, Ilias, & Efstanthios, 2011; Judi, Amin, Zin, & Latih, 2011; Edmunds, Thorpe, & Conole, 2012). Shen and Chuang (2010) found that factors such as self-efficacy, perceived ease of use, and perceived usefulness influence the attitudes of elementary school students regarding the use of technology in the classroom. Furthermore, it has been discovered that the attitudes of parents toward technology significantly impact the attitudes of their children toward technology (Lin, Liu, & Huang, 2012).

An element found in the *Unified Theory of Acceptance and Use of Technology* (Vanketesh, Morris, Davis, & Davis, 2003), voluntariness of use is defined as "the extent to which potential adopters [of technology] perceive the adoption decision to be non-mandatory" (Vanetesh, 2013, p. 1). When the use of technology is mandatory rather than voluntary, particularly in the early stages of experience with using the technology, social

influence has been found to be a significant predictor of intention and use (Hartwick & Barki, 1994; Karahanna, Straub, & Chervany, 1999; Taylor & Todd, 1995a; Thompson, Higgins, & Howell, 1994; Venkatesh & Davis, 2000). In the case of this study, teachers may be required by their administrators or school district to incorporate technology in their instruction. Students may be given tasks to complete, assigned by their teachers, which require the use of technology. If these obligations are to be completed at home, students may also feel compelled to use technology because their parents are involved in overseeing the completion of their homework assignments. Finally, parents may feel that the use of technology for the student is mandatory because the teacher has assigned it. Therefore, because this study took place in a school setting where others may mandate curriculum and assignments outside of the individual's control, voluntariness of use was considered to be a social influence.

Finally, although the UTAUT identifies factors that ultimately predict use behavior, it is uncertain whether one's attitude toward technology in an elementary instrumental music setting can predict or explain the actual use of technology. It is unclear what technologies are in use in elementary band and orchestra, if any. Further, the use of technology in band or orchestra may be mandatory for participants, regardless of their attitudes. Therefore, this study examined whether a relationship exists between attitude and use rather than assuming that attitude is a direct predictor of use.

Research Model of Study

Factors that may impact one's attitude toward using technology in a school instrumental music environment but that were not considered in the scope of this study include gender and age. The participants' genders are fixed and were indicated in the

questionnaire, although they were not calculated in this study to contribute to the attitudes of the participants toward technology. Many researchers have determined a need to consider the relationship between gender and attitudes towards technology and have generated mixed results. For example, Goktas (2012) found that gender was a significant variable in the attitudes of collegiate physical education and sports students toward technology. In addition, Papanastasiou and Angeli (2008) noticed that there were significant gender differences on a technology survey given to teachers. On the other hand, Naaz (2012) found no significant difference between gender and the attitudes of pre-service teachers toward technology. For younger students, Colley, Comber, and Hargreaves (1997) found no differences in attitude among males and females and that both genders felt that the use of music technology improved their musical achievement. Webster (2011) concluded that more studies are needed in order to consider the issue of gender and technology as it relates to music education.

While Smith (2012) and Goktas (2012) found significant differences between the age of students and their attitudes toward technology, this study was delimited to examine only fourth and fifth grade students involved in their first year of instrumental music study. Therefore, the age group of students examined was held constant. Kul found no significant differences in technology use among teachers of varying ages in a 2013 study. While the age ranges of parents and teachers involved varied and were indicated on the questionnaire, age was not considered as a factor that may impact one's attitude toward technology in this study.

Based on the nature of the participants, conditions, and environment of this particular inquiry, experience was divided into two separate components. First,

experience was defined in this research as the number of years the music instructor has been teaching professionally. Rohaan, Taconis, and Jochems (2012) found that teachers' self-efficacy, subject matter knowledge, and pedagogical content knowledge, all of which can be improved with teaching experience, strongly influence their attitudes toward technology. Music teachers were asked to indicate on the questionnaire how many years of professional teaching experience they had acquired as well as how many years of professional teaching experience they had working in a first-year instrumental music setting.

Second, experience was determined as the teacher's number of years of experience working with technology. The amount of time teachers spend using technology, or the number of years of experience they have in working with technology, may affect the attitudes of teachers, students, and parents towards its use. Those who have more past and current experience working with technologies may be more comfortable with their use and have more favorable attitudes towards using them than those whose experiences are limited. While the satisfactoriness teachers, students, and parents feel toward their levels of technological training was determined separately as a facilitating condition (described further on in the text), the teacher's number of years of technological experience was addressed separately because it is typically the teacher who is responsible for selecting the technology to be used in instructional settings. The teacher's technological experience, therefore, may have a greater influence on the attitudes of all parties in question. Rohaan, Taconis, and Jochems (2012) suggest that the teacher's technological knowledge affects the student's ability to learn the technology. Furthermore, it was assumed that students and parents have had minimal to no experience

working with technologies that are used for the purposes of instrumental music instruction, so the number of years of technological experience acquired by students and parents were not addressed. Manochehri and Sharif (2010) found that students' prior technology experience did not impact their attitudes. The final research model that was used in this study can be found below in Figure 3.

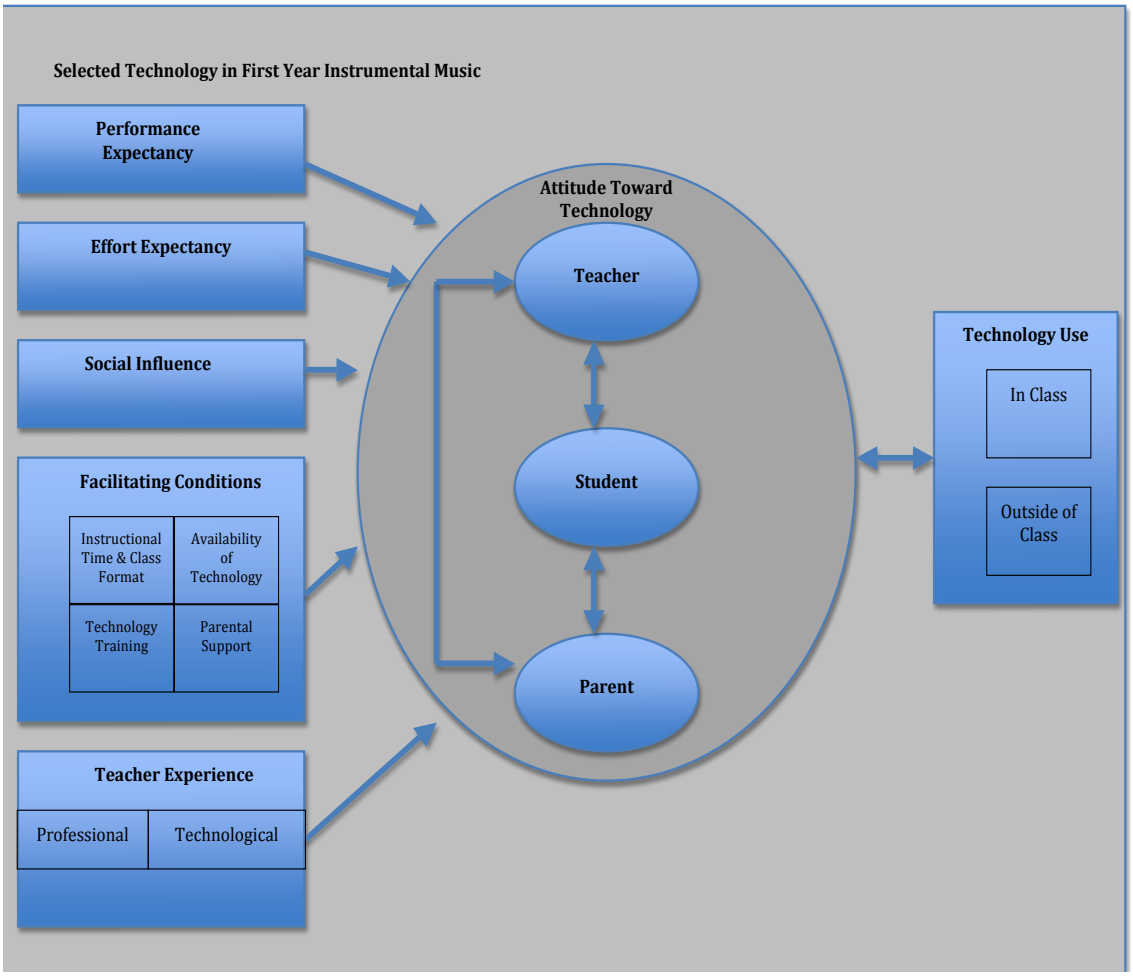

Figure 3: Gilbert Research Model of Attitude Toward Technology Use in First-Year Instrumental Music

Definitions of performance expectancy, effort expectancy, social influence, and facilitating conditions as determined by Venketesh, Morris, Davis, and Davis in the

UTAUT were previously provided in the Definition of Terms. These terms can now be redefined within the context of this research model.

Performance expectancy is defined as the degree to which an individual believes that using the technology can help attain gains in job performance (Venkatesh, Morris, Davis, & Davis, 2003). In terms of instrumental music, performance expectancy can be thought of as the degree to which an individual believes that using the technology for band or orchestra can help the student attain gains in music performance and learning. This may also be conceived as perceived usefulness, result demonstrability, or the tangibility of results through the use of technology. Output quality, or the degree to which an individual believes the technology performs the given task well, also falls under this category. Perceived usefulness has been found to influence one's attitude toward the use of classroom technology (Shen and Chuang, 2010).

Effort expectancy is defined as the degree of ease associated with the use of the technology, or the perceived ease of use (Venkatesh, Morris, Davis, & Davis, 2003). Self-efficacy, enjoyment, and anxiety also contribute to effort expectancy and may impact one's attitude toward using technology for instrumental music (Celik & Yesilyurt, 2013; Shen & Chuang, 2010). Because it was assumed that students and parents had limited experience working with technology for instrumental music, as well as the possibility that this study may have revealed that technology was not being used at all in first-year band or orchestra settings, effort expectancy in this inquiry determined to what degree participants perceive the ease of use to be with technology in general.

Social influence may be defined as the degree to which an individual perceives that important others believe that he or she should use the technology (Venkatesh,

Morris, Davis, & Davis, 2003). Important others in this study included administrators, colleagues, teachers, parents, students, or peers. Social influences may also consist of one's image, job relevance, or in this study, voluntariness of use, described earlier as whether or not one determines the use to be mandatory or voluntary. In addition, social influences in a school setting may impact one's perception of the usefulness of technology. If important others believe the individual should use the technology, then its use may seem more beneficial. For example, if a student believes that his parents and teacher require him to use the technology when practicing at home, he may perceive using the technology to be a useful tool that will help him to become a better musician.

A *facilitating condition* is the degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the technology, or the perception of external control (Venkatesh, Morris, Davis, & Davis, 2003). Items considered to be facilitating conditions in instrumental music settings include: instructional time and class format, availability of technology, training and professional development, and parental support.

The format of many elementary school instrumental music classes is "pull-out instruction," meaning students taking band or orchestra may miss instructional time in other subjects in order to participate. In addition, instrumental music classes are not always part of the master schedule in elementary schools (i.e. they do not have set, structured class times) and may not always start at the beginning of the year. Furthermore, because participation is voluntary and based on interest, the number of students participating at any given time may be flexible. Students are typically able to join or discontinue participation at any point during the school year. Instructional time is

often limited to weekly or biweekly half hour sessions during the school day and usually consists of smaller groups of homogeneous instruments. Teachers often are assigned to multiple elementary schools and travel to several buildings throughout the day. Students may not consistently meet for band or orchestra on the same days or the same times each week. Additionally, elementary schools do not usually have typical band or orchestra rooms. Teachers are often asked to hold class in untraditional locations such as stages, gymnasiums, or even storage areas that may not be equipped with the same kinds of technologies and resources to which teachers in regular classrooms, or instructors in middle or high schools, have access. Therefore, the amount of instructional time first-year students receive as well as the format of classes were thought of as facilitating conditions that may impact participants' attitudes towards using technology for instrumental music.

Availability of appropriate technology in class and in practice environments was also labeled as a facilitating condition, possibly affecting the attitudes of the participants. It was necessary to determine what types of technological equipment and software are accessible for use in the classroom and whether or not teachers feel like they are able to acquire the types of technology they would like to use in their teaching. It was also necessary to determine whether students and parents feel they have adequate access to technology related to instrumental music practice at home or in their practice environments outside of class. A comparison was then made between what the instructor assigns and what is accessible to the students and parents at home to determine if there was a relationship between the availability of technology and attitudes towards using it. Students who do not have adequate access to technology at home tend to possess more

negative attitudes toward using technology than their peers who have more resources available to them (Lebens, Graff, & Mayer, 2009).

Although Alexiou-Ray, Wilson, Wright, and Peirano (2003) found the attitudes of teachers, students, and parents toward technology to be generally positive, their survey results revealed that participants had initial negative reactions to using new educational technology due to unfamiliarity and inexperience with using it. Therefore, with adequate training for teachers, students, and parents, and professional development for teachers, one's attitude toward using new or unfamiliar technology may improve. This study sought to reveal whether the training one has toward using technology for instrumental music influences the overall attitude of the participant.

Because beginning instrumental music teachers do not often see their students for a sufficient amount of time for instruction, they rely heavily on students being able to practice their instruments and assignments at home with the support of their parents. Learning to play a musical instrument is a new and challenging task that is met with more success when parents assume an active role in assisting and encouraging students during their practice sessions. Kinney (2010) found that family structure was a significant predictor of enrollment decisions for middle school band students. In addition, students from two-parent or two-guardian homes were more likely to persist in band (Kinney, 2010). Some also suggest that parental support may help retain students in the program (Poliniak, 2012). Furthermore, it was found that students who decide to quit participating in instrumental music during the early stages might do so because of loss of interest or lack of parental support (Boyle et al., 1995). If teachers assign work to be done at home using technology that is easily understood and manageable by the parents, they will likely

be better able to assist their children in completing the assignments and may have a more positive attitude toward using technology for music learning. Lin, Liu, and Huang (2012) claim that technology training for parents and students can build confidence and comprehension for both parties. Therefore, the facilitating condition of parental support was also examined in this study.

Methodology

Subjects

The participants in this study were comprised of teachers, students, and parents associated with first-year instrumental music in a large, Midwestern urban school district. Selected *teachers* included those who are responsible for the instrumental band and orchestra education of elementary school students. *Students* in their first year of study were fourth and fifth graders in an elementary school setting and were actively participating in orchestra or band. The *parents* in this study were the parents or legal guardians of first-year instrumental music students enrolled in the district.

Because there were a combined total of 25 teachers working with beginning band and orchestra students in the district, the survey instrument was distributed to all elementary instrumental music teachers in order to reduce error and achieve a high response rate of teachers to include in the study. With the support of the district's instrumental music supervisor, the researcher met with teachers at a staff meeting on October 28, 2014. The surveys were distributed to teachers who participated in the study at the meeting.

The population of students and parents for this study included all students involved in first-year instrumental band and orchestra as well as one parent per each of

the students. Participating teachers distributed the questionnaire to a convenience sample of all fourth and fifth graders known to be participating in first-year instrumental music. Sampling continued until an adequate number of completed responses were obtained to reduce non-response error.

Equipment and Materials

Teacher participants were asked to complete the *Technology in Music Usage Questionnaire* (TMUQ) that is located in Appendix D. Comprised of ten questions, the TMUQ provided an inventory of what technologies are being used in first-year band and orchestra settings, described to what extent technology is being used in those settings, and determined the years of experience teachers have with using technology for instrumental music. All participants completed the *Technology in Music Attitude Questionnaire* (TMAQ), located for teachers, students, and parents in Appendices D, E, and F, respectively. The TMAQ is comprised of the same number of questions (25) that were answered by each group of participants and contains a 5-point numerical rating scale to facilitate a comparison among the groups.

Procedure

The distribution of the survey, provided as paper copies in envelopes to teachers at the October staff meeting, included the cover letter, appropriate informed consent forms, and questionnaire. Paper copies of the questionnaire were sent home from school with students whose classes were selected for students and parents to complete and return to school for the researcher to collect. Teachers were provided with student and parent survey packets according to the number of students participating in band or orchestra. The researcher did not have access to class rosters or the names and contact information

of students or parents. Students and parents received all of their materials in the same envelope to facilitate the distribution and return of the surveys from and to school. By distributing and returning all materials for students and parents in one envelope, child assent was matched with parental consent to ensure permission was received. Completing and returning the surveys to the school of the participant implied participant consent. This also linked student and parent responses with their corresponding teacher in order to determine the relationship of attitudes and technology use among teachers, students, and parents. Based on the population size of 7,483 subjects (25 teachers, 3,729 students, 3,729 parents), 0.05 margin of error, 95% confidence level, and 0.5 standard of deviation, it was determined that a combined total of 366 survey responses were needed for all groups of participants (teachers, students, and parents).

Data Analysis

Teacher participants completed the *Technology in Music Usage Questionnaire* (TMUQ), questions 1-10, to determine what kinds of technologies are being used in class and for practice outside of class during the first year of instrumental music study and to what extent (Research Question 1). Descriptive statistics were calculated and reported in frequency distributions, histograms, and tables. Comparisons were made between the technologies used, individually as well as by category (hardware, software, and online resources), with the number of teachers who use them. The percentage of teachers who use each type or category of technology was calculated. In addition, the technology used was compared with the time spent in use. The numbers and percentages of teachers who responded to each prompt regarding the purpose and reasons for using or not using technology were also reported.

All participants completed the *Technology in Music Attitude Questionnaire* (TMAQ) to determine to what extent performance expectancies (items 6-10), effort expectancies (items 11-15), social influences (items 16-20), and facilitating conditions (items 21-25) contribute to one's attitude (items 1-5) toward technology in first-year instrumental music settings (Research Question 2). Additional independent variables included years of professional teaching experience (measured in the demographic portion of the teacher TMAQ, item 3) as well as years of technological experience of the teachers (measured in the TMUQ, item 2). Constructs were measured by collecting responses using numerical scale data numbered 1-5 (1=strongly disagree; 5=strongly agree). Descriptive statistics were used to determine the mean (central tendency) and standard deviation (variability) of responses. Data were analyzed using multilevel (hierarchical) linear modeling (MLM) to ensure teacher responses were matched with the students and parents with which they were associated and to account for the likely correlation of errors within each unit. Three mixed effects models were developed, one for each group of participants (teacher, student, and parent), with two levels for each model. The attitude of each group served as the dependent variable for each model while independent variables included performance expectancy, effort expectancy, social influence, facilitating conditions, attitude of the second group, attitude of the third group, years of professional teaching experience of the teacher, and years of technological experience of the teacher. Data were tested to ensure assumptions of MLM were upheld prior to analysis. Model fit was assessed for each model using -2 log likelihood tests to compare the intercepts-only models with the full models. Solutions for fixed effects were examined to determine whether any of the independent variables significantly predict attitude.

Responses from the TMAQ also determined if there were any significant differences in attitude between teachers, students, and parents toward using technology in first-year instrumental music settings (Research Question 3). Because participants all completed the same attitude questionnaire, a one-way ANOVA analysis was conducted to examine the three groups of participants (teachers, students, and parents) to determine if there were any significant differences. The independent variable was the group to which participants belonged and the dependent variable was attitude. A Fisher's Least Significant Difference (LSD) post-hoc test determined where the levels of significance lie. Post hoc tests gave the mean difference between each group and a *p* value to indicate where the groups differed significantly.

Finally, to determine whether or not a statistically significant relationship exists between attitude toward technology use and technology use in class and assigned for practice outside of class, a series of bivariate correlations were conducted (Research Question 4). Attitude scores of teachers, students, and parents represented one variable and the time spent in the use of the technology represented the second variable compared. First, attitude scores were compared with the average time (in number of minutes) spent using technology in class per lesson. Then, attitude was compared with the average amount of time (in number of minutes) teachers expect students to use technology outside of class in their practice assignments. Results of the nature and strength of the bivariate relationships were summarized in scatter plots imposed with lines of best fit as well as by calculating Pearson's product-moment correlation coefficients (*r*) for each set of data. Scatter plots were examined to ensure that the relationships were not curvilinear or influenced by outliers. In order to determine the proportion of variability in attitude

scores that is associated with time spent using the technology, the coefficient of determination (r^2) was calculated.

Significance of Study

There is an ever-growing demand for schools to integrate more technology into their educational practices and they are spending increasing amounts of time, money, and resources in order to do so. All subject areas, including instrumental music, are implicitly expected, if not required, to incorporate current and relevant technology towards the instruction and assessment of students. However, even if technology is being utilized in the classroom, the attitudes of those directly involved in its use may impact the effectiveness of the technology and ultimately the success of the students. Wai-chung Ho (2004) states that the demand for teachers to upgrade their technological skills and practices is increasing. When carefully considered and integrated, instructional technology can benefit the music classroom by supporting students' motivation and improving the quality of their learning (Wai-chung Ho, 2004).

Music educators working with beginning instrumental students may face unique challenges that differ from those of their colleagues in other disciplines or even from music directors who work with more advanced ensembles. Although a variety of technology is available for use in instrumental music settings, the challenges associated with learning a new instrument may impact the attitudes of those involved toward incorporating technology. In order for the technology to work as intended, the music instructor must take into account factors such as the attitudes of the teacher, students, and parents towards technology (Alexiou-Ray, Wilson, Wright, & Peirano, 2003).

A study of the relationship of attitudes among teachers, students, and parents toward technology integration in first-year instrumental music settings can fill in the gap of lack of current information on the subject and provide much needed insight. Music educators can use the results of this study to improve their teaching, seek out technology training for themselves and their students, and make better choices regarding the selection of technological devices, software, and applications for their students to use in class and in practice environments. Perhaps the information gathered from this study may even be of value to programmers who design technology for the young instrumentalist so they can better adapt their tools based on the attitudes of teachers, students, and parents in order to facilitate stronger learning environments. By carefully examining the relationships of attitudes toward technology among those involved in beginning instrumental music, educators can hopefully create a more positive experience for students that will motivate them to continue ensemble participation and foster a lifelong love of music.

CHAPTER 2

REVIEW OF THE LITERATURE

Introduction

This quantitative survey study was designed to determine what technologies are being used in first-year instrumental music settings and to examine factors that influence the attitudes of teachers, students, and parents toward the use of those technologies. In order to support the theoretical model as well as research model of the study, an array of resources were consulted including journals, databases, websites, and electronic search engines such as Academic Search Premier, JSTOR, Premier Sources (EBSCO), and Dissertation Abstracts International. The literature review begins with a description of the *Unified Theory of Acceptance and Use of Technology* (UTAUT) and summarizes many other leading models used in technology usage and acceptance inquiries. Technology in education in general is then explored, including research found on teacher, student, and parent attitudes toward technology as well as research that examines attitudes from a combination of perspectives. Finally, the use of technology specifically in music education is addressed with examples from the literature that relate to composition and creativity, motivation and participation, performance, technological tools and availability, and attitudes toward music technology. The literature review is therefore divided into three main sections: (1) technology use and acceptance models, (2) technology in education, and (3) technology in music education.

Technology Use and Acceptance Models

Technology use and acceptance models serve to inform those in leadership positions, such as management and administrative staff, of the technological use behavior of individuals in an organization or company in order to improve productivity. In a 2003 study by Venkatesh, Morris, Davis, & Davis, the researchers discussed and compared eight prominent, pre-existing models that sought to explain the acceptance and use of technologies by individual users. These were the *Theory of Reasoned Action* (TRA), *Technology Acceptance Model* (TAM/TAM2), *Motivational Model* (MM), *Theory of Planned Behavior* (TPB), *Combined TAM and TPB* (C-TAM-TPB), *Model of PC Utilization* (MPCU), *Innovation Diffusion Theory* (IDT), and the *Social Cognitive Theory* (SCT). A description of each will be summarized below. Upon examination of the many competing models, the authors developed the *Unified Theory of Acceptance and Use of Technology* (UTAUT) in order to synthesize the information available into one cohesive model. This was needed, they posited, because researchers had too many models from which to choose and therefore had to select some constructs while disregarding the offerings from alternative models.

The other eight models utilized between two to seven determinants of acceptance for a total of thirty-two constructs across the models, explaining 17-53% of the variance in user intentions to use information technology (Venkatesh, Morris, Davis, & Davis, 2003). On the other hand, the UTAUT condensed the number of core determinants of intention and usage of technology to four, along with four additional moderators of key relationships (experience, gender, age, and voluntariness of use). The UTAUT was tested

to account for a marked improvement of 70% of the variance, or R^2 change, in one's intention to use information technology.

In order to compare the existing eight models, the authors conducted a within-subjects, longitudinal validation using data from four organizations. Field studies were conducted among adult individuals who were introduced to new technology in the workplace, in a nonacademic setting. They were administered a questionnaire containing items which measured constructs across all eight pre-existing models with usage as the key dependent variable. The authors determined there to be a basic conceptual framework fundamental to all the models explored that explained individual acceptance of technology (Figure 4). After formulating the UTAUT, they empirically validated the new model by comparing it with the original data and cross-validated it by using data from two new organizations. The study of the validation of the UTAUT looked at how determinants of intention and behavior evolve over time for adult employees.

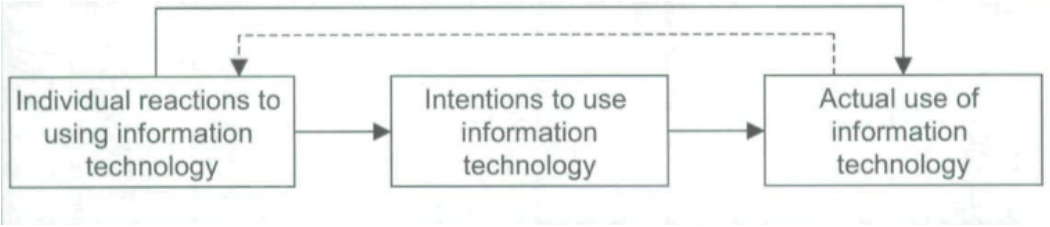

Figure 4: Basic Conceptual Framework of User Acceptance of Technology Models. Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, *27*(3), 425–478.

The first of the eight models compared, the *Theory of Reasoned Action* (TRA), is a theory of human behavior used primarily in social psychology, though it has been applied to individual acceptance of technology (Davis, Bagozzi, & Warshaw, 1989). Two core constructs thought to predict behavior in the TRA include one's attitude toward the

behavior and subjective norm. Though the four key moderators (experience, gender, age, and voluntariness of use) addressed by Venkatesh, Morris, Davis, and Davis (2003) were not included in the original TRA model, it has since been determined that attitude appears to become a more significant predictor of technology use with increasing experience while subjective norm becomes less significant with increasing experience (Karahanna, Straub, & Chervany, 1999).

According to Davis, Bagozzi, and Warshaw (1989), the *Technology Acceptance Model* (TAM) (Figure 5) was designed to predict one's acceptance of computer usage on the job by measuring his or her intentions as well as to explain intentions according to one's attitudes, perceived usefulness, and perceived ease of use. This was believed important in order to evaluate technological systems and guide interventions by employers to reduce the problem of technology going unused.

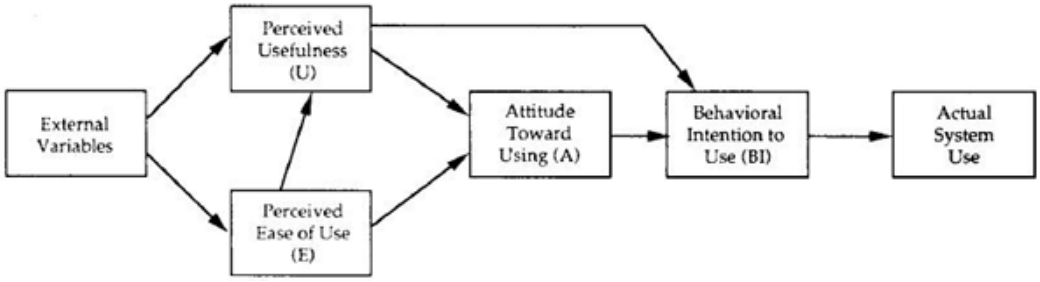

Figure 5: The *Technology Acceptance Model* (TAM). Davis, F. D., Bagozzi, R. P., and Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science, 35*, 982-1003.

Studies on the TAM since its development have generated mixed results on the role of attitude as a predictor of use and intention, necessitating further research be done on the issue (Ursavas, 2013; Dishaw & Strong, 1999). While some have determined that attitude is nonsignificant in predicting actual technology use (Teo, 2009; Nistor & Heymann, 2010), others have found that attitude does have a significant effect on

behavioral intention to use technology (Ursavas, 2013; Lopez-Bonilla and Lopez-Bonilla, 2011). Ursavas (2013) tested the role of attitude in the TAM by surveying a group of pre-service teachers. The research model was tested both with and without attitude as a construct. Using structural equation modeling, Ursavas (2013) found that attitude has a significant correlation with other variables in the TAM and significantly contributes to the overall variance in behavioral intention to use technology, particularly when the use is voluntary.

The *Technology Acceptance Model 2* (TAM2) (Figure 6) adapted by Venkatesh and Davis in 2000 extended the original TAM by including subjective norm as an added predictor of intention when the technology use was mandatory by individuals. In the TAM2, attitude is excluded as an explicit construct in order to explain intention in a more compacted model. Attitude is resolved into the underlying belief structure within the technology adoption constructs.

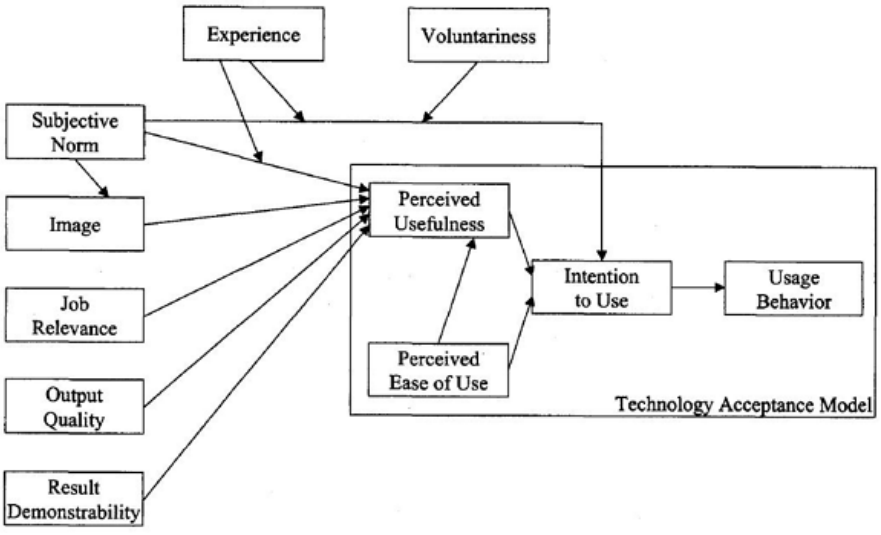

Figure 6: The *Technology Acceptance Model 2* (TAM2). Venkatesh, V. & Davis, F.D. (2000). A theoretical extension of the Technology Acceptance Model: Four longitudinal field studies. *Management Science, 46,* 186-204.

While experience is not included as a moderator in the original TAM, it has been found that ease of use is not significant with increased experience (Davis, Bagozzi, & Warshaw, 1989; Szajna, 1996). Gender and age are also not included as moderators in the TAM or TAM2, but voluntariness of use is included in the TAM2. It was also discovered that subjective norm is only pertinent in mandatory settings of usage and when experience with the technology is limited (Hartwick & Barki, 1994; Karahanna, Straub, & Chervany, 1999; Taylor & Todd, 1995a; Thompson, Higgins, & Howell, 1994; Venkatesh & Davis, 2000).

The third of the eight models compared when designing the UTAUT, the *Motivational Model* (MM), is found in psychology research as a tool to explain behavior. It has been applied to research in information systems in order to understand new technology adoption and use (Davis, Bargozzi, & Warshaw, 1992; Venkatesh & Speier, 1999). Two core constructs, extrinsic motivation and intrinsic motivation, are thought to predict behavior.

An extension of the TRA, the *Theory of Planned Behavior* (TPB) also utilized attitude toward behavior and subjective norm as core constructs. It also added perceived behavioral control as an additional determinant of intention and behavior. Harrison, Mykytyn, and Riemenschneider (1997), Mathieson (1991), and Taylor and Todd (1995b) have applied the TPB to understand individual acceptance and use of technologies. Studies on the moderators of gender, age, and experience within the TPB found that attitude was more significant for men and subjective norm while perceived behavioral control more prominent for women in the early stages of experience (Venketesh, Morris, & Ackerman, 2000). In addition, Morris and Venkatesh (2000) discovered that attitude

was more significant for younger workers, perceived behavioral control more significant for older workers, and subjective norm more relevant for older women.

A hybrid model, the *Combined TAM and TPB* (C-TAM-TPB) uses the core constructs of attitude toward behavior, subjective norm, perceived behavioral control, and perceived usefulness as predictors of intention to use technology. The sixth model examined, the *Model of PC Utilization* (MPCU), is derived from the 1977 theory of human behavior developed by Triandis. It was adapted to predict individual acceptance and usage of technology by Thompson, Higgins, and Howell in 1994. To predict usage behaviors, the MPCU uses the core constructs of job-fit, complexity, long-term consequences, affect towards use, social factors, and facilitating conditions.

With a foundation in sociology, the *Innovation Diffusion Theory* (IDT) has been adapted to study various innovations since the 1960's. Applied to information technology by Moore and Benbasat (1991), the IDT applies the core constructs of relative advantage, ease of use, image, visibility, compatibility, results demonstrability, and voluntariness of use. Finally, the *Social Cognitive Theory* (SCT) is a theory of human behavior that was applied to the utilization of computers by Compeau and Higgins (1995) using the core constructs of performance outcome expectations, personal outcome expectations, self-efficacy, affect, and anxiety.

Upon examination of the eight models described above, Venkatesh, Morris, Davis, and Davis (2003) developed the *Unified Theory of Acceptance and Use of Technology* (UTAUT) (Figure 7) to incorporate four of the most significant constructs found in the pre-existing models of individual acceptance and use of technology: performance expectancy, effort expectancy, social influence, and facilitating conditions.

In addition, they reasoned there are also the four moderating variables of gender, age, experience, and voluntariness of use. According to the authors, the UTAUT is a "useful tool for managers needing to assess likelihood of success for new technology introductions and helps them understand the drivers of acceptance in order to proactively design interventions (including training, marketing, etc.) targeted at populations of users that may be less inclined to adopt and use new systems" (p. 425-426).

Performance expectancy, effort expectancy, and social influence are all direct predictors of one's intention to use the technology, with intention being a direct predictor of actual use behavior of technology. Facilitating conditions was found not to be a predictor of intention, but rather to directly predict one's use behavior. It was determined that attitude toward using technology, self-efficacy, and anxiety were not significant determinants of one's intention to use technology. Also, because intention only examines internal motivations to use the technology, prolonged usage behavior may be habitual, or routine actions, and therefore not the outcome of premeditated thoughts (Venkatesh, Morris, & Ackerman, 2000).

Gender is found to moderate performance expectancy, effort expectancy, and social influence. Age moderates all four core constructs while experience moderates all but performance expectancy. Finally, voluntariness of use only affects social influence in mandatory settings, but is nonsignificant in voluntary settings.

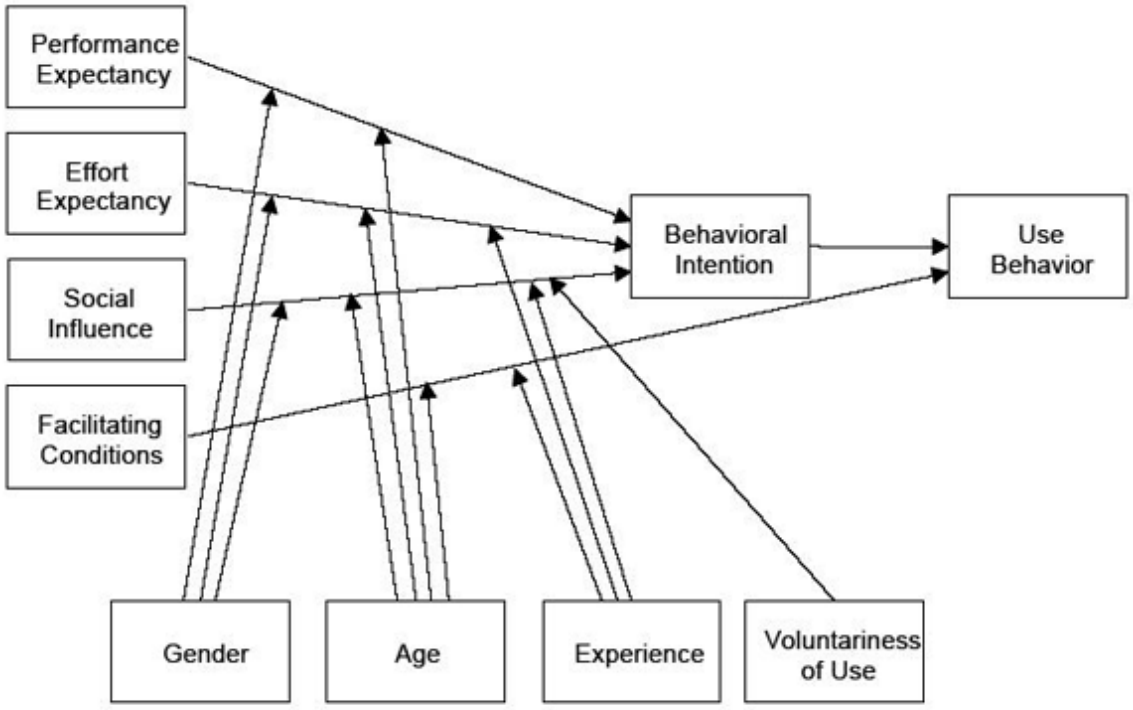

Figure 7: Unified Theory of Acceptance and Use of Technology (UTAUT). Venkatesh, V., Morris, M.G., Davis, F.D., & Davis, G.B. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27, 425-478.

Performance expectancy, defined as the degree to which an individual believes that using the system will help attain gains in job performance, was derived from five constructs among the eight different models studied: perceived usefulness (TAM/TAM2 and C-TAM-TPB), extrinsic motivation (MM), job-fit (MPCU), relative advantage (IDT), and outcome expectations (SCT) (Venkatesh, Morris, Davis, & Davis, 2003). The authors determined that it was the strongest predictor of intention to use technology among adult employees.

Effort expectancy, or the degree of ease associated with the use of the technological system, was developed from three constructs of the pre-existing models: perceived ease of use (TAM/TAM2), complexity (MPCU), and ease of use (IDT). The

researchers found effort expectancy to be significant in the beginning stages of using the technology; however, it becomes nonsignificant over time and with sustained use.

Social influence is defined as the degree to which an individual perceives important other believe that he or she should use the new technology as well as the explicit or implicit notion that people's behavior is influenced by the way in which they believe others will view them as a result of having used the technology. This core construct draws from subjective norm (TRA, TAM2, TPB, C-TAM-TPB), social factors (MPCU) and image (IDT). Again, social influence was determined not to be significant in voluntary contexts, but is significant when the use is mandated, particularly in the early stages of experience with using the technology (Hartwick & Barki, 1994; Karahanna, Straub, & Chervany, 1999; Taylor & Todd, 1995a; Thompson, Higgins, & Howell, 1994; Venkatesh & Davis, 2000).

Finally, facilitating conditions, or the degree to which an individual believes an organizational and technical infrastructure exists to support the use of the system, is the fourth construct found to predict the use of technology. It can also be defined as aspects of the technological and or organizational environment designed to remove barriers to the use of technology. Facilitating conditions is derived from three constructs originating from previous models: perceived behavioral control (TPB, C-TAM-TPB), facilitating conditions (MPCU), and compatibility (IDT). Although facilitating conditions were found to be nonsignificant in predicting intention when both performance expectancy and effort expectancy constructs are present, they do directly predict one's use behavior of technology beyond what is accounted for by intention.

Attitude, or an individual's overall affective reaction to using a system, is found in four constructs and six models among the eight models studied: attitude toward behavior (TRA, TPB, C-TAM-TPB), intrinsic motivation (MM), affect toward use (MPCU), and affect (SCT). All constructs related to attitude convey one's enjoyment, pleasure, and liking connected with the use of technology. Attitude was omitted from the UTAUT model because the authors believed that attitude would not have a direct or interactive influence on intention to use technology due to the strong relationships that exist between performance expectancy and intention and effort expectancy and intention. This belief that attitude is not significant in predicting intention is shared in the C-TAM-TPB, MPCU, and SCT models. However, attitude is not only significant, but is also the strongest predictor of behavioral intention in the TRA, TPB, and MM models.

Technology in Education

Despite the prevalence of technology available for teaching and learning in all areas of education, many teachers do not utilize much technology in the classroom, if it is used at all (Armstrong, 2014; Agbatogun, 2013; Blackwell et al, 2013; Ozel, 2014). When technology is used in the classroom, it is often outdated or ineffective for the goals of the lesson (Garner & Bonds-Raacke, 2013; Aldunate, R., & Nussbaum, M., 2013). Teachers may also use technology because of a sense of moral obligation rather than for a pedagogical purpose (Webster, 2011). Garner and Bonds-Raacke (2013) discovered that while a growing number of teachers have impressive technological knowledge, they lack the ability to transfer that knowledge into sound instructional practices. Armstrong (2014) also found that teachers' use of technology seems to run counter to concerns about and

perceptions of student use of technology. Teachers felt that students rely too heavily on technology for research rather than traditional materials.

Studies have shown that students use technology at home more frequently than they do at school and that students would prefer to use a greater variety of appropriate technology in the classroom environment. For example, a 2014 study of middle school students by Armstrong found that 39% of students use Smartphones and 31% of students use tablets to do homework, but that is not matched in the classroom. Wiebe and Kabata (2010) also concluded that students expect an appropriate rather than extensive integration of technology in instruction. Cassidy et al (2014) conducted a study about the use and preferences of technology among students in order to improve library services. The aim was to provide the most popular technologies while making the most efficient use of resources. The research determined which technologies students use and which they prefer to use. Results showed that students are increasingly using and depending on technology. Students also expressed a desire for library services to offer more of a variety of appropriate technologies.

Challenges associated with incorporating technology in the classroom include a lack of funding, technical support, availability of appropriate technology, teacher acceptance, and district policies (Armstrong, 2014; Agbatogun, 2013). Technical issues during class as well as significant demands on teachers' time also prove to be problematic (Min Liu, Navarette, & Wivagg, 2014; Ozel, 2014). In addition, Armstrong (2014) found accessibility of technology in school and home environments to be an obstacle for the integration of technology. While 54% of teachers feel that students have adequate access to technology at school, only 18% of teachers feel that students have appropriate access

to technology at home (Armstrong, 2014). Further, Avci, Onal, and Usak (2014) conducted a study that revealed teachers are often unable to use technology because of a lack of instructional time or equipment as well as overcrowded classrooms. Although the use of technology is increasingly expected in all content areas, some classroom environments, such as physical education, are unique in nature and make technology implementation difficult (Pyle & Esslinger, 2013). In order to overcome challenges associated with technology use in education, it is recommended that teachers receive ongoing training and professional support as well as to enlist the help of a dedicated support staff (Armstrong, 2014; Min Liu, Navarette, & Wivagg, 2014; Lee & Lee, 2014).

While most research has revealed that those involved in education have positive attitudes toward using technology for teaching and learning, as discussed further in this section, there have been mixed results as to whether or not the use of technology improves student performance and achievement (Incantalupo, Treagust, & Koul, 2014). Min Liu, Navarrete, and Wivagg (2014) conducted a case study on the effect of providing iPod touch devices for teachers and students to use in class and at home. Results revealed that the iPod touch supported content learning, extended the learning time from the classroom to the home, and provided differentiated instructional support. In a 2006 study, Kang-Mi and Shen concluded that technology does not necessarily lead to better performance when compared to traditional instruction. However, they found that the use of technology does lead to an improvement of students' perceptions of their learning environments.

Teacher Attitudes Toward Technology

Much research is available concerning attitudes toward technology integration in an educational environment from the teacher's perspective, although many studies examine pre-service rather than in-service teachers. For instance, a 2012 study by Naaz found a positive relationship between the attitudes of pre-service teachers and computer usage. Birch and Irvine (2009) explored the factors that influence pre-service teachers' acceptance of information and communication technology integration in the classroom. Celik and Yesilyurt (2013) examined the attitudes, perceived self-efficacy, and anxiety of pre-service teachers toward technology and found that all three are important predictors of the teachers' attitudes toward using computer-supported education. An examination of the attitudes of pre-service history teachers toward technology revealed a positive relationship (Akbaba, 2013).

Many studies of in-service teachers have generated results that indicate that teachers have positive attitudes toward technology usage in the classroom environment. For example, Avidov-Ungar and Eshet-Alkakay (2011) conducted a study to determine the correlation between teachers' technological knowledge and attitudes towards change and found a positive correlation. A survey of primary and secondary teachers revealed that teachers have a generally positive attitude toward technology acceptance (Teo, 2014). On the other hand, Ifenthaler and Schweinbenz (2013) found diversity in the attitudes of teachers towards the integration of tablet-PCs in classroom instruction.

A 2013 study by Aldunate and Nussbaum examined the connection between the type of technology used and the attitude of the teacher toward innovation. Their findings indicated that teachers follow a process for technology adoption based on a learning

curve and that there are exit points during the process of technology adoption. Regardless of the difficulty level of the technology, teachers who devote a substantial amount of time to incorporating technology in their teaching practices in the early stages of the technology usage appear more likely to fully adopt the technology. Conversely, teachers who do not invest much time into incorporating the new technology in the early stages of use appear less likely to adopt the technology and more apt to discontinue use at specified points in the adoption process.

The *Unified Theory of Acceptance and Use of Technology* (UTAUT) was applied to a study of early childhood educators in an effort to examine predictors of teachers' access to and use of traditional technologies as well as newer technologies, such as mobile devices (Blackwell et al, 2013). Although results revealed that there were barriers to access to many technologies for teachers, their positive beliefs about the use of technology in student learning significantly predicted their actual use of technology in the classroom.

By applying the TAM, C-TAM-TPB, and UTAUT models of acceptance and use of technology, Ho, Hung, and Chen (2013) sought to examine teachers' usage behavior of adopting mobile phone messages as a way to communicate with parents. They discovered that attitude mediates perceived usefulness and behavior intention. The researchers found this to be the case even when teachers feel the mobile device is useful but have a negative attitude toward the device itself. Social influences, such as the perceptions of family and friends as well as the expectations from superiors, significantly influenced teachers' intention to use the technology. Furthermore, despite whatever intentions to use

technology teachers might possess, the actual use behavior of the technology relates to the school policies of the teachers' classrooms.

Student Attitudes Toward Technology

Research generally shows students have positive attitudes toward using technology in educational environments (Eyyam & Yaratan, 2014; Berz & Bowman, 1994; Webster, 2002; Ouren, 1998; Airy & Parr, 2001). Armstrong (2014) and Hwang, Wu, and Kuo (2013) found that students who were provided with technology to generate their work were much more likely to possess a positive attitude than when provided with traditional materials such as pencils and paper. In a 2014 experimental study of the attitudes toward technology of mathematics students by Eyyam and Yaratan, results indicated that attitudes were significantly higher for the students who used technology in the experimental group versus the students in the control group who received traditional instruction. Safar and Alkhezzi (2013) also found that students prefer a blended pedagogical approach that incorporates technology-based online teaching and learning with traditional instructor-led methods rather than receiving traditional instruction alone. Their research aimed to determine the effect and usefulness of a blended approach on academic achievement, motivation, and attitudes. Results indicated that students in the experimental group significantly outscored students in the control group.

A 2010 study by Shen and Chuang found that the attitudes and behavioral intentions of elementary school students regarding the use of interactive white boards are affected by factors such as interactivity, perceived self-efficacy, perceived ease of use, and perceived usefulness. Miranda and Russell (2012) examined predictors of teacher-directed student use of technology (TDS) among elementary-aged students. Results

indicated that the strongest predictors of TDS are teachers' experience with technology, the belief that technology is useful to meet instructional objectives, and perceived importance of technology for teaching. Beliefs and perceived importance were found to be the strongest predictors of TDS. The researchers also found that various obstacles with technology integration in the classroom prevent teachers from using technology.

Lebens, Graff, and Mayer (2009) found that secondary school-aged children from low socioeconomic backgrounds tend to be more cautious towards computers than children with an average to high socioeconomic status, despite the prevalence of technology in school. A study of the effects of technology on sixth grade students' learning achievement and attitude found that students who were exposed to technology-based instruction had significantly higher attitudes and degrees of acceptance than when they were exposed to traditional paper and pencil instruction (Hwang, Wu, & Kuo, 2013). Maria, Persa, Ilias, and Efstanthios (2011) surveyed high school students to determine their attitudes toward technology integration in art education and found a positive relationship. In addition, Judi, Amin, Zin, and Latih (2011) examined the attitudes of rural secondary school students towards information and communication technology and found that the relationship is generally positive. In 2012, Yu, Lin, Han, and Hsu looked at the attitudes of junior high school students toward technology in order to develop an attitudinal model, identify the factors influencing students' decision to pursue technology-related jobs, determine students' identification with technology, and to describe students' experiences with technology in the classroom.

Research is also available concerning the attitudes of collegiate level students toward technology. For example, Edmunds, Thorpe, and Conole (2012) examined the

attitudes of university students toward the use of information and communication technology using the *Technology Acceptance Model* (TAM). They determined that students' attitudes were most favorable toward technology in the context of work and are significant motivators for technology use in other situations. Smith (2012) looked at college students' attitudes and perceptions of aptitudes toward computers and found significant differences in age and gender but reported no significant differences in terms of liking, confidence, or anxiety. A 2010 study by Manochehri and Sharif explored the relationship between recently introduced classroom technology and the attitudes of university students. They discovered that the use of newly implemented classroom technologies increases with perceived ease of use and capacity for self-directed learning; however, prior technology experience did not impact the students' attitudes (Manochehri & Sharif, 2010). Goktas (2012) conducted a study on the attitudes of university physical education and sport students and pre-service teachers toward technology and discovered that there are significant correlations between their attitudes and variables such as gender, age, computer ownership, and computer instruction. Finally, Sawang, Sun, and Salim (2014) examined the effects of attitude, subjective norm, and perceived control on college students' technology adoption. They found that subjective norm had a moderating role on technology attitude and perceived control was a moderator of adoption intent.

Parent Attitudes Toward Technology

Unfortunately, not much salient information is available on the attitudes of parents toward technology usage for their children. A 2012 study by Lin, Liu, and Huang found that parents' perceptions towards educational robots were a significant factor in impacting the attitudes of their children towards technology. They recommend that

technology training for parents and students can build confidence and comprehension for both groups. Davies (2011) examined the use of educational technologies at home, focusing on the effort of parents to both provide technology for their children as well as regulate their children's use of technology. Results indicated that some students develop independence and creativity in their use of technology and other students moderate their technology usage according to what is suitable to their parents.

Deveci, Onder, & Cepni (2013) looked at the opinions of parents toward homework assignments using a researcher-developed Parent Homework Scale which measured function, attitude, and behavior. Results varied according to the parents' gender, educational background, occupation, and average monthly income. In examining the views of parents regarding the effectiveness of educational technology at home, Hollingworth et al (2011) found that cultural and economic capital as well as certain physical characteristics impacted the ability of parents to involve with the learning of students. The authors discuss the inequality of access to technology for families as well as how parents experience and manage technology at home.

Comparing Teacher, Student, and Parent Attitudes Toward Technology

There is a limited number of studies that explore a relationship of attitudes among teachers, students, and parents, although some studies have been found that explore the relationship of attitudes among teachers and students and students and parents. For example, Wiebe (2010) conducted a mixed methods survey to examine the effects of educational technology, specifically computer assisted language learning (CALL), on the attitudes of teachers and students. Wiebe found a discrepancy between students' awareness of teachers' goals for using CALL and the importance instructors placed on

the technology. There was also a disparity between the use of CALL as reported by the students and the teacher perceptions of the student use of CALL. Finally, there was a difference between the types of technology teachers thought were useful for student learning and the types of technology deemed useful by the students themselves. The outcome of the research revealed that while students and teachers were generally positive about the use of technology in learning a foreign language, fewer students than teachers found it to be useful. Wiebe concluded that teachers would benefit from knowing student perceptions of the use of technology in the classroom and should inform students of the purpose and goals behind the use of technology.

Puhek et al (2013) studied the perceived usability and acceptance of technology of students and teachers. They found that although there were obstacles to integrating the technology, the participants possessed positive attitudes toward the technology. When looking at the use of technology at home versus at school, results also suggested that students are more technologically savvy than their teachers. Furthermore, younger teachers tended to have more positive attitudes toward the use of technology in education than their older counterparts.

In examining the attitudes of adult, continuing education students and their teachers in higher education toward the use of information and communication technology (ICT), Ingleby (2014) used questionnaires and focus group discussions to uncover the perceptions of the participants. The major outcome of the study suggested that students associate ICT with computers and software while their teachers concentrate on pedagogical learning with technology in a broader sense.

There is a deficiency in the literature regarding the relationship of attitudes among teachers, students, and parents. An action study completed in 2003 by Alexiou-Ray, Wilson, Wright, and Peirano examined the impact of technology integration on students, parents, and school personnel in a high school history class setting after the instructor noticed negative reactions to classroom technology integration. After conducting surveys among the three groups of participants, the researchers concluded that attitudes toward technology were generally positive and "much of the initial resistance to technology integration derived from discomfort with the unknown" (Alexiou-Ray, Wilson, Wright, & Peirano, 2003, p. 58). In addition, Grant (2011) examined the perceptions of parents, teachers, and students toward the use of technology at school as well as at home. While all three groups of participants value technology for communication, Grant also discusses difficulties with using technologies at school and factors that need to be considered when connecting technology for learning between school and home. Because instruction in first-year band settings relies on the cooperation of teachers, students, and parents, it will be important to generate further research that examines how each group's attitude influences the attitudes of the other two groups.

Technology in Music Education

Amidst a time of rapid change and growth in education, music educators are increasingly seeing the need to upgrade their technological skills and practices (Wai-chung Ho, 2004). However, while technology has long been present in music outside the walls of the classroom, many music educators have not embraced the full potential of technology for music teaching and learning (Rees, 2011). One reason for music educators' hesitancy to better incorporate technology is their lack of experience using

technology in their own educational training. Those educators who do use technology may have had to learn how to do so on their own (Rees, 2011).

Students are experiencing high levels of engagement with technology in other facets of their lives, creating the need for teachers to make use of students' comfort with technology in order to enhance their learning experiences (Lebler, 2012). The main goal for learning about music technology, Muro (1997) suggests, is to allow music educators to satisfactorily and effectively meet the needs of students. While Webster (2002) posits that the need for technology serves to enable students to engage and improve in music, he also warns against teaching technology in a musical environment as the end goal. The effectiveness of the music technology, he claims, depends on the context in which it is used, the teacher, and the instructional use of the technology.

When music educators use technology, it is often used for the purposes of administrative tasks (Taylor & Deal, 2000; Jassman, 2004; Ohlenbusch, 2011), assessment, and far less often, pedagogical aids (Lebler, 2012; Webster, 2002). Technology in the music classroom has also been found to support a constructivist, student-centered learning environment (Koh, Chai, & Tsai, 2014; Ward, 2009; Keast, 2004; Bueher, 2000; Webster, 2011). Although the majority of established research on technology in music education strongly supports the use of technology in the schools (Webster, 2002), some people argue against the effectiveness of technology in enhancing the learning process (Conlon & Simpson, 2003; Convery, 2009; Treadway, 2001). Research on technology used in music teaching and learning focuses on composition and creativity, motivation and participation, performance, the technological tools available for use in the music classroom, and attitudes toward using technology in music education.

Composition and Creativity

Most research available concerning composition in the music classroom focuses on late secondary and collegiate level students. There have been far fewer studies that explore how elementary and primary aged students use technology as a compositional tool (Shibazaki & Marshall, 2013). One 2008 case study by Bolton examined the possibilities of integrating a technology project called Compose in primary schools in order to establish more composition opportunities for young students. Using software and online learning features, Bolton found that the use of Compose expanded compositional opportunities, resulting in increased composition skills and knowledge among students as well as helping students develop a positive musical self-concept.

Because of the ways in which many schools have invested in technologies for the music classroom, composition courses in music education have become largely associated with music technology (Armstrong, 2008; Nielsen, 2013). Kardos (2012) contends that most students in a composition class cannot read musical notation, have taught themselves how to play musical instruments, and have usually only had prior musical experience with using computer-sequencing software. According to Nielsen (2013), music technology classes designed to develop the compositional skills of high school students are becoming more prominent in education. He conducted a case study to describe the development of creativity in high school students through their participation in a high school music technology course. Upon asking students and teachers to describe the process of student creativity throughout the course, Nielsen generated four themes associated with developing student creativity through music technology and composition: the technology background of the student, the musical background of the student, the

music style preferences of the student, and the types of learning activities offered in the course.

Crow (2006) suggested that music technology is an important tool for creative thinking in music, allowing for a broader range of people to demonstrate musicality. A 2009 study by Ward demonstrated that secondary students are able to more freely compose using technology regardless of their formal musical training. When students are able to use technology in the music classroom, Ward claims they become more inventive, motivated, and enthusiastic toward the lesson material.

Motivation and Participation

Several authors posit that technology used in music settings can increase student motivation, promote higher levels of confidence, and allow for more individualized learning among students (Shibazaki & Marshall, 2013; Bolton, 2008; Kardos, 2012). In addition, the use of multimedia and digital technologies in the music classroom has been found to support a blended learning environment that can improve learning achievement and motivation (Pao-Ta Yu et al, 2010; Kumpulainen, Mikkola, & Jaatinen, 2014). On the other hand, Crow (2006) wrote that technology does not always engage or motivate students because the processes and outcomes are often perceived to be distant from students' musical lives and lacking in musical authenticity.

Ho (2004) found that primary aged students across genders reported higher degrees of motivation for learning about music while utilizing technology than secondary students. After studying the effect of technology usage on the motivation of beginning piano students, Simms (1997) found that students enjoyed using technology as long as they were successful, but avoided technology use if they were unsuccessful. A study of

the perceptions of secondary students toward the use of technology in music classrooms looked at the students' motivation to learn music, their preferred musical activities, and musical styles preferred for classroom learning (Ho, 2007). Upon analysis of written questionnaires completed by students, Ho determined that most students believe the use of technology in the music classroom is motivating and can extend the boundaries of learning.

The use of technology in the music classroom also appears to promote participation and accessibility for a broad range of students, particularly those who may otherwise be unable to participate (Airy & Parr, 2001). For example, Kelderman (2010) suggests that technology increases accessibility to resources for music students with visual impairments. McCord and Watts (2010) conducted a study that examined music educators' preparation of individual education programs (IEP) for students in addition to teachers' knowledge and attitudes toward using assistive technology for students with disabilities. Although teachers acknowledged the usefulness of assistive technology in music settings, they admitted a low level of involvement in the educational planning process for students with disabilities as well as a limited knowledge of appropriate resources. Recommendations for teachers include better preparation opportunities and improved collaboration among other educators.

Lagerlof, Wallerstedt, and Pramling (2013) studied student engagement and participation using new music technology, exploring what this participation implies for learning. Their results indicated that children are able to best participate while adults serve as guides and introduce the technology for children to creatively use on their own. In addition, Hanna and Kelly (2013) suggest that the interactivity of the Web 2.0 can

facilitate participation in music regardless of one's location and culture. This type of technology makes it possible to connect, share, collaborate, and receive feedback about music from any region of the world.

Performance

Studies on the use of technology and music performance have generated mixed results. For example, Orman (1998) evaluated the effect of technology on beginning saxophonists' achievement and attitude. Findings revealed that students exposed to technology-assisted instruction scored significantly higher in terms of achievement. In addition, students were found to have strong, positive attitudes toward the use of technology. However, when examining the effect of technology on beginning clarinet tone quality, Malave (1990) reported no significant differences in tone between the experimental group exposed to technology and the control group that performed without the use of technology. Likewise, a longitudinal study of elementary school students learning to play the clarinet explored the effect of integrating instruction using the Music Paint Machine interactive technology (Nijs & Leman, 2014). The authors also found no statistically significant differences between the experimental and control groups. However, they concluded that the complexity of authentic educational settings warrants further consideration in regards to research on technology in music education.

Karlsson, Liljestrom, and Juslin (2009) looked at reasons for the negative impressions of performers who use computer programs to express emotions during performances. The researchers compared feedback from a performance between a teacher and the computer program. Results indicated that a performer's belief that feedback came from a teacher versus feedback actually coming from the teacher yielded higher quality

ratings of the feedback. Performers reported that they preferred teacher feedback because it was often more detailed than the computer's output. In addition, teachers tended to offer encouragement, examples, and explanations that the computers did not.

A 2014 study by Leong and Cheng examined the use of real-time visual feedback tech (VFT) in the vocal training of pre-service music teachers in order to ascertain the effectiveness of the VFT software and to examine the teacher's perspective of their experiences using VFT. Pre-test and post-test results of singing tasks indicated that participants using VFT improved their vocal timbre significantly. Also, responses from a questionnaire survey found that most participants held positive attitudes about the effectiveness of VFT in vocal training.

Technological Tools and Availability

Many music educators may have difficulty in finding technology well suited for use in the classroom due to challenges such as a lack of equipment and resources, a lack of sufficiently trained music staff, and the high cost of technology (Gall, 2013; Webster, 2002). However, despite obstacles to technology integration, access to technology in music education settings is rising. For example, Lebler (2012) writes that the Internet's capability to provide easy access to information is significant because students no longer see their teachers as a primary source of information necessary for their learning. Yet teachers have often reported a desire to develop more experience and acquire more training in instructional technology for use in their classrooms (Webster, 2002). Bauer (2001) claims that while student attitudes toward technology in music class are generally positive, their attitudes vary depending on the availability of technology at home as well as their past experiences with using technology.

Teachers who are able to persevere past difficulties acquiring technology have explored using various tools in their lessons including videoconferencing programs such as *Skype*, podcasts, handheld devices, online resources, and software applications such as *SmartMusic*. For instance, Kruse, Harlos, Callahan, and Herring (2013) examined the benefits and challenges of conducting collegiate-level piano lessons via *Skype* in order to determine the feasibility of music distance learning. Reported benefits included a natural feel to lessons, an evolution of imagination and enthusiasm, and the mastering of equipment and music. However, challenges with using *Skype* for piano lessons included technological complications that hindered instruction as well as literal and figurative disconnectedness. Bolden (2013) writes that the use of podcasts in music education settings provides expanded opportunities for student learning. Bolden concluded that student production of podcasts yields benefits such as opportunities for active music listening, enhanced reflection, self-expression, enriched communication, increased self-knowledge, and creativity. Handheld devices were found by Carlisle (2014) to enrich the instructional approaches of elementary general music education students. Carlisle reported that technology integration operates at a tertiary level for use with common general music methods such as Dalcroze, Kodaly, and Orff, with the use of musical instruments being a secondary focus. Handheld technology, Carlisle concluded, can provide feedback to students as well as enrich students' experiences with musical instruments.

While most studies on the use of *SmartMusic* in educational settings reveal that participants have positive attitude toward the technology, mixed results have been reported regarding the effectiveness of the software in terms of improving musical

achievement. Repp (1999), for example, found that applied vocal students and their teachers had positive attitudes toward using *SmartMusic*, but that they preferred to use it outside of class rather than during lessons. Tseng (1996) reported that *SmartMusic* helps students with the learning of musical material, intonation, and performance preparation. In a study of middle school instrumentalists, Ouren (1998) concluded that the use of *SmartMusic* yields improvement in performance and also generates positive student attitudes. In 2002, Glenn and Fitzgerald conducted a study that examined the use of *SmartMusic* among college-level applied music students. They discovered that students who used *SmartMusic* reported an improvement in their overall levels of musicianship. Finally, while Glenn (2000) suggested that students enjoy using *SmartMusic* and feel its use contributes to their musicianship, no significant differences were found between experimental and control groups when comparing whether or not applied college students used the software.

Attitudes Toward Music Technology

While studies that examined the attitudes toward technology of teachers, students, and parents were previously addressed, reference will now be made to research that deals with the attitudes toward technology of teachers and students in musical environments. No research has been found that speaks to the attitudes of parents toward music technology.

Shibazaki and Marshall (2013) conducted a study to compare the attitudes of ten to eleven year old students between composing with instruments and composing with computers. Interview results revealed that students could appreciate both advantages and disadvantages of using computers to compose. Elementary aged students are suggested to

have higher positive attitudes toward technology usage in musical settings than secondary aged students (Wai-chung Ho, 2004). Studies regarding student attitudes toward technology according to gender have generated mixed results. Some have found many significant differences between the attitudes of female versus male students (Shibazaki & Marshall, 2013), while others have reported few differences in attitude across genders (Wai-chung Ho, 2004; Ho, 2004).

Ecoff (2007) suggests that the most important aspect of improving the technological skills of teachers is the attitude they have toward the music technology. Strategies are offered to help teachers locate appropriate resources to aid in the improvement of technological knowledge for music instruction. A survey of undergraduate music majors examined their attitudes toward using music technology as well as the practices of their former high school music teachers regarding technology usage in the classroom (Meltzer, 2001). Questionnaire results indicated that while students seem comfortable using technology in general, they have limited understanding of and experience with using music technology specifically. Recommendations are offered for the professional development and training of in-service teachers.

Wai-chung Ho (2004) conducted an interview study concerning concepts of informational technology (IT) with primary and secondary school teachers and their students. Results indicated that IT can support student motivation and enhance the quality of student learning with is carefully planned, designed, and integrated into good music practice in classrooms. When examining preschool children's interaction with music technology, Addessi and Pachet (2005) conducted video-based observations on students as well as gathered questionnaires from parents about the musical taste and experiences

of their children, though the attitudes of parents regarding the technology usage was not addressed.

Summary

In summary, research literature that aided in the development of the current study can be categorized into three main areas: technology use and acceptance models, technology in education, and technology in music education. A comparison of eight of the most prominent technology usage and acceptance models in 2003 by Venkatesh, Morris, Davis, and Davis gave rise to the *Unified Theory of Acceptance and Use of Technology* (UTAUT) which serves as the theoretical foundation for the research model of this study. Studies on the use of technology in education have shown that while teachers and students generally have positive attitudes toward using technology in the classroom, more work needs to be done to address challenges associated with technology use in an educational setting, including a lack of training and professional development for teachers, issues concerning availability and accessibility of technology, funding, and support. Also, despite positive attitudes, teachers appear to use technology infrequently in school and there is a discrepancy between technology use among teachers and use among students. More research could also be generated related to the perspectives of parents toward the use of technology in education.

Findings in research regarding technology in music education likewise show that while most participants in classroom music environments favor the use of technology, the actual use of technology is scant and often lacks pedagogically sound objectives. Although studies on the effects of technology use in music education on improvements in musical achievements have generated mixed results, most research reveals that music

technology promotes creativity, opportunities for participation, motivation, and positive attitudes among participants.

There is a lack of literature on attitudes toward technology integration in an elementary classroom instrumental music setting as well as a deficiency in resources pertaining to the attitudes of late elementary or middle school aged students and their parents toward technology. Furthermore, Alexiou-Ray, Wilson, Wright, and Peirano (2003) state that "much of the research done on technology integration assumes that once appropriate technological tools are in place in the classroom, students, teachers, and parents will overwhelmingly support the change toward a technologically based curriculum" (p. 58). Yet faced with the primary challenge of learning to play a new instrument, teachers, students, and parents may or may not feel as inclined to take on the additional process of learning new facets of technology that accompany instrumental music. This study aimed to fill in the gap in the literature related to the attitudes of teachers, students, and parents toward technology use in first-year instrumental music settings.

CHAPTER 3

METHODOLOGY

Introduction

The purpose of this quantitative, descriptive study was to determine what technologies are being used in first-year instrumental music settings and to examine factors that influence the attitudes of teachers, students, and parents toward the use of those technologies. In this chapter, information is organized in order to describe the: (a) participants, (b) instruments, (c) methods, (d) procedures, and (e) analysis of the data. Data was collected via a survey method approach.

Research regarding one's acceptance and use of technology, the role of technology in education in general as well as in music education specifically, and the attitudes of teachers, students, and parents toward technology in educational settings was summarized in the literature review. However, there is a lack of studies focusing on the use of and attitudes toward technology in school music environments, particularly for elementary-aged beginning instrumental music students. This study aimed to fill in the gap in existing literature by exploring the use of technology in elementary instrumental band and orchestra as well as the attitudes of the teachers, students, and parents involved in those experiences. Because no such study has been previously conducted, survey instruments were designed by the researcher based on a review of the literature, an examination of various related questionnaires, and feedback generated from a panel of experts in the field of music education.

Subjects

The participants in this study were comprised of teachers, students, and parents associated with first-year instrumental music in a large, Midwestern urban school district. The district was selected for inclusion in this study because it is one of the largest in the state. Therefore, it could yield the most substantial pool of in-service elementary band and orchestra directors as potential participants that could feasibly be reached by the researcher. Furthermore, because of the young age of the elementary student participants and consequent rigorous process for approval by school districts, only one school district was selected. Selected teachers included those who are responsible for the instrumental band and orchestra education of elementary school students. Students in their first year of study were fourth and fifth graders in an elementary school setting and were actively participating in band or orchestra. The parents in this study were the parents or legal guardians of first-year instrumental music students enrolled in the selected school district.

Because there were a combined total of 25 teachers working with beginning band and orchestra students in the district, the survey instrument was distributed to a convenience sample of all elementary instrumental music teachers in order to reduce error and achieve a high response rate of teachers to include in the study. The instrumental music supervisor of the district provided support for this study. The researcher met with district teachers at a staff meeting on October 28, 2014. At the meeting, surveys were distributed to all teachers.

The population of students and parents for this study included all of those who were involved in first-year instrumental band and orchestra in the district. Participating teachers distributed the questionnaire to a convenience sample of fourth and fifth graders

known to be participating in first-year instrumental music as well as their parents. Responses were solicited from one parent responsible for each of the students. Sampling continued until an adequate number of completed responses were obtained to reduce non-response error. Paper copies of the questionnaire were sent home from school with students whose classes were selected for students and parents to complete and return to school for the researcher to collect. To determine the relationship of attitudes among all groups of participants, students and parents returned their completed surveys combined in a single envelope to their schools where the researcher collected them. This ensured that student and parent participants were linked with the appropriate teachers who completed the questionnaire. Based on the population size of 7,483 participants (25 teachers, 3,729 students, 3,729 parents), 0.05 margin of error, 95% confidence level, and 0.5 standard of deviation, an *a priori* calculation of the sample size determined a combined total of 366 survey responses was needed for all groups of participants (teachers, students, and parents).

The Survey Instruments

Development of the Survey Instruments

Upon a review of the literature, examination of existing surveys on attitudes toward technology usage, and feedback received from a panel of experts in the field of music education, the researcher developed two survey instruments to use for data collection. The *Technology in Music Usage Questionnaire* (TMUQ) was developed for elementary instrumental music teachers, and the *Technology in Music Attitude Questionnaire* (TMAQ) was developed for teachers, students, and parents associated with

elementary instrumental music (Appendices D-F). The University of Nebraska-Lincoln Institutional Review Board for the Protection of Human Rights approved both of the instruments prior to survey distribution (Appendix A).

The researcher examined a variety of surveys from existing research on technology attitudes in order to develop the survey instruments used for this study. These included the Faculty Members Technology Use Scale (Agbatogun, 2013), the Children's Attitude Toward Technology Scale (CATS) (Frantom, Green, & Hoffman, 2002), the Computer Attitude Scale for Secondary Students (CASS) (Jones & Clark, 1994), the revised Computer Attitude Scale for Secondary Students (Smalley, Graff, & Saunders, 2001), Teachers' Attitudes Toward Information Technology (TAT) (Knezek, Christensen, & Arrowood, 1998), and Factors Affecting Teachers Teaching with Technology (SFA-T3), Part Four: Computer Attitudes (Papanastasiou & Angeli, 2008). In addition, items were examined from several scales that were adapted for the questionnaire used by Venkatesh, Morris, Davis, and Davis (2003) in the construction of the *Unified Theory of Acceptance and Use of Technology* (UTAUT). These scales included the *Theory of Reasoned Action* (Davis, Bagozzi, & Warshaw, 1989), *Technology Acceptance Model* (Davis, 1989; Davis, Bargozzi, & Warshaw, 1989; Venkatesh & Davis, 2000), *Motivational Model* (Davis, Bargozzi, & Warshaw, 1992), *Theory of Planned Behavior* (Taylor & Todd, 1995a, 1995b), *Model of PC Utilization* (Thompson, Higgins, & Howell, 1991), *Innovation Diffusion Theory* (Moore & Benbasat, 1991), and *Social Cognitive Theory* (Compeau & Higgins, 1995). The instrument designed for teacher participants for the current study included the following sections: (a) *Technology in Music Usage Questionnaire* (TMUQ), (b) *Technology in Music Attitude*

Questionnaire (TMAQ), and (c) demographics. Surveys developed for student and parent participants included the following sections: (a) *Technology in Music Attitude Questionnaire* (TMAQ), and (b) demographics.

Design of the Survey Instruments

Technology in Music Usage Questionnaire (TMUQ)

Teacher participants were first asked to complete the *Technology in Music Usage Questionnaire* (TMUQ) that can be located in Appendix E. Comprised of ten questions, the TMUQ provided an inventory of what technologies are being used in first-year instrumental music settings, described to what extent technology is being used in those settings, and determined the years of experience teachers have with using technology for band or orchestra. Based on the researcher's experiences and knowledge of available technologies that can be used for instrumental music instruction as well as information regarding music technology from the literature, a list of technologies was generated that categorized items as software (*SmartMusic, Interactive Practice Studio, Interactive Pyware Assessment System, Finale, Sibelius, GarageBand, iTunes*, and supplemental discs included in method books), hardware (computer, laptop, tablet, digital music player, interactive white board, smart phone/cell phone), or online resources (*Noteflight, MuseScore, Audacity*, social media, class website). Teachers also had the option of entering technologies that were not included on the list. Webster (2002) claimed that computer-related technology dominates what is used in education and thus does not consider instructional television, teaching machines that are not computer-based, stand-alone audiotape, slides, or motion pictures to be as relevant. Therefore, these technologies were excluded from the inventory list in the TMUQ. Technologies that may be more

pertinent in music education include: hardware such as personal computers, tablets, phones, personal music players, laptops, and iPods; software such as digital audio editing, traditional notation and graphics-based composition programs, loop-based composition and arranging, intelligent accompaniment; and online tools such as Internet interactive resources and social networking (Webster, 2011). Muro (1997) argued that the most commonly available technological tools for music educators were computers and electronic keyboards and that technology was used by music educators to reinforce basic musical concepts, arrange and compose, and access information via the Internet. However, because instrumental music directors may be less inclined to use electronic keyboards in class, they were not included on the list, although teachers may have added them in the "other" option if they were used.

Responses from the TMUQ served to answer the first research question of this study: What kinds of technologies selected for first-year instrumental music are being used in class and for practice outside of class and to what extent are these technologies being used? The first item in the TMUQ asked teacher participants to indicate which technologies they are currently using in class or assigning for use outside of class as well as which technologies they would like to use, if not already using, in class or would like to be able to assign for practice outside of class. Next, teachers were asked to indicate how many years of experience they have using technology for instrumental music in order to contribute to information needed to answer the study's second research question: To what extent do performance expectancies, effort expectancies, social influences, facilitating conditions (such as instructional time and class format, availability of technology, technology training, and parental support), and teachers' experience (with

professional teaching as well as technology) contribute to one's attitude toward technology in first-year instrumental music settings?

Teachers were also asked whether or not technology is used in class or assigned for practice outside of class in the third question. If teachers indicated that technology is used, they were then asked to respond to questions regarding how much time is spent using technology in class, how much time they expect students to practice using technology outside of class, what goals the use of technology serves, what ways technology is used, and what reasons teachers have for using technology in first-year instrumental music settings. If teachers responded that technology is neither used in class nor assigned for practice outside of class, they were then asked whether they previously used technology for music and whether they would like to use technology if given the opportunity. Finally, the tenth question asked teachers who reported not using technology in first-year instrumental music to identify reasons why technology is not used.

Technology in Music Attitude Questionnaire (TMAQ)

The purpose of this section was to assist in answering the second research question of the study by determining how performance expectancies, effort expectancies, social influences, and facilitating conditions contribute to one's attitude toward technology in first-year instrumental music settings. All participants were asked to complete the *Technology in Music Attitude Questionnaire* (TMAQ), located for teachers, students, and parents in Appendices D, E, and F, respectively. The TMAQ is comprised of the same number of questions (25) to be answered by each group of participants and contains a 5-point numerical rating scale, where 1 indicates "Strongly Disagree" and 5 indicates "Strongly Agree," to facilitate a comparison among the groups. The wording of

the items differed slightly for the questionnaires given to each group of participants. However, a panel of experts analyzed all versions of the questionnaire prior to data collection to ensure content validity.

Five constructs incorporated in the design of the TMAQ included: (a) attitude, (b) performance expectancy, (c) effort expectancy, (d) social influence, and (e) facilitating conditions. Based on the five constructs listed above, a set of 25 statements was generated, five for each construct, to which the participants were asked to respond. For each construct, item statements were worded both positively and negatively in order to increase the reliability of the questionnaire. The first construct, one's attitude toward technology, is defined as an individual's positive or negative feeling about using technology (Venkatesh, 2013; Fishbein & Ajzen, 1975). Statements were generated based on items found from attitude constructs in existing models (Davis, Bagozzi, & Warshaw, 1989; Fishbein & Ajzen, 1975; Taylor & Todd, 1995a, 1995b; Davis, Bagozzi, & Warshaw, 1992; Thompson, Higgins, & Howell, 1991; Compeau & Higgins, 1995). Examples of the statements developed for the attitude construct in the TMAQ include: *(1) Music would be more interesting with technology; (2) I like the idea of using technology for music; (3) Using technology for music does NOT seem enjoyable; (4) Music would get boring quickly with technology; and (5) Using technology for music would be fun.*

Performance expectancy, or the degree to which an individual believes that using the technology can help attain gains in job performance (Venkatesh, Morris, Davis, & Davis, 2003), is the second construct incorporated in the TMAQ. Existing items from related constructs (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989; Davis, Bagozzi, & Warshaw, 1992; Thompson, Higgins, & Howell, 1991; Compeau & Higgins, 1995;

Moore & Benbasat, 1991) served as a basis for the construction of the five statements created for the current study: *(1) Technology has no effect on the quality of music performance; (2) Technology is useful for learning to play an instrument; (3) Music students can learn more when they use technology than when they don't; (4) Using technology for music does NOT work very well; and (5) Technology creates positive results for instrument performance.*

The third construct featured in the TMAQ, effort expectancy, is the degree of ease associated with the use of the technology, or the perceived ease of use (Venkatesh, Morris, Davis, & Davis, 2003). Based on the constructs perceived ease of use (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989), complexity (Thompson, Higgins, & Howell, 1991), and ease of use (Moore & Benbasat, 1991), examples of effort expectancy statements were: *(1) Working with technology is so complicated, it's difficult to understand what's going on; (2) Using technology is easy; (3) Using technology takes too much time away from other things I have to do; (4) I can accomplish more when I use technology than when I don't; and (5) It would take too long to learn to use technology to make it worth the effort.* As mentioned in the first chapter, because it is assumed that students and parents have limited experience working with technology for instrumental music, as well as the possibility that this study may reveal that technology is not being used at all in first-year band or orchestra settings, effort expectancy in this inquiry will examine to what degree participants perceive the ease of use to be with technology in general.

Social influence is the fourth construct considered in the development of the TMAQ, defined as the degree to which an individual perceives that important others

believe that he or she should use the technology (Venkatesh, Morris, Davis, & Davis, 2003). Items from previous constructs relating to social influence were examined in the construction of the five TMAQ statements (Ajzen, 1991; Davis, Bagozzi, & Warshaw, 1989; Fishbein & Ajzen, 1975; Mathieson, 1991; Taylor & Todd, 1995a, 1995b; Thompson, Higgins, & Howell, 1991; Moore & Benbasat, 1991). These specific statements included: *(1) Using technology for music would make me appear to be a better teacher; (2) I don't have to use technology for music if I don't want to; (3) Other teachers use technology for music, so I feel like I should, too; (4) I use technology for music because someone else thinks I should; and (5) Using technology for music makes me more valuable to my administrators.*

Finally, facilitating conditions are defined as the degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the technology, or the perception of external control (Venkatesh, Morris, Davis, & Davis, 2003). Derived from constructs used in previous research (Ajzen, 1991; Taylor & Todd, 1995a, 1995b; Moore & Benbasat, 1991; Thompson, Higgins, & Howell, 1991), the five statements adapted for use in the TMAQ were: *(1) The way music is scheduled during the day makes it really difficult to use technology; (2) The music room is well-equipped to use technology during class; (3) Students do NOT have everything they need to use technology when practicing their instruments at home; (4) If I don't know enough about using technology for music, I know where I can go for help; and (5) Parents do a good job helping students use technology for practicing their instruments at home.*

Demographics

Demographic information gathered about the teachers included gender, age, years of professional teaching experience, years of experience teaching first-year instrumental music students, highest earned professional degree, a description of the teaching assignment, the length and frequency of lessons, the number of schools to which the teacher is assigned, and the number of students enrolled in first-year instrumental music at the school(s) to which the teacher is assigned. Students and parents were asked to indicate their gender, age, the student's grade level in school, and whether the student is participating in first-year orchestra, band, or both. As stated previously, although gender and age were not included in the research model for this study and therefore not taken into consideration in the data analysis, all participants were asked to provide this information in the demographic portion of the survey because both gender and age were components of the theoretical basis of the study.

Assessment of the Survey Instruments

The final stage of constructing the survey consisted of an assessment of the instruments' validity and reliability. In order to measure the accuracy of the survey by testing its content validity, the researcher reviewed the related literature, examined existing questionnaires that gathered data similar to the information needed for the current study, and modeled survey items after previously existing questions (see section above). In addition, the questionnaires were given to a panel of experts in the field of music education. The individuals who comprised the panel included five university

professors of music education, two doctoral students in music education, six in-service music educators, and one elementary school administrator. Members of the panel received the Instrument Assessment Form (Appendix B), a description of survey constructs and items, and the survey questionnaires. They were asked to complete the Instrument Assessment form and evaluate the survey in order to provide feedback that could improve the design of the instruments. In addition, panel members were asked to comment on the length of the survey, layout, formatting, and visual appeal in order to establish face validity. Based on suggestions made by the panel of experts, final versions of the questionnaires were constructed. Revisions included the addition of the response choice "Unable to Answer" in the TMAQ, minor changes in the wording of items, and asking participants to enter numeric data rather than selecting a response from a range of numbers. All panel members indicated that the 25 items in the TMAQ were closely related to the five constructs examined in the survey: attitude, performance expectancy, effort expectancy, social influence, and facilitating conditions.

A pilot test was conducted prior to the actual distribution of the survey for a small group of teachers, students, and parents that were not included in the sample for the research study. Participants in the pilot test were also asked to answer the following questions: (a) Are all words in the survey understood?; (b) Is there a clear interpretation of the survey?; (c) Can all the questions be answered by all respondents?; (d) What is your impression of the layout and visual design?; (e) How long did it take you to complete the survey?; (f) What was the difficulty level of the survey?; and, (g) Please give any other thoughts or comments you may have.

Upon examining the results of the pilot test, it was determined that all participants thought the visual design and layout were appealing, professional, and easy to follow. Participants also said that the survey took them about five to seven minutes to complete and most would prefer to take the survey in an online format. However, requirements of the participating school district in this study mandated that the surveys be taken via a paper format rather than an online format. Suggestions made by the pilot test participants to improve the survey included needs to: avoid duplicate items; provide comment boxes in order to better explain responses; make clearer distinctions between being a first-year teacher and being a teacher of first-year students; change the formatting of the response boxes to facilitate online surveys, if used; and determine how the participants should proceed with the survey if little or no technology is used in instrumental music settings.

To obtain a measure of the consistency and reproducibility of the data, Cronbach's coefficient alpha was calculated. This reflected how well the different items in the survey varied together when applied to each group of respondents. After collecting data for the pilot study, results determined that the estimated reliability coefficient for the survey is 0.897, indicating a high value of the instrument for individual measurement and diagnosis (Leonhard & House, 1972).

Procedure

Approval to conduct the study was obtained from the University of Nebraska-Lincoln Institutional Review Board (Appendix A) and the school district that was surveyed. The survey, distributed as paper copies in envelopes to teachers at a staff meeting on October 28, 2014, included the cover letter (Appendix C), appropriate informed consent forms, and questionnaires. Versions of the questionnaires constructed

for teachers, students, and parents can be found in Appendices D, E, and F, respectively. Teachers were given student and parent envelopes to distribute to students at school. Students were asked to take the survey materials home for students and parents to complete and return. Teachers were provided with packets of questionnaires to distribute to their participating students and parents. The researcher did not need access to class rosters or the names and contact information of students or parents. Students and parents received all of their appropriate materials (cover letter, child assent form, parental consent form, informed consent form, as well as student and parent questionnaires) in the same envelope to facilitate the distribution and return of the surveys. By distributing and returning all materials for students and parents in one envelope, it was also possible to match child assent with parental consent to ensure permission was received. Completing and returning the surveys to the school of the participant implied consent.

Completion of the surveys for all participants took place at the home of the participants, outside of the school day. Pilot test results revealed that the questionnaire took participants between five and seven minutes to complete. Participants were asked to return completed surveys to their schools where the researcher picked them up. Survey packets were sorted according to participant group (teacher, student, parent) prior to data entry to ensure anonymity and confidentiality of responses. Participants were not asked to provide any information that could identify them individually.

The data collection for this research was conducted primarily during the month of November because it was a mid-point in the fall semester when students and teachers had established well-developed classroom and practice routines. In addition, students had sufficient time to enroll in class, obtain their instruments, and participate in the program.

Furthermore, conducting the survey in November hopefully reached more participants prior to the holiday break when students are more likely to discontinue their participation in instrumental music during their first year.

Data Analysis

Upon collection of the surveys, data was entered into a Microsoft Excel document and then uploaded to SPSS and SAS for data analysis. Assistance in analyzing the data was provided by the Nebraska Evaluation and Research (NEAR) Center.

Teacher participants completed the *Technology in Music Usage Questionnaire* (TMUQ), questions one to ten, to determine what kinds of technologies selected for first-year instrumental music are being used in class and for practice outside of class and to what extent (Research Question 1). Descriptive statistics were calculated and reported in frequency distributions and tables. Comparisons were made between the technologies used, individually as well as by category (hardware, software, and online resources) with the number of teachers who use them. The percentage of teachers who use each type or category of technology was calculated. In addition, the researcher compared the technology used with the time spent in use, as well as reported the number and percentage of teachers who responded to each prompt regarding the purpose and reasons for using or not using technology.

All participants completed the *Technology in Music Attitude Questionnaire* (TMAQ) to determine to what extent performance expectancy (items 6-10), effort expectancy (items 11-15), social influence (items 16-20), and facilitating conditions (items 21-25) contribute to one's attitude (items 1-5) toward technology in first-year instrumental music settings (Research Question 2). Constructs were measured by

collecting responses using numerical scale data numbered 1-5 (1 = strongly disagree; 5 = strongly agree). Descriptive statistics were used to determine the mean (central tendency), standard deviation (variability), and distribution of responses. Data were analyzed using multilevel (hierarchical) linear modeling (MLM). This helped to ensure that the teachers were matched with the students and parents with which they were associated. Also, an MLM takes into account the fact that the errors within each randomly sampled unit are likely correlated, allowing for more accurate inferences about the data. Analyzed in SAS using the Proc Mixed package, three models were developed, one for each group of participants (teacher, student, and parent), with two levels for each model. In the teacher model, for example, the two levels are (1) teachers (level-2 unit) and (2) students and parents together (level-1 units). The students and parents are nested within teachers. In other words, there are multiple student and parent pairings for each teacher. Similar to multiple regression, MLM ascertains the degree of relationship among the dependent variable (attitude) and various independent variables (predictors). MLM is also able to take into account the hierarchical structure of the data, considering the unique effect each group has on the other groups, by allowing for random intercepts and slopes. The choice was made to use maximum likelihood as the type of estimation in order to account for unbalanced data.

Prior to analysis, an evaluation of the assumptions of MLM was conducted. According to Tabachnick and Fidell (2012), "MLM is designed to deal with the violation of the assumption of independence of errors expected when individuals within groups share experiences that may affect their responses" (p. 793). In MLM, the assumption of independence is frequently violated at each level; therefore, independence of errors is not

a necessity. In this study, for example, a teacher, his or her students, and their associated parents, are likely to influence each other and be more alike than the teachers, students, and parents from different schools.

Computer analysis generated two models for each group of participants. The intercepts-only, or null, model was generated first to test for mean differences between groups on the dependent variable (attitude) and did not contain any predictors. The second model added eight predictors to the intercepts-only model. For example, the teacher group model considered the degree of relationship among teacher attitude (dependent variable) and: (1) teacher scores on performance expectancy, (2) teacher scores on effort expectancy, (3) teacher scores on social influences, (4) teacher scores on facilitating conditions, (5) student attitude scores associated with teacher, (6) parent attitude scores associated with student's teacher, (7) years of teacher's professional teaching experience, and (8) years of teacher's technological experience (independent variables). In order to assess model fit, -2 log likelihood-ratio tests were conducted for each of the three models. This compared the intercept-only model (mean) with a model in which all predictors were added. To determine whether any predictors significantly contribute to attitude, tables were examined for the solutions for fixed effects for each of the three groups of participants surveyed.

Responses from items designed to measure attitude on the TMAQ (items 1-5) also determined if there are any significant differences in attitude between teachers, students, and parents toward using technology in first-year instrumental music settings (Research Question 3). Because participants all completed the same attitude questionnaire (TMAQ), a one-way ANOVA analysis could be conducted to examine the three groups of

participants (teachers, students, and parents) to determine if there were any significant differences. The independent variable was the group to which participants belonged and the dependent variable was attitude. A Fisher's Least Significant Difference (LSD) post-hoc test determined where the levels of significance lie. Post-hoc tests give the mean difference between each group and a *p* value to indicate where the groups differ significantly.

Finally, to determine whether or not a statistically significant relationship existed between attitude toward technology use and actual technology use in class and technology assigned for practice outside of class, a series of bivariate correlations were run (Research Question 4). Attitude scores of teachers, students, and parents individually as well as combined represent one variable and the time spent in the use of the technology represents the second variable compared. First, attitude scores were compared with the average time (in number of minutes) spent using technology in class per lesson. Then, attitude was compared with the average amount of time (in number of minutes) teachers expect students to use technology outside of class in their practice assignments. Results of the nature and strength of the bivariate relationships were summarized in scatter plots as well as by calculating Pearson's product-moment correlation coefficients (r) for each set of data. Scatter plots were examined to ensure that the relationships were not curvilinear or influenced by outliers. In order to determine the proportion of variability in attitude scores associated with time spent using the technology, coefficients of determination (r^2) were also calculated.

Summary

This chapter described the methods and procedures employed in this quantitative survey. First, the population of participants was defined and described along with the technique for selecting the sample size of subjects approached with taking part in the study. The sampling method was discussed as well as a description of how responses were solicited from participants.

Researcher-designed survey instruments were created to determine the technology used in first-year instrumental music and participants' attitudes towards the use of those technologies. The *Technology in Music Usage Questionnaire* (TMUQ) was distributed to elementary band and orchestra directors associated with the selected school district. This instrument determined what types of technologies are in use in first-year instrumental music and to what extent, answering the first research question. *The Technology in Music Attitude Questionnaire* (TMAQ), distributed to teachers as well as a sample of students and parents, was designed to ascertain to what extent performance expectancies, effort expectancies, social influences, and facilitating conditions contribute to one's attitude toward technology in elementary band and orchestra and to determine whether there are any significant differences between the attitudes of teachers, students, and parents.

A literature review as well as an examination of the survey instruments by a panel of experts established content validity and face validity. After collecting pilot test data, it was estimated that the reliability coefficient for the questionnaire is 0.897. This indicated a high value of the instrument for individual measurement and diagnosis.

Next, the survey procedures were described. All teachers from the selected school district received both questionnaires (TMUQ and TMAQ). A convenience sample of students and parents were selected to receive the TMAQ. Participant responses on the TMAQ helped to reveal the attitudes of teachers, students, and parents toward using technology in first-year instrumental music.

Finally, the data analysis for this study employed descriptive statistics to illustrate the population of participants who responded to the survey. Descriptive statistics were also used to answer the first research question by reporting information regarding whether teachers use technology in first-year instrumental music, what technology is used, and to what extent the technology is used. To answer research questions two, three, and four, inferential statistical procedures including multilevel linear modeling, a one-way ANOVA analysis, and Pearson's correlation coefficients were employed to examine factors that influence the attitudes of participants, show whether any statistically significant differences in attitude exist among teachers, students and parents, and reveal the nature and strength of any statistically significant relationship that may exist between attitude toward technology and use of technology in first-year instrumental music.

CHAPTER 4

PRESENTATION AND ANALYSIS OF DATA

Introduction

The purpose of this quantitative study was to discover what technologies are being used in first-year instrumental music settings and to examine factors that influence the attitudes of teachers, students, and parents toward the use of those technologies. In order to achieve the purpose of the study, four research questions were developed:

1. What kinds of technologies selected for first-year instrumental music are being used in class and for practice outside of class and to what extent are these technologies being used?
2. To what extent do performance expectancies, effort expectancies, social influences, facilitating conditions (such as instructional time and class format, availability of technology, technology training, and parental support), and teachers' experience (with professional teaching as well as technology) contribute to one's attitude toward technology in first-year instrumental music settings?
3. Are there any statistically significant differences in attitude among teachers, students, and parents toward using technology in first-year instrumental music settings?
4. Is there a statistically significant relationship between attitude toward technology use and technology use (in class and assigned for practice outside of class) and if so, what is the nature and strength of the relationship?

Chapter four begins with a discussion of the participant demographic factors. The remainder of the chapter will be devoted to the presentation of the results for each research question.

Demographic Analysis

Teacher Participants

Teacher demographics examined in this study included the following: gender, age, years of professional teaching experience, years of experience teaching first-year instrumental music students, highest earned professional degree, responsibilities included in the teaching assignment, the length and frequency of student lessons, and the number of schools to which the teacher is assigned (see Table 1).

Table 1

Demographic Characteristics of Teacher Participants

Characteristic	Frequency (%)
Gender	
Male	12 (52.2)
Female	11 (47.8)
Age (M = 43.18; SD = 12.62)	
20-29 years	4 (17.4)
30-39 years	5 (21.7)
40-49 years	4 (17.4)
50 years or more	9 (39.1)
Not Reported	1 (4.4)
Years of Professional Teaching Experience (M = 19.57; SD = 12.28)	8 (34.8)
0-10 years	3 (13.0)
11-20 years	6 (26.1)
21-30 years	6 (26.1)
31 years or more	
Years of Experience with First-Year Music Students	
0-10 years	8 (34.8)
11-20 years	6 (26.1)
21-30 years	6 (26.1)
31 years or more	3 (13.0)
Level of Education	
Bachelor's	11 (47.8)
Master's	11 (47.8)
Doctorate	1 (4.4)
Responsibilities in Teaching Assignment	
Elementary Band	11 (47.8)
Elementary Orchestra	15 (65.2)
Middle School Band	3 (13.0)
Middle School Orchestra	10 (43.5)
High School Band	3 (13.0)
High School Orchestra	2 (8.7)
Number of Schools in Teaching Assignment	
1	0 (0.0)
2	3 (13.0)
3	7 (30.4)
4	10 (43.5)
5 or more	3 (13.0)

Note: n = 23.

Of the 25 total teachers assigned to teach first-year band or orchestra in the school district surveyed, 23 teachers completed and returned the questionnaire for a response rate of 92.0%. With the cooperation of the instrumental music supervisor of the school district, the researcher was able to meet with teacher participants at a staff meeting prior to the distribution of the survey. The personal interaction with participants may have accounted for a larger than average response rate. Participant demographics were evenly distributed among gender, years of teaching experience, and professional degree (only one teacher had an earned doctorate). All teachers indicated that they meet with students for one, thirty-minute lesson per week. No teachers reported being assigned to choir, music technology, general music or music appreciation, or "other."

Student Participants

Student demographic information collected in the survey included gender, age, the student's grade level in school, and whether the student was enrolled in band, orchestra, or both (see Table 2).

Table 2

Demographic Characteristics of Student Participants

Characteristic	Frequency (%)
Gender	
Male	66 (29.5)
Female	158 (70.5)
Age	
9 years or younger	88 (39.3)
10 years	104 (46.4)
11 years	26 (11.6)
12 years or more	0 (0.0)
Not Reported	6 (2.7)
Grade Level	
4th Grade	112 (50.0)
5th Grade	111 (49.6)
Not Reported	1 (0.5)
Instrumental Music Classification	
Band	106 (47.3)
Orchestra	117 (52.2)
Band and Orchestra	1 (0.5)

Note: n= 224.

A total of 406 households received the survey packet that included both a student and parent questionnaire. Of those, 224 students completed and returned the survey for a response rate of 55.2%. While the completed responses of students were evenly balanced across grade level and classification (band or orchestra), the majority of student respondents was female (70.5%).

Parent Participants

Parent demographic information collected in the survey also included gender, age, their student's grade level in school, and whether their student was enrolled in band, orchestra, or both. However, because parent reporting of the latter two items mirrored what students had reported, this information was not duplicated in the parent demographic table (see Table 3).

Table 3

Demographic Characteristics of Parent Participants

Characteristic	Frequency (%)
Gender	
Male	47 (21.2)
Female	173 (77.9)
Not Reported	2 (0.9)
Age	
20-29 years	6 (2.7)
30-39 years	103 (46.3)
40-49 years	87 (39.2)
50 years or more	10 (4.5)
Not Reported	16 (7.2)

Note: n= 222.

Survey packets were distributed to a sample of 406 parents whose students were enrolled in first-year band or orchestra. Completed questionnaires were collected from 222 parents for a response rate of 54.7%. The majority of the respondents was female (77.9%) and was between 30-49 years of age.

Data Analysis

Research Question 1

Research Question 1: *What kinds of technologies selected for first-year instrumental music are being used in class and for practice outside of class and to what extent are these technologies being used?*

The frequency and percentage distribution of the technologies currently used for in-class instruction and assigned by the teachers for practice outside of class is displayed in Table 4. Teachers were asked to select which technologies they use for first-year instrumental music (band or orchestra) from a list on the Technology in Band Usage Questionnaire (TBUQ) that separated technology into three categories: software,

hardware, and online resources. In addition, teachers had the option of selecting "other" as an option if they used a technology not listed. They were also asked to specify responses selected as "other". Furthermore, teachers were asked to identify technologies from the same list that are not currently in use in first-year instrumental music settings, but that teachers would be interested in using if given the opportunity (Table 4).

Table 4

Distribution of Technologies in First-Year Instrumental Music

Technology Classification	**Currently Use In Class (%)**	**Would Like to Use in Class (%)**	**Currently Assign for Practice (%)**	**Would Like to Assign for Practice (%)**
Software				
SmartMusic	8 (34.8)	5 (21.7)	__	5 (21.7)
Interactive Practice Studio (IPS)	__	1 (4.4)	__	__
Interactive Pyware Assessment System (iPAS)	__	__	__	__
Finale	11 (47.8)	6 (26.1)	__	3 (13.0)
Sibelius	1 (4.4)	1 (4.4)	__	__
GarageBand	5 (21.7)	5 (21.7)	__	2 (8.7)
iTunes	13 (56.5)	1 (4.4)	__	1 (4.4)
Supplemental DVD/CD in Method Book	19 (82.6)	1 (4.4)	9 (39.1)	1 (4.4)
Other	3 (13.0)	__	1 (4.4)	1 (4.4)
Hardware				
Computer	8 (34.8)	1 (4.4)	1 (4.4)	1 (4.4)
Laptop	20 (87.0)	2 (8.7)	__	1 (4.4)
Tablet	1 (4.4)	16 (69.6)	__	2 (8.7)

Technology Classification	Currently Use In Class (%)	Would Like to Use in Class (%)	Currently Assign for Practice (%)	Would Like to Assign for Practice (%)
Digital Music Player	8 (34.8)	3 (13.0)	__	__
Interactive White Board	__	5 (21.7)	__	__
Smart Phone/Cell Phone	9 (39.1)	3 (13.0)	1 (4.4)	2 (8.7)
Other	2 (8.7)	__	__	__
Online Resources				
Noteflight	__	1 (4.4)	__	1 (4.4)
MuseScore	1 (4.4)	2 (8.7)	__	2 (8.7)
Audacity	1 (4.4)	4 (17.4)	__	3 (13.0)
Social Media	__	2 (8.7)	__	__
Class Website	1 (4.4)	4 (17.4)	__	__
Other	__	1 (4.4)	__	1 (4.4)

Note: Teacher n = 23.

The data show that more teachers use technology in class (87.0%) than assign technology for practice outside of class (39.1%). Of the technologies listed, laptops are used by the greatest percentage of teachers in class (87.0%), followed by the supplemental materials found in method books (82.6%). While most technologies are not assigned for outside practice, the greatest percentage of teachers (39.1%) indicated they also assign the supplemental method book materials for practice outside of class. If given the opportunity, the highest percentage of teachers would like to use tablets for in-class instruction (69.6%) while the highest percentage of teachers (21.7%) indicated they would like to assign *SmartMusic* for practice outside of class. Of the categories of

technologies listed (software, hardware, and online resources), online resources had the fewest number of teachers who actually use them or have an interest in using them.

In order to determine to what extent technologies are used in class and for practice outside of class during the first-year of instrumental music study, teachers were asked to answer questions regarding: whether or not technology is used, the average amount of time per class spent using technology, the average amount of time per week teachers expect students to practice with the aid of technology outside of class, how technology is used, and the purpose the teachers believe technology serves. The frequencies and percentages of the use of technology by teachers are displayed in Table 5.

Table 5

Distribution of the Use of Technology in First-Year Instrumental Music

Extent of Use	Frequency (%)
Use of technology	
1. Technology used in class AND assigned for practice.	3 (13.0)
2. Technology used in class but NOT assigned for practice.	17 (73.9)
3. Technology assigned for practice but NOT used in class.	1 (4.4)
4. Technology NEITHER used in class NOR assigned for practice.	2 (8.7)
Average minutes per class spent using technology	
No class time with technology	3 (13.0)
1-9 minutes	15 (65.2)
10-19 minutes	4 (17.4)
20 minutes or more	1 (4.4)
Average minutes per week of expected student practice using technology	
No expected practice with technology	16 (69.6)
1-9 minutes	1 (4.4)
10-19 minutes	2 (8.7)
20 minutes or more	4 (17.4)
Technology is primarily used for:	
Lesson Delivery	5 (21.7)
Student Interaction	3 (13.0)
Both Lesson Delivery & Student Interaction	12 (52.2)
Other	1 (4.4)
Technology Not Used	2 (8.7)
Purpose served by technology:	
Assessment	13 (56.5)
Recording	13 (56.5)
Accompaniment	15 (65.2)
Games	2 (8.7)
Composition/Arrangement	9 (39.1)
Visual Display of Notation	5 (21.7)
Listening	11 (47.8)
Other	3 (13.0)

Note: Teacher n = 23.

The data indicate that most teachers (73.9%) use technology in class but do not assign technology for practice outside of class. Within a thirty-minute lesson period, the

majority of teachers who use technology in class spend an average of 1-9 minutes per class using technology (65.2%). A majority of teacher respondents (69.6%) indicated that they do not expect students to practice using technology outside of class. Just over half of the teachers surveyed (52.2%) indicated that technology is used for both lesson delivery and student interaction. The top three reported purposes for technology use in instrumental music were accompaniment (65.2%), recordings (56.5%), and assessment (56.5%).

Further, if teachers indicated that they used technology in class, assigned technology for practice outside of class, or both, they were asked to select reasons why technology was used in these first-year instrumental music settings from a list of responses. Frequencies and percentages of responses selected by teachers for why technology is used are displayed in Table 6.

Table 6

Distribution of Reasons Given for Why Teachers Use Technology in First-Year Instrumental Music

Response	In-Class Frequency (%)	Assign for Practice Frequency (%)
It helps me reach my teaching goals.	15 (65.2)	1 (4.4)
It helps my students reach their performance goals.	14 (60.9)	10 (43.5)
It saves me time.	2 (8.7)	1 (4.4)
Technology is readily available.	7 (30.4)	5 (21.7)
Using technology is a requirement.	1 (4.4)	0 (0.0)
Using technology is inexpensive.	1 (4.4)	1 (4.4)
I am knowledgeable about using technology.	8 (34.8)	1 (4.4)
Using technology is easy.	3 (13.0)	1 (4.4)
Technology is useful in beginning instrumental music.	10 (43.5)	6 (26.1)
There is enough parental support to use technology.	2 (8.7)	4 (17.4)
Other	1 (4.4)	2 (8.7)

Note: Teacher n = 23.

Most teachers who reported using technology in class indicated that technology helped them to reach their teaching goals (65.2%) as well as helps their students reach their performance goals (60.9%). Of the teachers who assigned technology for practice outside of class, the greatest percentage of them (43.5%) indicated that technology helped their students reach their performance goals.

If teachers indicated that they neither used technology in class nor assigned it for practice outside of class, they were asked whether they previously used technology for first-year instrumental music but do not anymore, do not use technology and would *not*

like to in the future, or do not use technology but *would* like to in the future. Table 7 contains the frequencies and percentages of teacher responses.

Table 7

Distribution of the Disuse of Technology by First-Year Instrumental Music Teachers

Response	Frequency (%)
I previously used technology for music, but I don't anymore.	1 (4.4)
I do not use technology for music and I hope I never have to.	0 (0.0)
I do not use technology for music, but I would like to if I could.	2 (8.7)

Note: Teacher n = 23.

The data indicate that of the 23 teacher respondents, only three (13.0%) do not use technology in any capacity in first-year band or orchestra. Of the three who do not use technology, one teacher had previous experience using technology but does not currently use technology and two teachers do not currently use technology but indicated an interest in using technology if given the opportunity.

Finally, teachers were asked to select possible reasons why technology was *not* used in first-year band and orchestra settings from a list of responses. Frequencies and percentages of responses selected by teachers for why technology was *not* used are displayed in Table 8.

Table 8

Distribution of Reasons Given for Why Teachers Do Not Use Technology in First-Year Instrumental Music

Response	In-Class Frequency (%)	Assign for Practice Frequency (%)
There is not enough time.	9 (39.1)	1 (4.4)
The lesson schedule does not allow for me to incorporate technology.	4 (17.4)	0 (0.0)
I have to travel between buildings, so using technology is difficult.	6 (26.1)	0 (0.0)
Technology is not readily available.	1 (4.4)	2 (8.7)
Using technology is not a requirement.	2 (8.7)	0 (0.0)
Technology is too expensive.	2 (8.7)	0 (0.0)
I don't know enough about using technology.	3 (13.0)	3 (13.0)
Using technology is too difficult.	0 (0.0)	0 (0.0)
Technology is not useful in beginning instrumental music.	0 (0.0)	0 (0.0)
There is not enough parental support to use technology.	1 (4.4)	4 (17.4)
Other	2 (8.7)	1 (4.4)

Note: Teacher n = 23.

Although only three teachers indicated they did not use technology in any capacity in first-year instrumental music, many teachers provided responses for why they do not use technology. The greatest percentage of teacher respondents (39.1%) indicated they do not use technology in class because of a lack of time while a lack of parental support was the top reason given for why technology is not assigned for practice outside of class (17.4%).

Summary of Research Question 1

In answering research question one, it was discovered that the technologies used in class by a majority of teachers assigned to first-year band and orchestra include: laptops (87.0%), the supplemental materials (DVD/CD) included with the method books (82.6%), and iTunes (56.5%). Less than half of teacher respondents indicated assigning technology for practice outside of class with method book supplemental materials contributing to the highest percentage of technologies assigned (39.1%). A majority of teachers indicated that they would like to be able to use tablets in class if given the opportunity (69.6%), while a small number of teachers wished to be able to use other technologies for outside practice. Of the 20 teachers who indicated they used technology in class, 15 reported spending an average of 1-9 minutes per 30-minute class period using technology, 4 indicated spending between 10-19 minutes using technology, and one teacher reported spending more than 20 minutes using technology per class. A majority of teachers (69.6%) did not expect students to use any technology when practicing outside of class.

Research Question 2

Research Question 2: *To what extent do performance expectancies, effort expectancies, social influences, facilitating conditions (such as instructional time and class format, availability of technology, technology training, and parental support), and teachers' experience (with professional teaching as well as technology) contribute to one's attitude toward technology in first-year instrumental music settings?*

In order to answer this question, all participants (teachers, students, and parents) were asked to complete the *Technology in Music Attitude Questionnaire* (TMAQ). The

questionnaire is comprised of 25 items, collectively designed to measure the contributing factors to one's attitude toward using technology in instrumental music. Attitude served as the dependent variable for this study and was measured via survey items 1 to 5. The items were based on a five-point numerical rating scale, where 1 indicated "Strongly Disagree" and 5 indicates "Strongly Agree", with an average above 3.0 indicating a positive attitude. Independent variables (predictors) consisted of performance expectancies, effort expectancies, social influences, and facilitating conditions and were measured via survey items 6-10, 11-15, 16-20, and 21-25 respectively. Additional independent variables included years of professional teaching experience (measured in the demographic portion of the teacher TMAQ, item 3) as well as years of technological experience of the teachers (measured in the TMUQ, item 2). There were no hypothesized interactions among the predictors.

Data were analyzed using multilevel (hierarchical) linear modeling (MLM). Three models were developed, one for each group of participants (teachers, students, parents), with two levels per model. Each model was a mixed effects model where the intercepts and slopes were fixed components and error accounted for the random components. There were two separate null hypotheses, one each for the fixed and random effects. For the fixed effects, the null hypothesis is that there are no differences in the means of each treatment group:

$$H_0 : \mu_1 = \mu_2 = \mu_3$$

The null hypothesis for the random effect is that its variance is equal to zero:

$$H_0 : \sigma^2\beta = 0$$

The multilevel models used to analyze the data were built through the specification and combination of different level-1 and level-2 models in order to account for the nested configuration of the data. The resulting general equation used in this study was:

$$Y = a + b_1X_1 + b_2X_2... + b_8X_8 + e$$

or

$$\text{Attitude} = \text{intercept} + \text{slope}(\text{predictor}_1) + \text{slope}(\text{predictor}_2) \ldots + \text{slope}(\text{predictor}_8) + \text{random error of prediction}$$

The equations for each of the three models used in this study were as follows:

(1) Teacher Attitude = 1.9774 + 0.06932 (Teacher Performance) + 0.2615 (Teacher Effort) + 0.1161 (Teacher Social) + 0.1667 (Teacher Facilitating) + -0.00438 (Student Attitude) + 0.01019 (Parent Attitude) + -0.00492 (Teaching Experience) + 0.02634 (Technological Experience) + 0.1395

(2) Student Attitude = 1.9543 + 0.4404 (Student Performance) + 0.2318 (Student Effort) + -0.1039 (Student Social) + 0.1052 (Student Facilitating) + 0.1148 (Parent Attitude) + -0.2220 (Teacher Attitude) + -0.00820 (Teaching Experience) + 0.01200 (Technological Experience) + 0.4306

(3) Parent Attitude = 0.6504 + 0.4129 (Parent Performance) + 0.3989 (Parent Effort) + -0.01368 (Parent Social) + 0.03310 (Parent Facilitating) + 0.06571 (Student Attitude) + -0.02392 (Teacher Attitude) + -0.00255 (Teaching Experience) + 0.005501 (Technological Experience) + 0.2191

Evaluation of Assumptions

A total of 469 participants completed the survey (teacher n = 23; student n = 224; parent n = 222). In MLM, unequal sample sizes are not problematic but are instead expected (Tabachnick & Fidell, 2012). In order to answer research question 2, it was necessary to be able to pair teachers with their corresponding students and parents. There were cases where some teachers completed responses but did not have associated student and parent responses. Likewise, there were some students and parents who completed the survey but could not be linked to their teacher's responses. Therefore, a total number of 228 responses were used in building the MLM models. Missing values were replaced with group averages for those participants. This occurred, for instance, when a student was linked to a parent, but the parent did not provide a response. The missing parent's response was then replaced with the average parent response associated with that teacher's group. With the sample size over 60, a large enough sample of participants was achieved in order to use the maximum likelihood technique of MLM.

In order to assess model fit, -2 log likelihood-ratio tests were conducted for each of the three models. This compared the intercept-only model (mean) with a model in which all predictors were added. In the teacher model, the intercept-only model (with a -2 log likelihood value of 287.3) was compared against the eight-predictor, full model (with a -2 log likelihood value of 175.3):

$$\text{Teacher Model: } \chi^2 = 287.3 - 175.3 = 112$$

With df = 8 and a statistically significant value, the full model leads to prediction that is significantly better than chance or by considering the mean attitude score of teachers

alone. In the student model, the intercept-only model (with a -2 log likelihood value of 631.2) was compared against the full, eight-predictor model (with a -2 log likelihood value of 391.1):

$$\text{Student Model: } \chi^2 = 631.2 - 391.1 = 240.1$$

This value is also statistically significant with df = 8, indicating that the full model predicts student attitude significantly better than by chance. Finally, in the parent model, the intercept-only model (with a -2 log likelihood value of 487.8) was compared against the eight-predictor, full model (with a -2 log likelihood value of 262.6):

$$\text{Parent Model: } \chi^2 = 487.8 - 262.6 = 225.2$$

With df = 8 and a statistically significant value, the full parent model also leads to significantly better prediction of parent attitude than by examination of the mean score of parent attitude alone. Comparisons of the -2 log likelihood values between the intercepts-only models and the full models for all three groups of participants suggest good model fit; therefore, the use of MLM is advisable for each group of participants.

Descriptive Statistics and Distributions

To test whether the distribution of the TMAQ attitude scale deviated from normal, skewness and kurtosis values were examined for data from each group of participants. The data displayed in Table 9 shows the descriptive statistics of teacher responses for each of the constructs measured in the TMAQ.

Table 9

Descriptive Statistics of Teacher Responses on the TMAQ

Variable	Mean	95% CI		SD	Min	Max	Skewness		Kurtosis	
		LB	UB				Statistic	Std. Error	Statistic	Std. Error
Attitude	4.2	3.9	4.4	0.6	2.8	5.0	-0.6	0.5	-0.1	0.1
Performance	3.8	3.5	4.1	0.7	2.5	5.0	0.3	0.5	-0.3	0.9
Effort	3.4	3.1	3.7	0.7	2.0	4.8	-0.1	0.5	0.4	0.9
Social	3.3	3.1	3.6	0.5	2.4	4.3	0.2	0.5	-1.1	0.9
Facilitating	2.6	2.3	2.9	0.8	1.3	4.3	0.3	0.5	0.2	0.9

Note: n =23.

All 23 teachers who returned a survey completed all 25 questions in the TMAQ; therefore, all responses were usable. If the skewness and kurtosis values range from -1.0 to +1.0, the data distribution is approximately normal in shape (Huck, 2012). The teacher data revealed that the constructs of attitude, performance expectancies, effort expectancies, and facilitating conditions were approximately normal. However, the construct of social influences had a kurtosis value of -1.1, revealing the distribution to be platykurtic (where the hump of the distribution is smaller and the tails thicker).

Descriptive statistics for student participants are found below in Table 10. Although skewness and kurtosis values for student attitude indicated a normal distribution, examination of the stem-and-leaf plot as well as a box-and-whisker plot indicate the distribution of scores to be negatively skewed (Figure 8). Student scores for the constructs of performance expectancies, effort expectancies, social influences, and facilitating conditions have approximately normal distributions. Of the 224 students who returned surveys, 218 students completely answered the questions for a 97.3% completion rate.

Table 10

Descriptive Statistics of Student Responses on the TMAQ

Variable	Mean	95% CI		SD	Min	Max	Skewness		Kurtosis	
		LB	UB				Statistic	Std. Error	Statistic	Std. Error
Attitude	3.8	3.7	3.9	1.0	1.0	5.0	-0.8	0.2	0.0	0.3
Performance	3.4	3.2	3.5	0.9	1.0	5.0	-0.3	0.2	-0.3	0.3
Effort	3.7	3.6	3.8	0.9	1.0	5.0	-0.7	0.2	0.0	0.3
Social	3.7	3.5	3.8	0.9	1.3	5.0	-0.4	0.2	-0.7	0.3
Facilitating	3.5	3.4	3.6	0.9	1.0	5.0	-0.3	0.2	-0.1	0.3

Finally, descriptive statistics for parent participants are found below in Table 11. Skewness and kurtosis values revealed that attitude, performance expectancies, social influences, and facilitating conditions are relatively normally distributed. Examination of stem-and-leaf plots reveals attitude and performance expectancy scores to have bimodal distributions. With a kurtosis value of 1.7 for effort expectancies, the distribution is found to be leptokurtic with large numbers at the center (overly peaked). Of the 222 parents who returned surveys, 217 parents completely filled out answers to the TMAQ for a completion rate of 97.7%. A summary of descriptive results on the TMAQ for all groups of participants is found below in Table 12.

Table 11

Descriptive Statistics of Parent Responses on the TMAQ

Variable	Mean	95% CI		SD	Min	Max	Skewness		Kurtosis	
		LB	UB				Statistic	Std. Error	Statistic	Std. Error
Attitude	3.9	3.8	4.0	0.7	1.4	5.0	-0.7	0.2	0.7	0.3
Performance	3.6	3.5	3.7	0.8	1.0	5.0	-0.5	0.2	0.4	0.3
Effort	3.9	3.9	4.0	0.6	1.5	5.0	-0.9	0.2	1.7	0.3
Social	3.5	3.4	3.6	0.9	1.0	5.0	-0.2	0.2	-0.3	0.3
Facilitating	3.4	3.2	3.5	1.0	1.0	5.0	-0.3	0.2	-0.3	0.3

Table 12

Summary of Descriptive Results on TMAQ for Teachers, Students, and Parents

GROUP		Attitude	Performance	Effort	Social	Facilitating
Teacher	Mean	4.1623	3.8109	3.4065	3.3457	2.6014
	N	23	23	23	23	23
	Std. Deviation	.60095	.65556	.69614	.54724	.75797
Student	Mean	3.7548	3.3459	3.6712	3.6943	3.5133
	N	224	221	224	222	221
	Std. Deviation	.99218	.91340	.88411	.92501	.90585
Parents	Mean	3.9092	3.5995	3.9477	3.4833	3.3545
	N	220	219	219	218	220
	Std. Deviation	.73485	.79900	.63509	.86281	.96556
Total	Mean	3.8476	3.4890	3.7881	3.5776	3.3928
	N	467	463	466	463	464
	Std. Deviation	.86760	.86008	.78273	.88693	.94706

Further examination of box-and-whisker plots for each of the constructs measured in the TMAQ show the variability of data. Positions of the rectangles ends are determined by Q3 and Q1, upper and lower quartile points. Whiskers are drawn to show variability beyond the 75^{th} and 25^{th} percentiles. Small circles beyond the whiskers indicate outlier scores. The middle line in the rectangle indicates the mean. If the whiskers are equal length, then the distribution is probably symmetrical. Distributions are skewed if whiskers are of unequal lengths. Box-and-whisker plots for the scores of attitude, performance expectancies, effort expectancies, social influences, and facilitating conditions are found below in Figures 8-12.

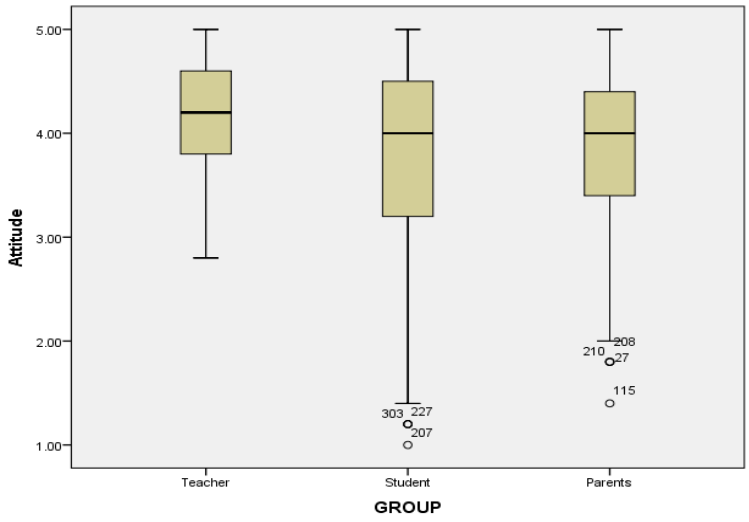

Figure 8: Box-and-Whisker Plot for Teacher, Student, and Parent Attitude Scores on the TMAQ.

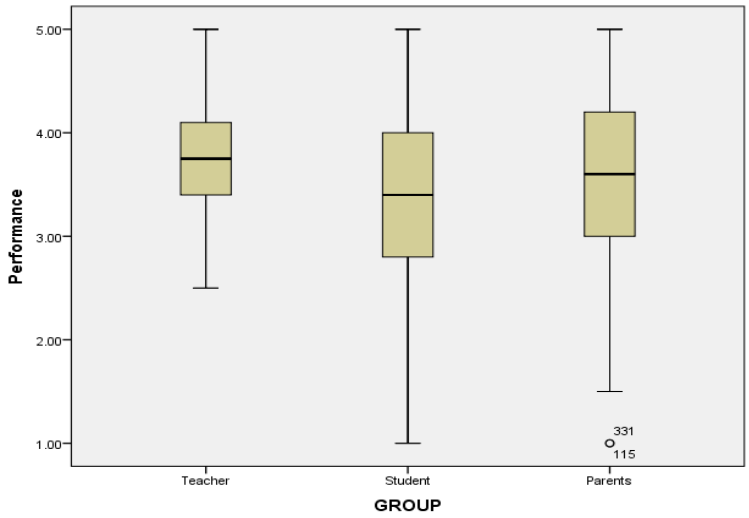

Figure 9: Box-and-Whisker Plot for Teacher, Student, and Parent Performance Expectancy Scores on the TMAQ.

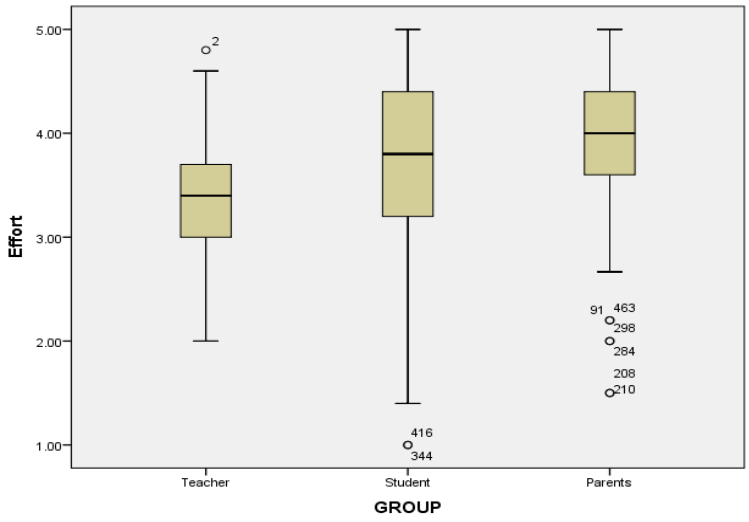

Figure 10: Box-and-Whisker Plot for Teacher, Student, and Parent Effort Expectancy Scores on the TMAQ.

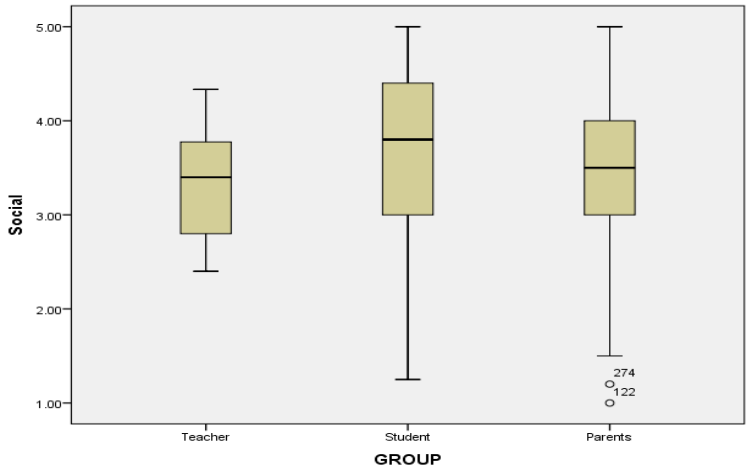

Figure 11: Box-and-Whisker Plot for Teacher, Student, and Parent Social Influence Scores on the TMAQ.

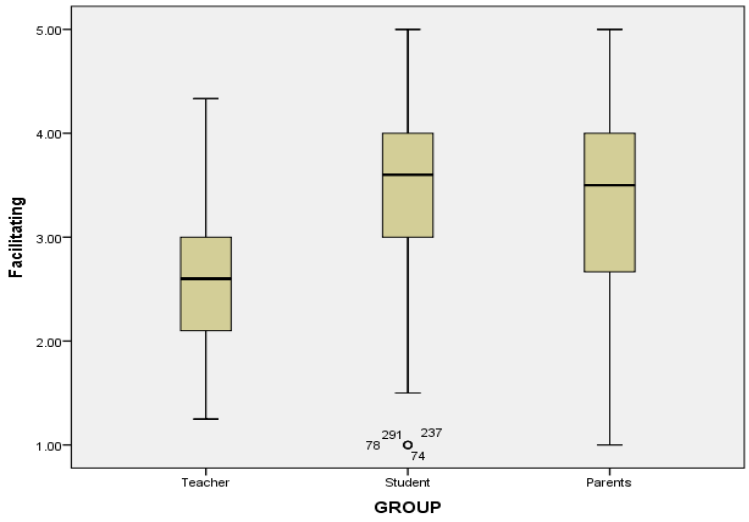

Figure 12: Box-and-Whisker Plot for Teacher, Student, and Parent Facilitating Conditions Scores on the TMAQ.

Multilevel Modeling

Three, two-level models were constructed for analysis. The first full model constructed for teacher participants examined the degree of relationship between the dependent variable (teacher attitude) and the following independent variables: (1) teacher performance expectancies, (2) teacher effort expectancies, (3) teacher social influences, (4) teacher facilitating conditions, (5) student attitude, (6) parent attitude, (7) teaching experience of teacher, and (8) technological experience of teacher. For fixed effects, effort expectancies (0.2615, t (193) = 3.81, p = 0.0002), facilitating conditions (0.1667, t (193) = 3.28, p = 0.0012), and technological experience (0.02634, t (193) = 5.31, p <0.0001) significantly predicted teacher attitude when averaged over student and parent attitudes. The parameter estimates show that teacher attitude is greater when effort expectancies are greater; for each unit increase in effort expectancy, attitude increased by about 0.26 on a scale of 1-5. Attitude also increased when perceptions of facilitating conditions were higher. For every one-unit increase in facilitating condition scores,

attitude increased by 0.167. However, the estimated coefficient alpha for facilitating conditions was lowest for teachers (0.564), suggesting that additional study may be warranted (Appendix G). Further, for every additional year of technological experience, teacher attitude also increased by 0.026. No statistically significant effects were found for performance expectancies, social influences, student attitude, parent attitude, or years of professional teaching experience (Table 13).

Table 13

Solution for Fixed Effects for Teacher Multilevel Model (MLM)

Effect	Estimate	Std. Error	DF	t Value	Pr > |t|
Intercept	1.9774	0.3881	193	5.10	< 0.0001
Teacher Performance	0.06932	0.05890	193	1.18	0.2407
Teacher Effort	0.2615	0.06867	193	3.81	0.0002*
Teacher Social	0.1161	0.06046	193	1.92	0.0563
Teacher Facilitating	0.1667	0.0587	193	3.28	0.0012*
Student Attitude	-0.00438	0.02798	193	-0.16	0.8758
Parent Attitude	0.01019	0.03861	193	0.26	0.7922
Teaching Experience	-0.00492	0.004094	193	-1.20	0.2304
Technological Experience	0.02634	0.004960	193	5.31	<0.0001*

Note: * $p < .05$

The second model constructed for student participants examined the degree of relationship between the dependent variable (student attitude) and the following independent variables: (1) student performance expectancies, (2) student effort expectancies, (3) student social influences, (4) student facilitating conditions, (5) parent

attitude, (6) teacher attitude, (7) professional teaching experience of teacher, and (8) technological experience of teacher. Resulting data for fixed effects indicated that student performance expectancies (0.4404, t (187) = 5.97, $p < 0.0001$) and student effort expectancies (0.2318, t (187) = 3.15, $p = 0.0019$) significantly predicted student attitude when averaged over teacher and parent attitudes. Parameter estimates suggest that for every unit increase in student performance expectancy, student attitude increased by about 0.44 on a scale of 1-5. In addition, for every unit increase in effort expectancy, student attitude increased by 0.232. However, the residual value in the student model is also significant. There is still variance in student attitude that cannot be explained. No statistically significant effects were found for social influences, facilitating conditions, parent attitude, teacher attitude, professional teaching experience, or the technological experience of the teacher (Table 14).

Table 14

Solution for Fixed Effects for Student Multilevel Model (MLM)

Effect	Estimate	Std. Error	DF	t Value	Pr > |t|
Intercept	1.9543	0.7173	187	2.72	0.0070
Student Performance	0.4404	0.07379	187	5.97	<0.0001*
Student Effort	0.2318	0.07356	187	3.15	0.0019*
Student Social	-0.1039	0.06443	187	-1.61	0.1085
Student Facilitating	0.1052	0.06089	187	1.73	0.0856
Parent Attitude	0.1148	0.06884	187	1.67	0.0970
Teacher Attitude	-0.2220	0.1155	187	-1.92	0.0561
Teaching Experience	-0.00820	0.005593	187	-1.47	0.1443
Technological Experience	0.01200	0.007841	187	1.53	0.1277

Note: * $p < .05$

The final model constructed for parent participants examined the degree of relationship between the dependent variable (parent attitude) and the following independent variables: (1) parent performance expectancies, (2) parent effort expectancies, (3) parent social influences, (4) parent facilitating conditions, (5) student attitude, (6) teacher attitude, (7) professional teaching experience of the teacher, and (8) technological experience of the teacher. Resulting data for fixed effects indicated that parent performance expectancies (0.4129, t (190) = 8.38, $p < 0.0001$) and parent effort expectancies (0.3989, t (190) = 6.02, $p < 0.0001$) significantly predicted parent attitude when averaged over teacher and student attitudes. Parameter estimates suggest that for every unit increase in parent performance expectancy, parent attitude increased by about 0.413 on a scale of 1-5. In addition, for every unit increase in parent effort expectancy,

parent attitude increased by 0.399. No statistically significant effects were found for social influences, facilitating conditions, student attitude, teacher attitude, professional teaching experience, or the technological experience of the teacher (Table 15).

Table 15

Solution for Fixed Effects for Parent Multilevel Model (MLM)

Effect	Estimate	Std. Error	DF	t Value	Pr>|t|
Intercept	0.6504	0.4693	190	1.39	0.1674
Parent Performance	0.4129	0.04925	190	8.38	<0.0001*
Parent Effort	0.3989	0.06624	190	6.02	<0.0001*
Parent Social	-0.01368	0.04147	190	-0.33	0.7419
Parent Facilitating	0.03310	0.04032	190	0.82	0.4127
Student Attitude	0.06571	0.03519	190	1.87	0.0634
Teacher Attitude	-0.02392	0.08049	190	0.30	0.7667
Teaching Experience	-0.00255	0.003938	190	-0.65	0.5184
Technological Experience	0.00501	0.005629	190	0.98	0.3297

Note: * $p < .05$

Summary of Research Question 2

In answering research question 2, it was determined by the data that effort expectancies, facilitating conditions, and years of technological experience significantly contribute to the attitude of teachers toward technology in first-year instrumental music settings. Teacher attitude increased by 0.2615, 0.1667, and 0.02634 on a scale of 1-5 for every unit increase in effort expectancy, facilitating conditions, and years of technological experience, respectively. Performance expectancies and effort expectancies significantly contribute to the attitude of students toward technology. Student attitude increased by 0.4404 and 0.2318 on a scale of 1-5 for every increase in performance

expectancy and effort expectancy, respectively. Finally, performance expectancies and effort expectancies significantly contributed to the attitude of parents toward technology in first-year instrumental music. Parent attitude increased by 0.4129 and 0.3989 on a scale of 1-5 for every increase in performance expectancy and effort expectancy, respectively. Effort expectancies were significant contributors to the attitudes of all groups of participants. No significant contributions to attitude were found among the predictors of social influences, the attitudes of other groups, or years of professional teaching experience of the teacher.

Research Question 3

Research Question 3: *Are there any statistically significant differences in attitude among teachers, students, and parents toward using technology in first-year instrumental music settings?*

To answer the third research question, a one-way, between-subjects analysis of variance (ANOVA) was conducted. Attitude scores (items 1-5) from the *Technology in Music Attitude Questionnaire* (TMAQ) served as the dependent variable. The group to which the participants belonged served as the independent variable with three levels: (a) teachers, (b) students, and (c) parents. The null hypothesis is $H_0 : \mu_1 = \mu_2 = \mu_3$ (the attitudes between groups are equal) was tested.

Prior to the administration of the ANOVA procedure, the data were tested to ensure the assumptions of normality, independence, randomness, and homogeneity of variance (the assumption that population variances are equal) were met. Homogeneity of variances was tested using Levene's test and revealed a significant Levene statistic of 12.240 with $p = 0.000$, indicating statistically unequal variances. Attitude variance scores

for teachers, students, and parents were 0.361, 0.935, and 0.539, respectively. Despite a high response rate of teacher participants (92.0%), a small number of teacher participants (23) resulted in unequal group sizes. Because the sample sizes are unbalanced, there is a greater chance of incorrectly rejecting the null hypothesis (Type I error). When the larger samples are associated with the populations with the larger variances, the chance of identifying a significant difference between the means is reduced, making the test more conservative. In this study, the student sample (with the greatest variance) had the largest number of participants of the three groups surveyed. Although every effort was made to include the greatest number of participants possible for each group, the nature of the inquiry and the teacher to student ratio made it impossible to achieve equal group sizes. Because ANOVA is a fairly robust test, the decision to employ an ANOVA to answer Research Question 3 was maintained.

All participants were asked to complete the 25-item TMAQ to determine one's attitude (items 1-5) toward using technology in instrumental music settings. Of the 222 parent questionnaires that were returned, two did not respond to items related to attitude and were therefore excluded from the analysis for this research question. Descriptive statistics for each participant group's results are displayed in Table 16.

Table 16

Descriptive Statistics of Attitude Scores of Teachers, Students, and Parents on the TMAQ

Group	N	Mean	SD
Teachers	23	4.2	0.6
Students	224	3.8	1.0
Parents	220	3.9	0.7
Total	467	3.8	0.9

Analysis of the data revealed a mean attitude of 4.2 for teachers, 3.8 for students, 3.9 for parents, and an overall mean attitude among all participants of 3.8. An ANOVA test (summarized below in Table 17) showed significant difference among the three groups of participants, $F(2,464) = 3.383$, $p = 0.035$. Because $p < 0.05$, mean scores differentiated more than would be expected by chance. Therefore, the null hypothesis was rejected, suggesting that the attitude means among the groups of participants were likely statistically unequal. The effect size calculated using eta squared was 0.01, indicating a small effect.

Table 17

ANOVA Summary Table of Attitude Scores of Teachers, Students, and Parents

Source	SS	df	MS	F	Sig.
Between Groups	5.042	2	2.521	3.383	* 0.035
Within Groups	345.732	464	0.745		
Total	350.774	466			

Note: * $p < .05$

In order to provide insight into where the significant differences occurred specifically, Fisher's Least Significant Difference (LSD) post-hoc test was employed. From among several methods, the LSD test was chosen because it is relatively liberal. This was necessary due to the unequal sample sizes of the three groups of participants surveyed. Also, because only one ANOVA analysis was conducted rather than multiple tests, the risk of inflated Type I error in this study was minimal. Results suggested a significant difference between the attitude scores of teachers and students [mean difference = 0.41, $p = 0.032$, 95 percent confidence interval (0.0361, 0.7789)]. No significant differences were found between the attitudes of teachers and parents or parents and students. When sample sizes are unequal, such as the case in this study, the chance of identifying a significant difference is reduced when the larger samples are associated with the populations with larger variances. However, a significant difference was found between the student and teacher samples, despite the fact that the student group had the largest sample size with the largest variance. Therefore, the decision was made to reject the null hypothesis and conclude that there was a significant difference in mean attitudes between teachers and students.

Summary of Research Question 3

In answering research question 3, it was determined by the data that the attitudes of first-year instrumental music teachers ($M = 4.2$, $SD = 0.6$), students ($M = 3.8$, $SD = 1.0$), and parents ($M = 3.9$, $SD = 0.7$) are generally positive towards using technology in band and orchestra. Combined, all groups have an overall positive attitude toward technology use ($M = 3.8$, $SD = 0.9$). A one-way ANOVA revealed significant difference among the three groups of participants ($F(2,464) = 3.383$, $p = 0.035$). Furthermore,

additional analysis revealed a statistically significant difference between the mean attitude scores of teachers and students toward the use of technology in first-year instrumental music settings.

Research Question 4

Research Question 4: *Is there a statistically significant relationship between attitude toward technology use and technology use (in class and assigned for practice outside of class) and if so, what is the nature and strength of the relationship?*

All teacher, student, and parent participants were asked to complete the *Technology in Music Attitude Questionnaire* (TMAQ) comprised of 25-items and measured using a 5-point numerical rating scale. Attitude scores were derived from survey items 1-5. Mean attitude scores for each group of participants are located above in Table 16.

Actual use of technology both in class and assigned by the teacher for practice outside of class was determined by teacher responses on the *Technology in Music Usage Questionnaire* (TMUQ). The fourth item asked teachers to indicate the average number of minutes per class spent using technology. In addition, the fifth item prompted teachers to indicate the average number of minutes per week in which they expect students to practice their instruments using technology outside of class. Results are reported above in Table 5.

To analyze the fourth research question, a series of bivariate correlations were conducted. The statistical significance of the correlation coefficients was evaluated by testing the null hypothesis that the unknown population correlation, ρ, is equal to zero, H_0: $\rho = 0$ using the sample correlation coefficients, r, generated from the teacher, student,

and parent samples. First, a comparison was made between the overall mean attitude of all participants combined (M = 3.84, SD = 0.86) with the average number of minutes teachers use technology during class (M = 8.64, SD = 13.23). Next, a comparison was made between the overall mean attitude (M = 3.84, SD = 0.86) with the average number of minutes teachers assign technology for use outside of class (M = 5.00, SD = 4.74). A table of descriptive statistics is located below (Table 18).

Table 18

Descriptive Statistics of Overall Attitude Scores and the Average Number of Minutes of Technology Used in Class and Assigned for Practice Outside of Class

	Mean	Std. Deviation	N
Overall Attitude	3.8476	0.86760	467
Average Minutes of Technology Use In Class	8.6424	13.23629	453
Average Minutes of Technology Assigned for Use Outside of Class	5.0022	4.74796	453

To determine whether a statistically significant relationship exists between overall attitude and technology use in class, Pearson's product-moment correlation coefficient (r = 0.022) was calculated (Table 19). Also, in order to determine the proportion of variability in attitude scores that is associated with time spent using technology in class, the coefficient of determination (r^2 = 0.000484) was computed. These calculations imply that no linear correlation exists between the overall attitude of participants toward technology use and the actual use of technology in class. Independence is suggested among the variables. Because the correlation coefficient was less than the tabled critical value, the decision was made to fail to reject the null hypothesis and determine that there

was not a statistically significant relationship between overall attitude towards technology use and the time spent using technology in class: r (465) = 0.022, $p > 0.05$.

Table 19

Correlation Between Overall Attitude Toward Technology Use and Average Minutes of Technology Use In Class

		Overall Attitude	Average Minutes of Technology Use In Class
Overall Attitude	Pearson Correlation	1	.022
	Sig. (2-tailed)		.648
	N	467	452
Average Minutes of Technology Use In Class	Pearson Correlation	.022	1
	Sig. (2-tailed)	.648	
	N	452	453

In addition, the data presented in the corresponding scatter plot in Figure 13 also revealed no linear relationship between one's attitude toward technology use and the actual use of technology in the classroom. Assumptions of linearity, homoscedasticity (equal variance), and normality are upheld. Examination of the scatter plot also ensures that the relationship is not curvilinear or influenced by outliers that would skew the results.

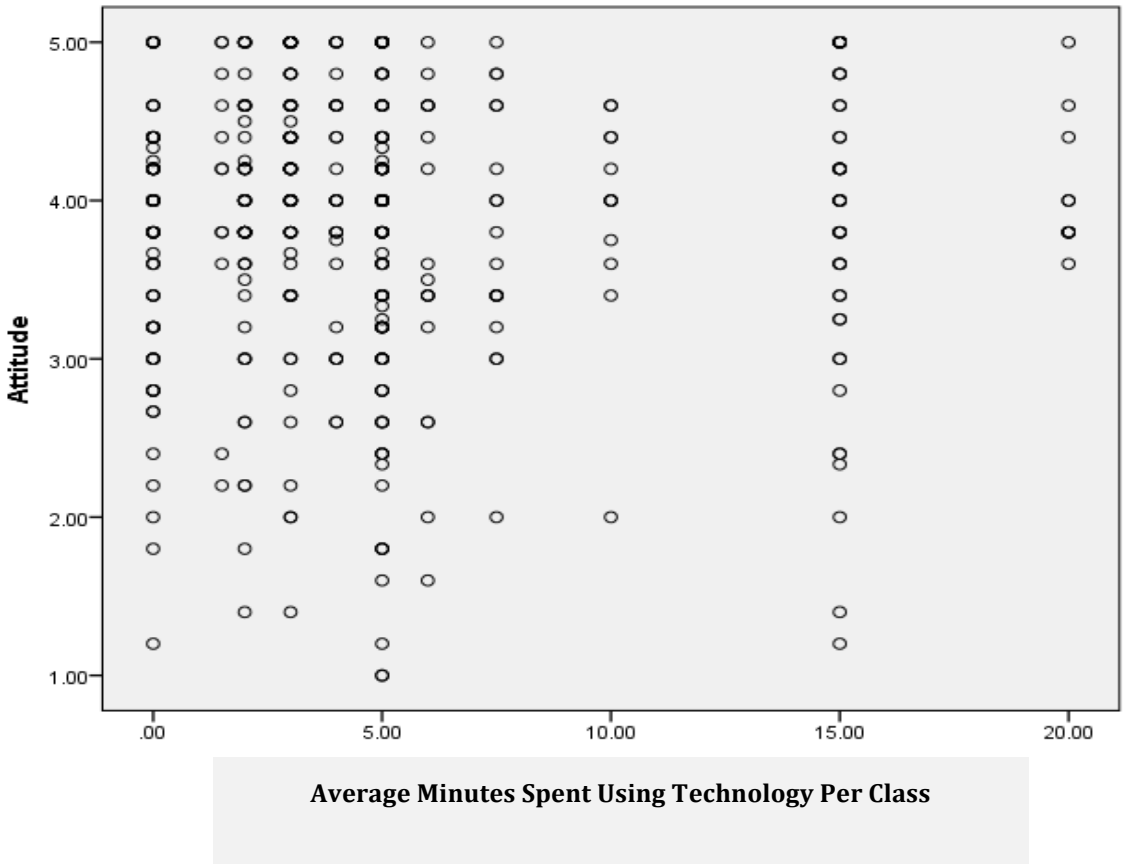

Figure 13: Scatter Plot Between Overall Attitude Scores of Participants and the Average Number of Minutes of Technology Use Per Class.

The product-moment correlation between attitude and minutes of practice using technology assigned by teachers is positive, yet nonsignificant (r = 0.012) with a coefficient of determination (r^2 = 0.000144) (Table 20). The data suggest independence among variables as well as no linear correlation between overall attitude and minutes of practice using technology. Since the correlation coefficient was less than the tabled critical value, the decision was made to fail to reject the null hypothesis and determine there is not a statistically significant relationship between overall attitude and assigned practice using technology outside of class: r (465) = 0.012, $p > 0.05$.

Table 20

Correlation Between Overall Attitude Toward Technology Use and Average Number of Minutes of Assigned Practice Using Technology

		Overall Attitude	Average Minutes of Assigned Practice Using Technology
Overall Attitude	Pearson Correlation	1	.012
	Sig. (2-tailed)		.793
	N	467	452
Average Minutes of Assigned Practice Using Technology	Pearson Correlation	.012	1
	Sig. (2-tailed)	.793	
	N	452	453

The data presented in the corresponding scatter plot in Figure 14 indicate that no linear relationship was present between one's attitude and technology assigned for practice outside of class. Moreover, examination of the scatter plot shows no violations of the assumptions of normality, linearity, and homoscedasticity (equal variance), and there were no outliers detected.

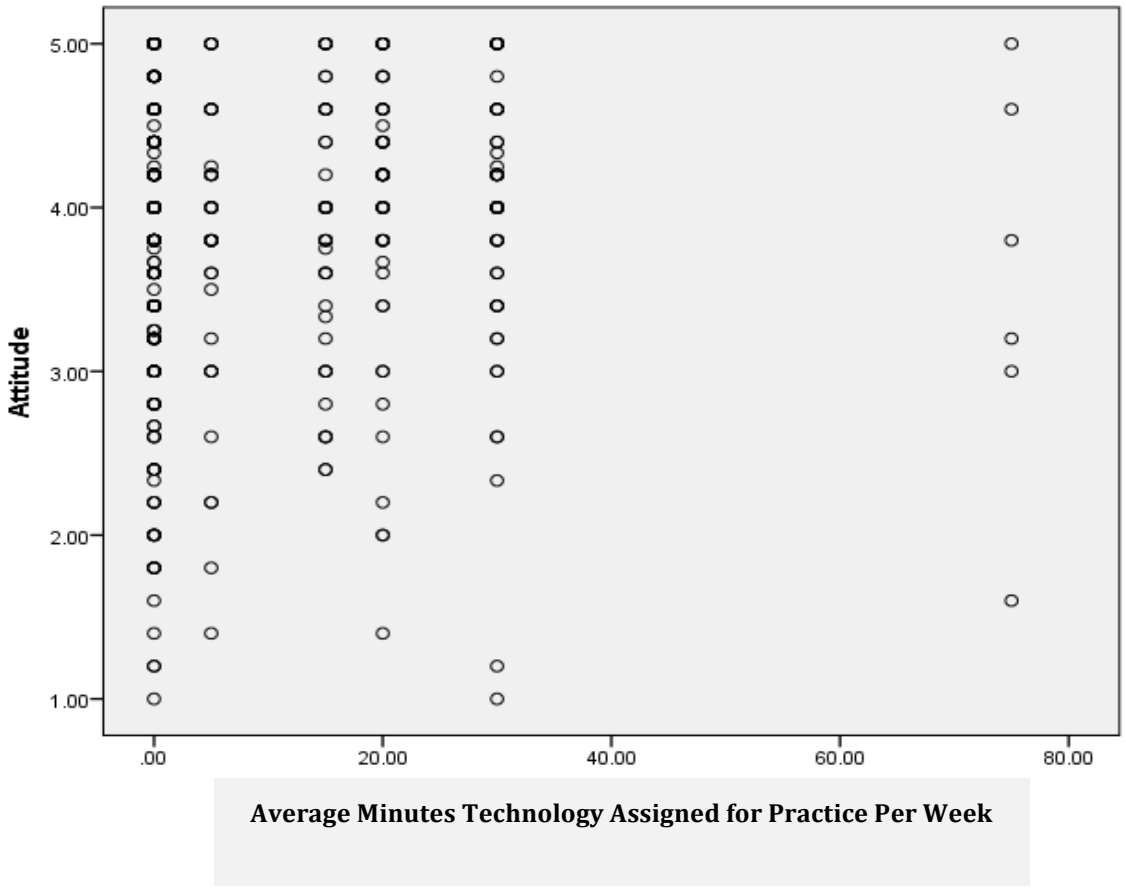

Figure 14: Scatter Plot Between Overall Attitude Scores of Participants and the Average Number of Minutes Technology is Assigned for Practice Outside of Class.

Additional analyses compared the attitude means of each individual group of participants (teachers, students, and parents) and the use of technology, both in class and assigned for practice outside of class. Teacher attitude was positively correlated with time spent using technology in class ($r = 0.351$ and $r^2 = 0.123201$) and with expected time spent using technology in practice ($r = 0.358$ and $r^2 = 0.128164$). These correlation coefficients were of medium effect sizes. Time spent using technology in class accounted for 12.32% of the variability in teacher attitude. Assigned time with technology at home accounted for 12.82% of the variance in teacher attitude. However, because r was less than the critical value of 0.413, the decision was made to fail to reject the null hypothesis

and determine that there is not a statistically significant relationship between teacher attitude and technology use in class (r (21) = 0.351, $p > 0.05$) or between teacher attitude and technology assigned for practice outside of class (r (21) = 0.358, $p > 0.05$).

Student attitude was found to have no relationship with time spent using technology in class (r = 0.000 and r^2 = 0.000) and virtually no relationship with the amount of practice time assigned using technology (r = -0.002 and r^2 = 0.000004). Time spent using technology in class and for practice outside of class accounted for 0% of the variance in student attitude towards using technology. Likewise, parent attitude appeared to have no relationship with time spent using technology in class (r = 0.019 and r^2 = 0.000361) or time assigned to practice using technology outside of class (r = -0.011 and r^2 = 0.000121). Technology use in class accounted for 0.04% of the variability in parent attitude while technology assigned for practice accounted for 0.01% of the variance in parent attitude. Therefore, because the correlation coefficients were less than their associated critical values, the decisions were made to fail to reject the null hypotheses and determine that there is not a statistically significant relationship between student attitude and technology use in class (r (222) = 0.000, $p > 0.05$), student attitude and technology assigned for at-home practice (r (222) = -0.002, $p > 0.05$), parent attitude and technology use in class (r (218) = 0.019, $p > 0.05$), or parent attitude and technology assigned for at-home practice (r (218) = -0.011, $p > 0.05$).

Summary of Research Question 4

In answering research question 4, it was determined by the data that no statistically significant linear relationship exists between the overall attitude of participants toward technology use and the reported time spent using technology in class

($r = 0.022$ and $r^2 = 0.000484$) or the amount of time technology is assigned for practice outside of class ($r = 0.012$ and $r^2 = 0.000144$). Further analysis revealed a positive, medium-sized relationship between teacher attitude toward technology use and time spent using technology in class ($r = 0.351$ and $r^2 = 0.123201$) as well as between teacher attitude and the amount of time teachers expect students to practice outside of class ($r = 0.358$ and $r^2 = 0.128164$). However, the decision was made to fail to reject the null hypotheses and conclude that the correlation coefficients were not statistically different from zero.

Summary

The data for the four research questions in this study were collected by distributing the *Technology in Music Usage Questionnaire* (TMUQ) to a group of teacher participants as well as the *Technology in Music Attitude Questionnaire* (TMAQ) to groups of teachers, students, and parents. All participants were associated with first-year instrumental music in a large, Midwestern school district. In order to describe the demographics of the study's participants, descriptive statistics involving frequencies and percentages were utilized. The demographic categories for teacher participants were gender, age, years of professional teaching experience, years of experience teaching first-year instrumental music students, level of education, responsibilities included in the teaching assignment, the number of schools to which the teacher was assigned, and the frequency and duration of lessons. Demographic categories for students and parents included gender and age. Additionally, students were asked to indicate their grade level and whether they were enrolled in band, orchestra, or both.

In examining the first research question, descriptive statistics were gathered to investigate what kinds of teacher-selected technologies were being used in class and for practice outside of class during the first year of instrumental music study and to what extent. The data indicated that a majority of teachers used the following technologies in class: laptops (87.0%), the supplemental materials (DVD/CD) included with the method books (82.6%), and iTunes (56.5%). Less than half of teacher respondents indicated assigning technology for practice outside of class with method book supplemental materials contributing to the highest percentage of technologies assigned (39.1%). Of the teachers who reported using technology in class, 75% spend an average of one to nine minutes per 30-minute class period using technology. Most teachers surveyed (69.6%) did not expect students to practice using technology outside of class.

Research question two determined to what extent performance expectancies, effort expectancies, social influences, facilitating conditions (such as instructional time and class format, availability of technology, technology training, and parental support), and teachers' experience (with professional teaching as well as technology) contributed to one's attitude toward technology in first-year instrumental music settings. Using responses from two researcher-designed instruments, the TMUQ and TMAQ, multilevel modeling determined that effort expectancies ($p = 0.0002$), facilitating conditions ($p = 0.0012$), and the technological experience of the teacher ($p < 0.0001$) significantly contributed to teacher attitude toward technology. Additionally, performance expectancies ($p < 0.0001$) and effort expectancies ($p = 0.0019$) significantly contributed to student attitude toward technology use. Finally, performance expectancies ($p < 0.0001$)

and effort expectancies ($p < 0.0001$) significantly contributed to parent attitude toward technology use in first-year instrumental music settings.

Research question three explored whether there were any significant differences in attitude among teachers, students, and parents toward using technology in first-year instrumental music settings. Based on attitude scores on the TMAQ, a one-way, between-subjects ANOVA showed significant difference among the three groups of participants ($F(2,464) = 3.383$, $p = 0.035$). Additional analysis revealed a statistically significant difference between the mean attitude scores of teachers and students.

Finally, research question 4 explored if a statistically significant relationship existed between attitude toward technology use and technology use (in class and assigned for practice outside of class) and if so, what the nature and strength of the relationship was. Based on participant responses from the attitude items (1-5) on the TMAQ as well as teacher responses from the TMUQ indicating the average time spent using technology in class and assigning practice with technology outside of class, a series of bivariate correlations were conducted. The resulting data indicated that no linear relationship existed between the attitude of participants toward technology use and the reported time spent using technology in class ($r = 0.022$ and $r^2 = 0.000484$) or the amount of time technology was assigned for practice outside of class ($r = 0.012$ and $r^2 = 0.000144$). A positive, medium-sized relationship was found between teacher attitude and technology use. Time spent using technology in class accounted for 12.32% of the variability in teacher attitude while assigned time with technology at home accounted for 12.82% of the variance in teacher attitude. However, because all correlation coefficients were less

than their associated critical values, the decision was made to reject the null hypotheses and conclude the relationships were not statistically different from zero.

CHAPTER 5

SUMMARY, DISCUSSION, AND RECOMMENDATIONS

Summary

The widespread development of technologies designed for music instruction and assessment has impacted the way music is taught and learned. Mobile devices, music software, and online resources have the potential to transform traditional approaches to instrumental music pedagogy, particularly for beginners in the early stages of learning to play an instrument (Muro, 1997). However, although the production of technologies marketed for young instrumentalists is increasing, it is unclear whether music educators are using these technologies as intended, if they are used at all (Webster, 2011). The demand for updated technology skills and practices is forecasted to continue to rise over time (Wai-chung Ho, 2004; Criswell, 2010). Because schools are spending large amounts of time, money, and resources to integrate technology in classrooms across a broad variety of content areas, it is important to determine the various technologies selected and employed as well as the attitudes of those directly involved in its use. Knowing the perceptions toward technology and the use patterns of consumers may impact its effectiveness and ultimately the success of the students involved.

Learning to play a musical instrument is most challenging during the first year of instruction (Moore, 2009). Obstacles specific to elementary band or orchestra include limited rehearsal space, pull-out schedules where students meet less frequently for shorter periods of time, the mechanics of learning a new instrument, and the often complex teaching assignments and schedules of instructors. Loss of interest, lack of parental

support, scheduling conflicts, complex peer relationships, and classroom management concerns can be problematic for retention (Boyle et al.,1995; Poliniak, 2012). When technology is integrated in the classroom, it is often assumed that teachers, students, and parents are automatically supportive of its use (Alexiou-Ray, Wilson, Wright, & Peirano, 2003). However, when technology is integrated amidst the already complex teaching and learning environments of first-year elementary instrumental music, it is unclear whether its use is perceived as a benefit or a hindrance.

A study of the relationship of attitudes among teachers, students, and parents toward technology integration in first-year instrumental music settings can fill in the gap of current information on the subject and provide much needed insight. Music educators can use the results of this study to improve their teaching, seek out technology training for themselves and their students, and make better choices regarding the selection of technological devices, software, and applications for their students to use in class and in practice environments. By carefully examining the relationships of attitudes toward technology among those involved in beginning instrumental music, music educators can use this information to guide the selection and use of technologies, ultimately increasing the potential for their students to succeed.

Purpose of the Study

The purpose of this study was to determine what technologies are being used in first-year instrumental music settings and to examine factors that influence the attitudes of teachers, students, and parents toward the use of those technologies.

Review of the Literature

The theoretical framework for this study was based on the experiences and observations of the researcher working as an elementary band director as well as from the *Unified Theory of Acceptance and Use of Technology* (UTAUT) designed by Venkatesh, Morris, Davis, and Davis (2003) (Figure 16). The UTAUT synthesized eight prominent, pre-existing models that sought to explain the acceptance and use of technologies by individual users. These were the *Theory of Reasoned Action* (TRA), *Technology Acceptance Model* (TAM/TAM2), *Motivational Model* (MM), *Theory of Planned Behavior* (TPB), *Combined TAM and TPB* (C-TAM-TPB), *Model of PC Utilization* (MPCU), *Innovation Diffusion Theory* (IDT), and the *Social Cognitive Theory* (SCT). The UTAUT incorporates four of the most significant constructs found in the pre-existing models of individual acceptance and use of technology: performance expectancy, effort expectancy, social influence, and facilitating conditions. These constructs, along with experience, were also examined in the scope of the current study.

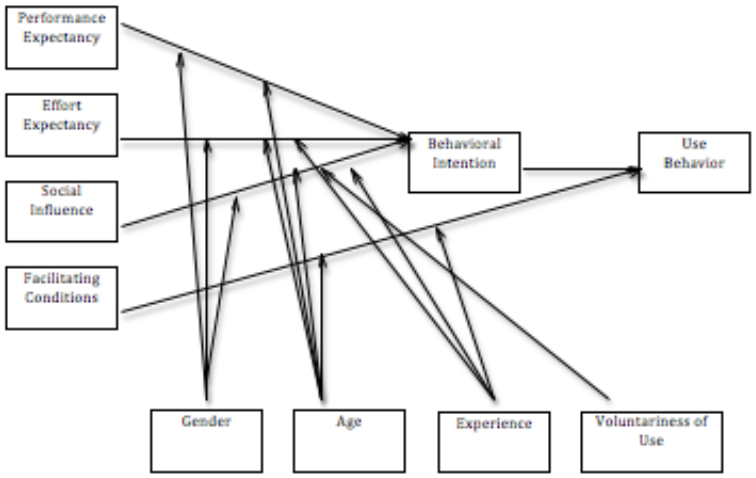

Figure 15: Unified Theory of Acceptance and Use of Technology (UTAUT). Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, *27*(3), 425–478.

The UTAUT, originally developed to address the technological use behaviors of adults in the workplace, was adapted in order to be applicable to the subjects of this inquiry: elementary instrumental music teachers (band and orchestra), first-year band and orchestra students (grades 4-5), and the parents of the students in question. Although attitude was a significant predictor of intention to use technology in various other models, including predecessors of the UTAUT, it was removed from the final version of the UTAUT and instead considered to be an implicit construct. Attitude, or an individual's overall affective reaction to using a system, conveys one's enjoyment, pleasure, and liking connected with the use of technology. Because attitude has been found to have significant correlations with other variables in technology acceptance (Ursavas, 2013), the decision was made to include attitude in the research model of this study (Figure 17).

Additionally, behavioral intention was replaced with the attitudes of teachers, students, and parents. Davis, Bagozzi, and Warshaw (1989) defined the behavioral intention to use technology as the degree to which a person has formulated conscious

plans to perform or not perform some specified future behavior. Because the use of technology in instructional settings may be habitual, prolonged, and not the outcome of premeditated thoughts, behavioral intention was removed from the research model for this study. Use behavior is the actual use of the technology in question. This study assumed that the technology selected and assigned by the school or teacher was already in use and therefore aimed to determine the participants' positive or negative feelings towards using it in class and for practicing outside of class.

Finally, although the UTAUT identifies factors that ultimately predict use behavior, it is uncertain whether one's attitude toward technology in an elementary instrumental music setting can predict or explain the actual use of technology. It is unclear what technologies are in use in elementary band and orchestra, if any. The use of technology in band or orchestra may be mandatory for participants, regardless of their attitudes. Therefore, this study examined whether a relationship exists between attitude and use rather than assuming that attitude is a direct predictor of use.

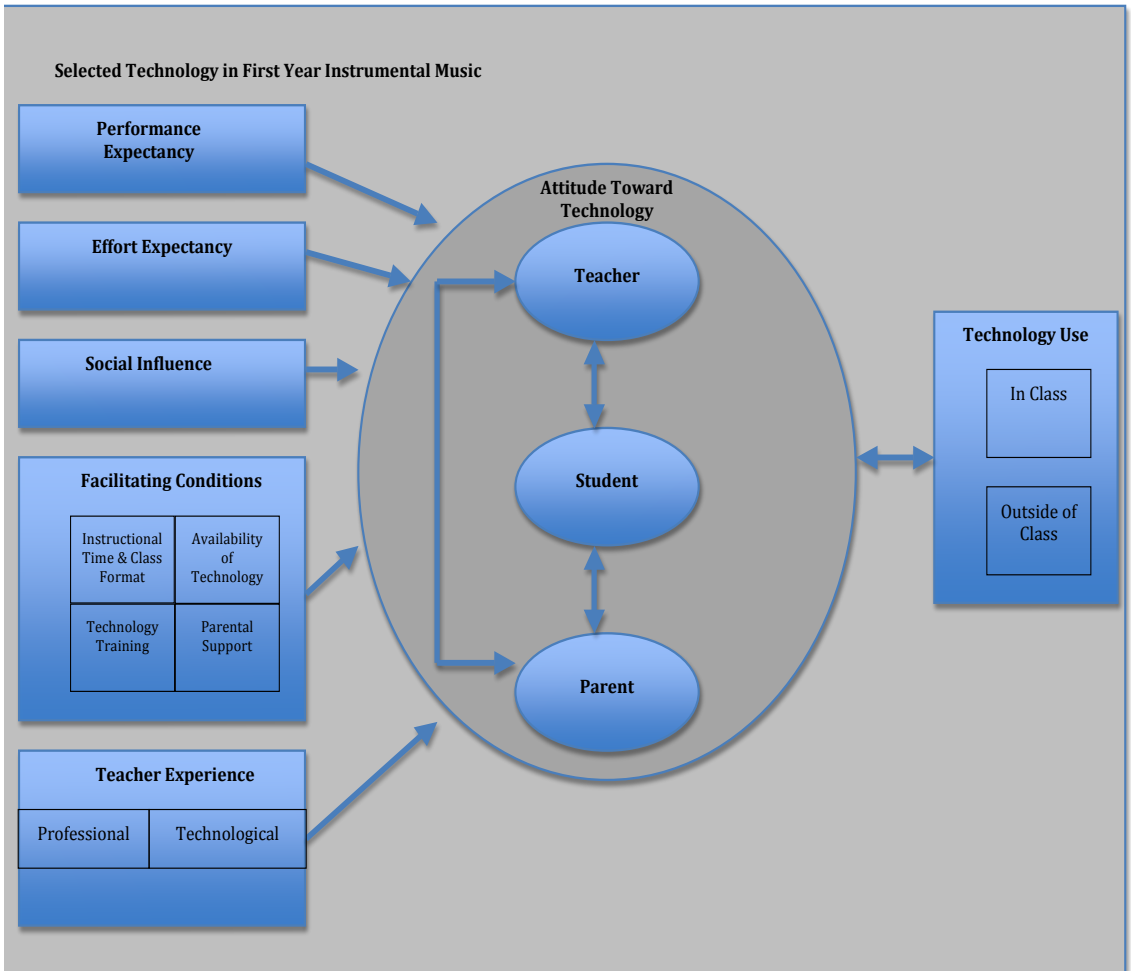

Figure 16: Gilbert Research Model of Attitude Toward Technology Use in First-Year Instrumental Music

Although technological resources designed for education are widely available, the actual use of technology by teachers is generally minimal (Armstrong, 2014; Agbatogun, 2013; Blackwell et al, 2013; Ozel, 2014). Technologies used in the classroom are often outdated and incompatible with lesson objectives (Garner & Bonds-Raacke, 2013; Aldunate, R., & Nussbaum, M., 2013). Challenges associated with incorporating technology in the classroom include a lack of funding, insufficient technical support, availability of appropriate technology, teacher acceptance, and district policies (Armstrong, 2014; Agbatogun, 2013). Technical issues during class as well as

considerable demands on teachers' time also prove to be problematic (Min Liu, Navarette, & Wivagg, 2014; Ozel, 2014). In addition, Armstrong (2014) found accessibility of technology in school and home environments to be an obstacle for the integration of technology.

However, despite barriers to the use of technology in the classroom, teacher attitude toward technology is generally positive (Naaz, 2012; Akbaba, 2013; Avidov-Ungar & Eshet-Alkakay, 2011; Teo, 2014; Blackwell et al, 2013). Research generally shows students have positive attitudes toward using technology in educational environments (Eyyam & Yaratan, 2014; Berz & Bowman, 1994; Webster, 2002; Ouren, 1998; Airy & Parr, 2001) and that students prefer to generate their work using technology rather than traditional pen and paper materials (Armstrong, 2014; Hwang, Wu, & Kuo, 2013). Unfortunately, not much research exists pertaining to the attitudes of parents toward instructional technology. Lin, Liu, and Huang (2012) found that parents' perceptions toward educational technology significantly impacted the attitudes of their children towards technology. There is also a limited number of studies that explore a relationship of attitudes among teachers, students, and parents, although some studies have been found that explore the relationship of attitudes among teachers and students and students and parents.

When music educators use technology, it is often used for the purposes of administrative tasks (Taylor & Deal, 2000; Jassman, 2004; Ohlenbusch, 2011), assessment, and far less often, pedagogical aids (Lebler, 2012; Webster, 2002). Although the majority of established research on technology in music education strongly supports the use of technology in the schools (Webster, 2002), some people argue against the

effectiveness of technology in enhancing the learning process (Conlon & Simpson, 2003; Convery, 2009; Treadway, 2001). Research on technology used in music teaching and learning focuses on composition and creativity, motivation and participation, performance, the technological tools available for use in the music classroom, and attitudes toward using technology in music education.

There is a lack of literature on attitudes toward technology integration in an elementary instrumental music setting as well as a deficiency in resources pertaining to the attitudes of late elementary or middle school aged students and their parents toward technology. This study aimed to fill in the gap in the literature related to the attitudes of teachers, students, and parents toward technology use in first-year instrumental music settings.

Procedure

For this descriptive, quantitative study, data were obtained through the use of two researcher-designed surveys: the *Technology in Music Usage Questionnaire* (TMUQ) (Appendix D) and the *Technology in Music Attitude Questionnaire* (TMAQ) (Appendices D-F). Survey items were constructed to provide an indicator of what technologies are in use in first-year instrumental music settings and to what extent, as well as to measure the contributions of performance expectancies, effort expectancies, social influences, and facilitating conditions to one's attitude toward using technology in elementary band or orchestra. Content validity of the instruments was assessed through a review of the literature, examination of existing surveys on attitudes toward technology use, and feedback provided from a panel of experts in the field of music education. Suggestions made by the panel of experts to improve the survey instruments resulted in a 10-item

TMUQ designed for teacher participants and a 25-item TMAQ designed for teacher, student, and parent participants.

Teacher responses to the *Technology in Music Usage Questionnaire* (TMUQ) provided an inventory of what technologies are being used in first-year instrumental music settings, described to what extent technology is being used, and determined the years of experience teachers have with using technology for elementary band or orchestra. Given a list of technologies categorized by hardware, software, and online resources, teachers were asked to indicate which technologies they currently use in class and assign for practice outside of class, as well as which technologies they would like to use if given the opportunity. Additionally, teachers were asked to provide information about the number of years of experience they have with using technology, how much time is spent using technology per class lesson, and how much time teachers assign students to practice using technology outside of class. If technology is used, teachers answered questions about how it is used and why. Conversely, teachers who do not use technology were prompted to address possible reasons for why it is not used.

The *Technology in Music Attitude Questionnaire* (TMAQ) was designed for all groups of participants (teachers, students, and parents) to determine the contributions of performance expectancies (items 6-10), effort expectancies (items 11-15), social influences (items 16-20), and facilitating conditions (items 21-25) to one's attitude (items 1-5) toward technology in first-year instrumental music settings. The TMAQ is comprised of the same number of questions (25) to be answered by each group of participants and contains a 5-point numerical rating scale, where 1 indicates "Strongly Disagree" and 5 indicates "Strongly Agree", to facilitate a comparison among the groups.

An average score above 3.0 indicated a positive attitude. For each of the five constructs measured, item statements were worded both positively and negatively in order to increase the reliability of the questionnaire.

An initial pilot test was conducted by distributing the survey instruments to a small group of teachers, students, and parents that were not included in the sample for the research study. Participants were asked to provide feedback about the questionnaires that would help establish reliability as well as face validity of the survey instruments. After collecting data for the pilot study, results determined that the estimated reliability coefficient for the survey is 0.897, indicating a high value of the instrument for individual measurement and diagnosis (Leonhard & House, 1972).

The participants in this study were comprised of teachers, students, and parents associated with first-year instrumental music in a large Midwestern urban school district. The district was selected for inclusion in this study because it is one of the largest in the state. Therefore, it yielded the most substantial pool of in-service elementary band and orchestra teachers as potential participants that could feasibly be reached by the researcher. Furthermore, because of the young age of the elementary student participants and consequent rigorous process for approval by school districts, only one school district was selected. Selected *teachers* included those who are responsible for the instrumental band and orchestra education of elementary school students. *Students* in their first year of study were fourth and fifth graders in an elementary school and were actively participating in band or orchestra. The *parents* in this study were the parents or legal guardians of first-year instrumental music students enrolled in the selected school district.

Because there are a combined total of 25 teachers working with beginning band and orchestra students in the district, the survey instruments were distributed to a convenience sample of all elementary instrumental music teachers in order to reduce error and achieve a high response rate of teachers to include in the study. The population of students and parents for this study included all of those who were involved in first-year instrumental band and orchestra in the district. Participating teachers distributed the questionnaire to a convenience sample of fourth and fifth graders known to be participating in first-year instrumental music as well as their parents. Responses were solicited from one parent responsible for each of the students surveyed. Sampling continued until an adequate number of completed responses were obtained to reduce non-response error.

Paper copies of the questionnaire were sent home from school with students. Students and parents were asked to complete and return the questionnaires to school for the researcher to collect. To determine the relationship of attitudes among all groups of participants, students and parents returned their completed surveys combined in a single envelope to their schools where the researcher collected them. This ensured that student and parent participants were linked with the appropriate teachers who completed the questionnaire. Based on the population size of 7,483 participants (25 teachers, 3,729 students, 3,729 parents), 0.05 margin of error, 95% confidence level, and 0.5 standard of deviation, an *a priori* calculation of the sample size determined a combined total of 366 survey responses was needed for all groups of participants (teachers, students, and parents).

The researcher obtained campus Institutional Review Board approval to conduct the study as well as approval from the school district surveyed. The school district's instrumental music supervisor provided support for the study and allowed the researcher to meet with teachers during a staff meeting to establish communication. Upon completion of the study, responses were recorded from 23 instrumental music teachers (92.0% response rate), 224 students (55.2% response rate), and 222 parents (54.7% response rate) for a total of 469 participants.

Design and Results of the Study

Four research questions were constructed in the design of this study:

1. What kinds of technologies selected for first-year instrumental music are being used in class and for practice outside of class and to what extent are these technologies being used?
2. To what extent do performance expectancies, effort expectancies, social influences, facilitating conditions (such as instructional time and class format, availability of technology, technology training, and parental support), and teachers' experience (with professional teaching as well as technology) contribute to one's attitude toward technology in first-year instrumental music settings?
3. Are there any statistically significant differences in attitude among teachers, students, and parents toward using technology in first-year instrumental music settings?
4. Is there a statistically significant relationship between attitude toward technology use and technology use (in class and assigned for practice outside of class) and if so, what is the nature and strength of the relationship?

A summary of the demographic information described the samples of teacher, student, and parent participants included in this study. Teacher participants were relatively balanced between gender (52.2% male; 47.8% female) and highest level of education completed (47.8% bachelor's degree; 47.8% Master's degree). The number of years of professional teaching experience included 34.8% between 0-10 years, 13.0% between 11-20 years, 26.1% between 21-30 years, and 26.1% of teachers who have taught 31 years or more. Of the teachers surveyed, 47.8% indicated a teaching assignment in elementary band while 65.2% indicated an assignment in elementary orchestra. All teachers reported having to travel between multiple school locations as part of their job assignment. 13.0% of teachers travel between 2 schools, 30.4% travel among 3 schools, 43.5% travel among 4 schools, and 13.0% of teachers are assigned to teach among 5 or more school buildings. All teachers indicated that they meet with students for one, thirty-minute lesson per week. No teachers reported being assigned to choir, music technology, general music or music appreciation, or "other."

Student demographical information included gender (29.5% male; 70.5% female), grade level (50.0% fourth grade; 49.6% fifth grade), instrumental music classification (47.3% band; 52.2% orchestra), and age. Of the student respondents, 39.3% were 9 years of age or younger, 46.4% were 10 years old, 11.6% were 11 years old, and 2.7% of student ages were not reported. Parent demographical information included gender (21.2% male; 77.9% female) and age. Parent respondents included 2.7% between the ages of 20-29, 46.3% between 30-39, 39.2% between 40-49, 4.5% 50 years of age or more, and 7.2% were unreported.

Research Question 1

Research Question 1: *What kinds of technologies selected for first-year instrumental music are being used in class and for practice outside of class and to what extent are these technologies being used?* Descriptive statistics generated from teacher responses on the TMUQ determined the number of teachers currently using technologies in class as well as assigning technology for use outside of class. Teachers also indicated whether there are technologies they would like to use in class or assign for practice if given the opportunity. Based on the researcher's experiences and knowledge of available technologies that can be used for instrumental music instruction as well as information regarding music technology from the literature, a list of technologies was generated that categorized items as software, hardware, or online resources. Teachers also had the option of entering technologies that were not included on the list. Of the choices available, teachers indicated the following technologies most commonly used in class: (a) laptops, 87.0%; (b) supplemental materials in the method book, 82.6%; (c) iTunes, 56.5%; and (d) Finale, 47.8%. Technologies currently assigned for practice at home included: (a) supplemental materials in the method book, 39.1%; (b) computer, 4.4%; and (c) smart phone, 4.4%. Most teachers (69.6%) reported that they would like to use tablets in class if given the opportunity while the largest percentage of respondents (21.7%) indicated they would like to be able to assign *SmartMusic* for students to use when practicing at home. Based on the data generated, it is evident that teachers generally do not require students to practice using technology at home (69.6%) and that teachers do not typically use, or have much interest in using, online resources for class instruction or practice.

Although most teachers (73.9%) reported using technology in class, 65.2% of teachers indicated that technology is only used between 1-9 minutes per 30-minute class period. When technology is used, it is mostly for: (a) accompaniment, 65.2%; (b) assessment, 56.5%; and (c) recordings, 56.5%. It was unclear whether teachers marked "recordings" because they play demonstrative recordings for students to hear or because teachers create recordings of student performances. Of the three teachers who conveyed that they do not use technology for instrumental music at all, one indicated that technology was previously used but is not anymore, and two indicated that they do not use technology but would like to if given the opportunity. When teachers were asked why they do not use technology, the top responses were: (a) a lack of time, 39.1%; (b) difficulty in traveling among school locations, 26.1%; and (c) a complicated class schedule, 17.4%.

Research Question 2

Research Question 2: *To what extent do performance expectancies, effort expectancies, social influences, facilitating conditions (such as instructional time and class format, availability of technology, technology training, and parental support), and teachers' experience (with professional teaching as well as technology) contribute to one's attitude toward technology in first-year instrumental music settings?* Descriptive and inferential statistics were employed to answer this question. All teacher, student, and parent participants were asked to respond to 25 items on the TMAQ designed to measure the contributing factors to one's attitude toward using technology in instrumental music. Attitude served as the dependent variable while performance expectancies, effort expectancies, social influences, and facilitating conditions served as predictors.

Additional independent variables included years of professional teaching experience (measured in the demographic portion of the teacher TMAQ, item 3) as well as years of technological experience of the teachers (measured in the TMUQ, item 2).

After ensuring assumptions were met, data were analyzed using multilevel (hierarchical) linear modeling (MLM) to guarantee that teachers were matched with the students and parents with which they were associated. This added two additional independent variables (predictors) for each model: the attitude scores of the other two groups of participants, nested within the attitude of the third group examined. Using the Proc Mixed package in SAS, three models were constructed, one for each group of participants (teacher, student, and parent), with two levels for each model. Model fit was tested for each model using a -2 log likelihood test. After comparing an intercepts-only model with the full model (including all predictors), it was determined that the full model led to significantly better prediction for all three groups. MLM determined the relationship among the dependent variable (attitude) and the eight predictors listed above while accounting for the hierarchical structure of the data. Each model developed was a mixed effects model where the intercepts and slopes were fixed components and the error accounted for the random components. In order to account for unbalanced data, maximum likelihood was chosen as the type of estimation.

The first full model designed for teacher participants examined the degree of relationship between the dependent variable (teacher attitude) and the following independent variables: (1) teacher performance expectancies, (2) teacher effort expectancies, (3) teacher social influences, (4) teacher facilitating conditions, (5) student attitude, (6) parent attitude, (7) teaching experience of teacher, and (8) technological

experience of teacher. For fixed effects, effort expectancies (0.2615, t (193) = 3.81, p = 0.0002), facilitating conditions (0.1667, t (193) = 3.28, p = 0.0012), and technological experience (0.02634, t (193) = 5.31, p <0.0001) significantly predicted teacher attitude when averaged over student and parent attitudes. The parameter estimates show that teacher attitude is greater when effort expectancies are greater; for each unit increase in effort expectancy, attitude increased by about 0.26 on a scale of 1-5. Attitude also increased when perceptions of facilitating conditions were higher. For every one-unit increase in facilitating condition scores, attitude increased by 0.167. Further, for every additional year of technological experience, teacher attitude also increased by 0.026. No statistically significant effects were found for performance expectancies, social influences, student attitude, parent attitude, or years of professional teaching experience.

The second full model designed for student participants examined the degree of relationship between the dependent variable (student attitude) and the following independent variables: (1) student performance expectancies, (2) student effort expectancies, (3) student social influences, (4) student facilitating conditions, (5) parent attitude, (6) teacher attitude, (7) professional teaching experience of teacher, and (8) technological experience of teacher. Resulting data for fixed effects indicated that student performance expectancies (0.4404, t (187) = 5.97, p < 0.0001) and student effort expectancies (0.2318, t (187) = 3.15, p = 0.0019) significantly predicted student attitude when averaged over teacher and parent attitudes. Parameter estimates suggest that for every unit increase in student performance expectancy, student attitude increased by approximately 0.44 on a scale of 1-5. In addition, for every unit increase in effort expectancy, student attitude increased by 0.232. However, the residual value in the

student model is also significant. There is still variance in student attitude that cannot be explained. No statistically significant effects were found for social influences, facilitating conditions, parent attitude, teacher attitude, professional teaching experience, or the technological experience of the teacher.

The final full model designed for parent participants examined the degree of relationship between the dependent variable (parent attitude) and the following independent variables: (1) parent performance expectancies, (2) parent effort expectancies, (3) parent social influences, (4) parent facilitating conditions, (5) student attitude, (6) teacher attitude, (7) professional teaching experience of the teacher, and (8) technological experience of the teacher. Resulting data for fixed effects indicated that parent performance expectancies (0.4129, t (190) = 8.38, $p < 0.0001$) and parent effort expectancies (0.3989, t (190) = 6.02, $p < 0.0001$) significantly predicted parent attitude when averaged over teacher and student attitudes. Parameter estimates suggest that for every unit increase in parent performance expectancy, parent attitude increased by approximately 0.413 on a scale of 1-5. In addition, for every unit increase in parent effort expectancy, parent attitude increased by 0.399. No statistically significant effects were found for social influences, facilitating conditions, student attitude, teacher attitude, professional teaching experience, or the technological experience of the teacher.

Research Question 3

Research Question 3: *Are there any statistically significant differences in attitude among teachers, students, and parents toward using technology in first-year instrumental music settings?* This question was answered by conducting a one-way, between-subjects analysis of variance (ANOVA). Attitude scores (items 1-5) from the

Technology in Music Attitude Questionnaire (TMAQ) served as the dependent variable. The group to which the participants belonged served as the independent variable with three levels: (a) teachers, (b) students, and (c) parents.

Results of the ANOVA showed significant difference among the three groups of participants, $F(2,464) = 3.383$, $p = 0.035$. To determine where the significant differences occur, a Fisher's Least Significant Difference (LSD) post-hoc test was conducted. The outcome suggested a significant difference between the attitude scores of teachers and students [mean difference = 0.41, $p = 0.032$, 95 percent confidence interval (0.0361, 0.7789)]. No significant differences were found between the attitudes of teachers and parents or parents and students. When checking to ensure assumptions were met prior to administering the ANOVA, it was discovered that the assumption of homogeneity of variance might have been violated (Levene statistic = 12.240, $p = 0.000$). Although the group of student participants had the greatest variance, students also accounted for the largest sample size of participants, reducing the chance of identifying a significant difference. However, because it would not have been possible to achieve balanced sample sizes among groups and because ANOVA is a fairly robust test, the decision was made to reject the null hypothesis that all group attitudes are equal and conclude that there was a significant difference in mean attitudes between teachers and students.

Research Question 4

Research Question 4: *Is there a statistically significant relationship between attitude toward technology use and technology use (in class and assigned for practice outside of class) and if so, what is the nature and strength of the relationship?* This question was answered based on participant responses to attitude items (1-5) on the

TMAQ as well as teacher responses to items 4-5 on the TMUQ. Bivariate correlations were conducted to compare the mean attitude of participants (M = 3.84, SD = 0.86) with the average number of minutes teachers use technology during class (M = 8.64, SD = 13.23) as well as the average number of minutes teachers assign technology for use outside of class (M = 5.00, SD = 4.74). To determine whether a statistically significant relationship exists between overall attitude and technology use in class, Pearson's product-moment correlation coefficient (r = 0.022; r^2 = 0.000484) was calculated. Because r was less than the tabled critical value, it was determined that there was no statistically significant relationship (r (465) = 0.022, $p > 0.05$).

Next, the product-moment correlation was computed between attitude and assigned minutes of practice using technology (r = 0.012; r^2 = 0.000144). However, the correlation coefficient was also less than the tabled critical value, so it was determined that there was not a statistically significant relationship between attitude and assigned practice with technology (r (465) = 0.012, $p > 0.05$). Examination of scatter plots confirmed no evidence of a linear relationship.

Additional analyses revealed no statistically significant relationships between: (1) teacher attitude and technology use in class (r (21) = 0.351, $p > 0.05$); (2) teacher attitude and assigned practice time with technology (r (21) = 0.358, $p > 0.05$); (3) student attitude and technology use in class (r (222) = 0.000, $p > 0.05$); (4) student attitude and assigned practice time with technology (r (222) = -0.002, $p > 0.05$); (5) parent attitude and technology use in class (r (218) = 0.019, $p > 0.05$); or (6) parent attitude and assigned practice time with technology (r (218) = -0.011, $p > 0.05$).

Discussion

Although the participant response rate to this survey was high (teachers, 92.0%; students, 55.2%; parents, 54.7%), a couple of observations pertaining to the demographic information gathered about the respondents were made that may be considered when generalizing the results. First, all participants belonged to the same school district where there may be shared ideologies regarding topics such as teaching, technology, and participation in musical ensembles. In the district surveyed, the use of technology was not required, but was encouraged. In addition, there was not a mandated curriculum or set of texts, so teachers were at liberty to choose whatever materials for learning or teaching they wanted. This may account for less influential scores on social influences than may be generated from districts where the use of specific technologies is required. Also, in the margins of the questionnaire, some teachers wrote about there being discrepancies between the resources available and the school location within the district. Finally, all of the teachers reported meeting with students for one, thirty-minute lesson a week and having to travel between multiple buildings. Every teacher had at least two schools to travel between, almost half of the teachers were assigned to four building locations (43.5%), and some teachers (13.0%) reported needing to travel among five or more schools. In other districts where there is not the need for multiple school assignments, scores on the facilitating conditions construct may be higher.

Second, while age was not a factor considered in the research model of this study, the highest percentage of teacher respondents (39.1%) were 50 years old or higher (M = 43.18, SD = 12.62). The higher age range of teachers working in this district may be atypical when compared to other districts. However, Kul (2013) found no significant

differences in technology use among teachers of varying ages. Additionally, the highest percentage of student participants (46.4%) was ten years of age ($M = 9.71$, $SD = 0.68$). The young ages of the students may have accounted for the greater spread of variability among their scores due to factors such as differences in reading levels and comprehension.

Finally, the teachers surveyed in this study had a relatively high average number of years of teaching experience ($M = 19.57$, $SD = 12.28$). Rohaan, Taconis, and Jochems (2012) found that teaching experience strongly influences teachers' attitudes toward technology. Caution may be exercised when comparing the results of this study with districts whose teachers do not have as high an average of years of teaching experience.

Research Question 1

The findings of research question 1 suggest that despite the prevalence of a wide variety of technological resources that may be used in elementary instrumental music classrooms, the supplemental materials found in method books are predominantly used in class and assigned for practice outside of class. This finding suggests that there has not been much growth in the use of technology among music educators, since method books are widely viewed as traditional materials, and is supported by similar research (Armstrong, 2014; Agbatogun, 2013; Blackwell et al, 2013; Ozel, 2014; Rees, 2011). Recent updates in some method books, such as the *Tradition of Excellence*, include the additions of DVDs, accompaniment recordings, *Interactive Practice Studio* applications, interactive whiteboard capabilities, and *SmartMusic* support to enhance the technological features offered. However, no teachers reported using *Interactive Practice Studio* or interactive whiteboards in class or for practice. While about a third of teachers reported

using *SmartMusic* in class, no teachers assign it for practice at home. Therefore, it appears as though the most advanced technological features of the method books are not being used.

Twenty of the twenty-three teachers surveyed reported using some technology in class, including laptops, supplemental materials in method books, and iTunes. However, because technology is generally used for less than a third of each class period, the actual time spent in use is still relatively small, consistent with other findings (Armstrong, 2014; Agbatogun, 2013; Blackwell et al, 2013; Ozel, 2014). Technologies are mostly used for accompaniment, recordings, and assessment. This result is supported by research that suggests music educators typically use technology for administrative tasks and, less often, as pedagogical aids (Taylor & Deal, 2000; Jassman, 2004; Ohlenbusch, 2011; Lebler, 2012; Webster, 2002). Although students may be involved in listening to recordings of pieces or playing along with accompaniment, the data suggest the use of technology is mostly driven by the teacher with fewer opportunities for student interaction with the technology.

Lack of time, having to travel among multiple school locations, and a difficult lesson schedule comprise the top reasons why teachers do not use more technology in class. Perhaps because of their convenience, intuitive design, and portability, tablets are the technology teachers overwhelmingly would like to use in class if given the opportunity. However, despite the seemingly flexible design of online resources included on the inventory list, teachers neither use, nor have much interest in using, Internet-based technologies in elementary band and orchestra. A majority of teachers do not assign any practice with the use of technology, nor indicate much of an interest in doing so. While

many teachers reported that using technology for at-home practice is useful in beginning instrumental music and could help students reach their performance goals, the most common reason indicated for not assigning technology for practice is a lack of parental support.

Research Question 2

To answer the second research question, data analysis revealed that the overall attitude of teachers, students, and parents toward using technology in first-year instrumental music is generally positive. Of the three groups of participants, teachers scored highest in the areas of attitude and performance expectancies and lowest in effort expectancies, social influences, and facilitating conditions. This suggests that teachers have the most interest and believe most strongly in the usefulness of technology for instrumental music instruction. Although teacher scores on effort expectancy were positive, teachers perceived the use of technology to be least easy among the groups surveyed. Also, while the use of technology is not mandatory, teachers have the strongest sense of social influence over their decision to use technology.

Examination of data analyzed for all participants revealed that effort expectancies significantly predicted the attitudes of teachers, students, and parents. This is the only construct that was found to be a significant predictor for all groups of respondents. In each case, the greater the perceived ease of use of the technology, the greater the attitude toward using technology. Therefore, in order for technology to be viewed favorably in elementary instrumental music settings, it must be easy to use. The finding that effort expectancies significantly predict teacher and student attitudes is supported by existing literature (Celik & Yesilyurt, 2013; Shen & Chuang, 2010). However, discoveries

concerning the contribution of effort expectancies to teacher attitude run contrary to teacher responses in the TMUQ. Only 13.0% of teachers reported that technology is easy to use in class and 4.4% of teachers said it is easy to use in practice environments. Perhaps while teachers have positive effort expectancies, implying that the technologies themselves are easy to use, there are other factors at play that make the implementation of technologies in actuality difficult to accomplish.

Student and parent attitudes toward technology use were also found to increase with rises in performance expectancy, or perceived usefulness. Existing literature supports the finding of performance expectancies significantly contributing to student attitude (Shen & Chuang, 2010). Of the constructs measured, average scores for students on performance expectancies were the lowest of the three groups studied, although they were still considered positive. It may be that students do not have as high of an understanding of how the use of technology can help them attain gains in instrumental performance. For both students and parents, it may help improve their attitudes toward incorporating technology if teachers can reinforce how its use can provide advantages in performance and practice.

The construct of facilitating conditions was also found to significantly predict teacher attitude toward using technology. Teacher scores on facilitating conditions averaged less than 3.0, indicating negative perceptions of the degree to which they believe an organizational and technical infrastructure exists to support the use of technology. Items generated to measure facilitating conditions included the topics of class scheduling, availability of technology in the classroom and at home, training and assistance provided for the use of technology, and parental support. Upon closer

examination of the results of each of the items within the construct, it was found that all items averaged less than 3.0, indicating negative perceptions. Teachers feel that the lesson schedule makes it difficult to use technology in class, the classroom is not well-equipped to support the use of technology, students do not have the resources necessary to use technology at home, and parents do not provide adequate support to help students practice using technology at home. However, facilitating conditions also generated the lowest reliability coefficient. This may be due to the small group size of teacher participants (Huck, 2012) as well as the possibility that items within the construct of facilitating conditions addressed a broader range of topics than other constructs.

Finally, years of technological experience were found to significantly predict teacher attitude. The more experience teachers had using technology for music, the more positive their attitude. However, the years of technological experience of the teacher did not significantly predict the attitudes of students or parents, despite literature suggesting otherwise (Rohaan, Taconis, & Jochems, 2012). This may be due to the low amount of actual use of technology by the participants, particularly in home practice environments where the students and parents use technology away from the teacher. The teachers in this study also may not involve students much in the technology used in class or convey much about their levels of technological experience within the short periods of time they interact with students and parents.

Contrary to existing research (Rohaan, Taconis, & Jochems, 2012), this study found years of teaching experience to be nonsignificant in predicting user attitudes toward technology. A possible reason for this may be because the subjects of this study perceive instrumental music instruction and technology as separate entities. The use of

technology in instrumental music may be considered a nicety, promoted primarily to save time, rather than a necessity. Music learning and performance is not reliant on technology, but may be enhanced by its use. Yet this may be hopeful news for music educators. If attitudes toward technology are generally positive whether a teacher is a novice or a veteran, then teachers of any level of professional teaching experience should feel encouraged to try incorporating relevant technological resources in their classrooms.

Also, a nonsignificant result in the contribution of parent attitudes toward student attitudes is contradicted by the literature (Lin, Liu, & Huang, 2012). Social influences were not found to significantly contribute to participant attitudes; however, the use of technology was not mandatory for respondents in the school district surveyed. Teachers were not required by administrators to use technology, and most teachers do not assign technology for practice outside of class. Social influence has been found in previous research to be a significant predictor when the use of technology is mandatory (Hartwick & Barki, 1994; Karahanna, Straub, & Chervany, 1999; Taylor & Todd, 1995a; Thompson, Higgins, & Howell, 1994; Venkatesh & Davis, 2000).

Research Question 3

In answering the third research question, attitudes were compared among teachers, students, and parents toward using technology to determine if there were any significant differences. While all three groups of participants generated positive attitude scores, a significant difference was found between the attitude scores of teachers (higher) and students (lower). No significant differences were found between the attitudes of teachers and parents or between students and parents. It is important to note that the effect size was small (0.01), suggesting a weak mean difference. It is also worthwhile to

keep in mind the considerably smaller sample size of teachers included in the study. Unbalanced sample sizes were due to the teacher to student ratio and nature of the inquiry. Furthermore, the assumption of homogeneity of variance was not met, perhaps due to the greater variance of student scores. Student attitude scores may have had greater variability due to their young ages or a weaker understanding of the questions asked. Although the decision was made to conclude there was a significant difference between teacher and student attitude scores, caution should be exercised when generalizing these results across other populations of teachers and students.

It may be surprising to discover that teachers had the highest attitude toward technology and students had the lowest attitude, when many may have supposed the contrary to be true. In a time when it is widely assumed that students brought up in the digital age are perhaps more favorable to using technology than adults, students may not think technology is as useful given the complicated task of learning to play an instrument. In fact, of all the constructs measured, students scored the lowest in performance expectancies, or perceived usefulness. Therefore, to increase student attitudes, teachers may need to better explain why the technology is necessary and helpful for musical growth.

Research Question 4

The fourth research question examined whether a statistically significant relationship exists between attitude towards technology and the actual use of technology, both in class and assigned for practice. Despite the overall positive attitudes of all participants towards technology in instrumental music, no statistically significant linear relationships were found between the overall attitudes of participants and the actual use

of technology, contrary to what might be expected. Whether or not technology is used in class or assigned for practice outside of class does not influence attitude toward technology, either positively or negatively.

Further examination also revealed there to be no relationship between student attitude and the actual use of technology or between parent attitude and the actual use of technology. This finding is contradicted by research that suggests student attitude improves with the use of technology (Maria, Persa, Ilias, & Efstanthios, 2011; Judi, Amin, Zin, & Latih, 2011; Edmunds, Thorpe, & Conole, 2012). Positive correlations of medium effect sizes were found between teacher attitude and time spent using technology in class as well as teacher attitude and expected time spent using technology in practice. However, these relationships were nonsignificant when generalized to the population, perhaps because of the small sample size of teachers. The trend identified in this study is supported by other research that revealed positive relationships between the attitudes of teachers and technology use (Naaz, 2012; Avidov-Ungar & Eshet-Alkakay, 2011).

Implications for Music Education

Based on the results of this study, it is recommended that music educators be given the option whether or not they wish to use technology as well as the opportunities to select their own technological resources. The fact that social influence scores were nonsignificant is favorable; teachers do not feel pressured to use technology. Likewise, their perceptions of influential people do not affect their attitudes one way or another. Therefore, it is not advisable for administrators and school districts to mandate the use of technology for elementary instrumental music teachers.

Teachers should use caution in selecting technologies and ensure that they can be easily understood and applied not only by themselves, but their students and their students' parents as well. Since effort expectancies significantly contributed to attitudes of all participants in this study, it is essential to promote technologies that are perceived as easy to use. Further, because performance expectancies significantly contributed to the attitudes of students and parents, it is critical for teachers to be able to effectively relay the educational and performance goals the technology serves. Wiebe and Kabata (2010) suggest that teachers allocate time to explain why the technology will benefit students in order for them to have positive attitudes towards the usefulness of the technology. For music educators, it may be beneficial for them to hold an informational meeting for students and parents to demonstrate exactly how the assigned technology should be used in practice at home. Letting students know the goals the technology serves may help bridge the gap between teacher and student attitudes toward technology.

Because teachers had an overall negative score for facilitating conditions, the use of technology should be governed by teachers based on their individual preferences, experiences, and the accommodations their teaching and learning environments provide. For teachers who only see each of their students for 30 minutes once a week, travel among multiple school locations, and lack the appropriate technological equipment necessary to fulfill their goals, implementing technology may seem infeasible and should not be standardized across the district. School administrators or other educational leaders may need to provide guidance and support to help alleviate some of the pressures teachers feel in their job assignments in order to improve their capacity to include technologies in the curriculum. Scheduling improvements, increased class time with

students, employing more qualified teachers to reduce extensive traveling, and the acquisition of transferrable technologies may be beneficial to improving the outlook of teachers toward technology implementation.

This study found that increased technological experience of teachers improves their attitudes toward technology. A trend was also revealed by the moderately positive correlation between teacher attitudes and the actual use of technology. Therefore, continued technological training and professional development is necessary in order to provide teachers with meaningful experience using technology. The need for support in the implementation of technology fit for the classroom is defended by previous research (Alexiou-Ray, Wilson, Wright, & Peirano, 2003).

Despite the finding that as perceived ease of use increases, teachers' attitudes toward technology increase, few teachers reported that technology is easy to use in class and in practice environments. This suggests that teachers consider the technologies they are actually using are not easy to use. Therefore, teachers may need further professional development to become aware of technologies that are available as well as opportunities to discover resources that provide the best fit for their classroom environments and levels of experience. Teachers are still widely using materials, such as method books, that are considered traditional without employing the full technological offerings many updated method books provide. Given time to complete training, develop awareness of what is available, and discover how resources can be used in the classroom, teachers may be able to use more effective technologies throughout longer portions of class periods. Further, acquiring knowledge and training about technologies that are interactive and allow students to connect with the technology during class may improve students' attitudes

towards technology as well as the relationship between student attitude and the actual use of technology. The fact that very low relationships were found to exist between the attitudes of all participants and the actual use of technology implies that perhaps the right kinds of technologies are not being used. It is not enough to simply use technology, but it may be more important to consider what is being used and how.

Tablets were the technologies most teachers (69.6%) wished they could use if given the opportunity. Teachers expressed concerns about not having well-equipped classrooms, a lack of technological resources, and insufficient parental support for practice at home. Portable, user-friendly devices such as tablets may be key in establishing a connection between technology that is used at school and transported to home for practice. Acquiring "crossover" technologies, such as tablets, that can be used similarly both in class and in practice environments, may improve perceived usefulness as well as reduce the amount of time needed in class to provide instruction on using the technology. Further, many technological resources available online are free to use and can be accessed through a variety of devices. For instance, 47.8% of teachers reported using the notation software *Finale* in class. However, free, Internet-based applications such as *Noteflight* have many of the same features and capabilities of *Finale*, but no teachers reported its use. Many applications and online resources are not only designed with the use of portable electronics such as tablets in mind, but they are much more economical to acquire than expensive software better suited for computers or laptops. Informing teachers of such possibilities may help alleviate some of their concerns about not having access to technologies.

Suggestions for Future Study

In order to keep up with current trends in educational policy and societal expectations with regards to the comprehensive integration of technology, it is essential for music educators to be informed about best practices in classroom technology and engaged in its application to the curriculum. Suggestions for future study on the topic of technology use and attitudes in elementary instrumental music include the following:

1. Continued development of the survey instruments constructed for this study, the *Technology in Music Usage Questionnaire* (TMUQ) and the *Technology in Music Attitude Questionnaire* (TMAQ), can establish test-retest reliability of the instruments for future studies.
2. Future studies involving a larger pool of teacher participants may be warranted to examine more closely the extent to which facilitating conditions contribute to teacher attitude toward technology as well as to determine whether a statistically significant relationship exists between attitude and the actual use of technology in elementary instrumental music settings. In addition, replications of this study with subjects from other school districts and different geographical locations may yield results worth comparing and investigating, especially if the use of technology is mandated versus voluntary.
3. Because technologies are continually changing and becoming more accessible, continued research will be necessary to examine the use of and attitudes toward technologies in future instrumental music classrooms. For example, more districts are exploring the possibility of providing students with school-issued laptops or tablets that can be used in all classes as well as for homework outside of school.

4. Approaching the current study using mixed-methods or qualitative analysis may provide deeper insight into the responses provided by participants, particularly the young students involved in elementary instrumental music.

5. Descriptive in nature, this study sought to identify what technologies are used in first-year instrumental music and perceptions toward technology use. However, future studies may examine whether actual use of technology in these settings influences student achievement or motivation for participation in instrumental music.

When carefully considered and integrated, technology can benefit the music classroom by supporting students' motivation and improving the quality of their learning (Wai-chung Ho, 2004). However, much training and professional development is needed for music educators to become aware of the technologies available and to understand how to effectively implement them into the curriculum. Teachers can help bridge the gap between their own attitudes toward technology and those of their students by explaining why the use of selected technologies are useful to instrument performance. Teachers may also provide training to students and parents on the expectations for using technology in practice at home to improve student growth outside of the classroom. School administrators and educational leaders can provide much needed assistance in alleviating some of the challenges elementary instrumental music educators face so that they are more empowered and willing to implement relevant technologies successfully. Only through the cooperated efforts of all stakeholders can technology lead to improved student learning environments.

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APPENDIX A

INSTITUTIONAL REVIEW BOARD APPROVAL LETTER

University of Nebraska Lincoln

September 10, 2014

Ashley Gilbert
School of Music
8038 Bauman Avenue Omaha, NE 68122

Brian Moore
School of Music
358 WMB, UNL, 68588-0100

IRB Number: 20140914458EP
Project ID: 14458
Project Title: An Exploration of the Use of and the Attitudes Toward Technology in First Year Instrumental Music

Dear Ashley:

This letter is to officially notify you of the approval of your project by the Institutional Review Board (IRB) for the Protection of Human Subjects. It is the Board's opinion that you have provided adequate safeguards for the rights and welfare of the participants in this study based on the information provided. Your proposal is in compliance with this institution's Federal Wide Assurance 00002258 and the DHHS Regulations for the Protection of Human Subjects (45 CFR 46). Your project was approved as an Expedited protocol, category 7.

Date of EP Review: 07/01/2014

You are authorized to implement this study as of the Date of Final Approval: 09/10/2014. This approval is Valid Until: 09/09/2015.

You are authorized to begin your research with the following sites:

Ã¢Â€Â¢ Omaha Public Schools
Ã¢Â€Â¢ Lincoln Public Schools.

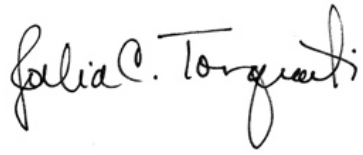
We wish to remind you that the principal investigator is responsible for reporting to this Board any of the following events within 48 hours of the event:
* Any serious event (including on-site and off-site adverse events, injuries, side effects, deaths, or other problems) which in the opinion of the local investigator was unanticipated, involved risk to subjects or others, and was possibly related to the research procedures;
* Any serious accidental or unintentional change to the IRB-approved protocol that involves risk or has the potential to recur;

* Any publication in the literature, safety monitoring report, interim result or other finding that indicates an unexpected change to the risk/benefit ratio of the research;
* Any breach in confidentiality or compromise in data privacy related to the subject or others; or
* Any complaint of a subject that indicates an unanticipated risk or that cannot be resolved by the research staff.

For projects which continue beyond one year from the starting date, the IRB will request continuing review and update of the research project. Your study will be due for continuing review as indicated above. The investigator must also advise the Board when this study is finished or discontinued by completing the enclosed Protocol Final Report form and returning it to the Institutional Review Board.

If you have any questions, please contact the IRB office at 472-6965.

Sincerely,



Julia Torquati, Ph.D.
Chair for the IRB

APPENDIX B

INSTRUMENT ASSESSMENT FORM

Technology in Music Attitude Questionnaire (TMAQ)

Instructions: Please provide feedback about the questionnaire by indicating your answer for the following questions and rating scales:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. The questionnaire directions are clear.					
2. The participants will be able to answer all questions.					
3. There are NO errors in words.					
4. The format of the questionnaire seems logical.					
5. The questions serve the appropriate purpose.					

Please provide comments for any of the above areas you feel might need further attention:

TMAQ Constructs & Items (Refer to corresponding document, *Survey Constructs & Items*)

6. Are the twenty-five opinion statements related to the five constructs associated with one's attitude toward technology usage in first-year instrumental music?

❑ Not Related ❑ Moderately Related ❑ Closely Related

7. If you feel there is a statement that is NOT placed under the correct construct, please list the item number below next to the construct you feel **better** represents that statement.

Five Constructs

1. Attitude
2. Performance Expectancy
3. Effort Expectancy
4. Social Influence
5. Facilitating Conditions

8. Please share any other comments you have about the survey:

APPENDIX C

COVER LETTER

University of Nebraska Lincoln

Glenn Korff School of Music

October 28, 2014

Greetings!

My name is Danni Gilbert and I am a PhD student at the University of Nebraska-Lincoln. I would please like your assistance in conducting a research project. The purpose of this study is to compare teachers, students, and parents in terms of their attitudes toward technology integration in first-year instrumental music settings.

The title of the project will be **An Exploration of the Use of and the Attitudes Toward Technology in First-Year Instrumental Music.**

Your identity throughout this process will be kept strictly confidential. Participation in this study will require that you respond to a survey that will take you about five to ten minutes to complete. There are no known risks to participating in this study. **To participate, simply fill out the following survey and return it in the envelope to your school as soon as possible.** A reminder to complete the survey will be sent in two weeks.

If you have any questions about the research project, please contact Danni Gilbert at danni2784@hotmail.com. If you have any questions about your rights as a research participant or to report any concerns, please contact the UNL Institutional Review Board at 402-472-6965 or irb@unl.edu. The results will be shared with all participants at the conclusion of the study. Thank you for your consideration in participating in this research study.

Sincerely,

Mrs. Danni Gilbert
Doctoral Candidate
University of Nebraska-Lincoln
8038 Bauman Avenue
Omaha, NE 68122
danni2784@hotmail.com

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Associate Professor of Music Education
University of Nebraska-Lincoln
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APPENDIX D

SURVEY INSTRUMENT (TEACHER VERSION)

Technology Attitudes in First-Year Instrumental Music

1. Technology in Music Usage Questionnaire (TMUQ)

*** 1. Please select the following technologies that you *currently use* OR *would like to use* for instrumental music. (Check all that apply. If you *do not use* an item, *would not like to use* an item, or are unsure, please leave blank.)**

	In-Class Instruction		Assign for Practice	
	Currently Use	Would Like to Use	Currently Assign	Would Like to Assign
Software				
SmartMusic	❑	❑	❑	❑
Interactive Practice Studio (IPS)	❑	❑	❑	❑
Interactive Pyware Assessment System (iPAS)	❑	❑	❑	❑
Finale	❑	❑	❑	❑
Sibelius	❑	❑	❑	❑
GarageBand	❑	❑	❑	❑
iTunes	❑	❑	❑	❑
Supplemental DVD/CD in Method Book (Please specify which method book used):	❑	❑	❑	❑
Other (please specify):	❑	❑	❑	❑
Hardware				
Computer	❑	❑	❑	❑
Laptop	❑	❑	❑	❑
Tablet (ex: iPad)	❑	❑	❑	❑
Digital Music Player (ex: iPod)	❑	❑	❑	❑
Interactive White Board (ex: SMART Board)	❑	❑	❑	❑
Smart Phone/Cell Phone	❑	❑	❑	❑
Other (please specify):	❑	❑	❑	❑
Online Resources				
Noteflight	❑	❑	❑	❑
MuseScore	❑	❑	❑	❑
Audacity	❑	❑	❑	❑
Social Media (ex: Facebook)	❑	❑	❑	❑
Class Website	❑	❑	❑	❑
Other (please specify):	❑	❑	❑	❑

*** 2. How many years of experience do you have using technology for music?**
Years of experience using technology for music: _____

*** 3. Do you use technology in class or do you assign technology for student practice? If your answer is "Yes", please continue with question #4. If your answer is "No", please skip to question #9.**

- ❍ Yes, I use technology in class AND assign technology for practice.
- ❍ Yes, I use technology in class, but do NOT assign it for practice.
- ❍ Yes, I assign technology for practice, but do NOT use it in class.
- ❍ No, I neither use technology in class nor assign it for practice.

*** 4. How many average minutes *per class* do you spend using technology?**
Average minutes *per class* using technology: _____

*** 5. How many average minutes *per week* do you expect students to practice using technology outside of class?** Average minutes *per week* of expected student practice using technology: _____

*** 6. I use technology primarily for:**

- ❍ Lesson delivery
- ❍ Student interaction
- ❍ Both lesson delivery and student interaction
- ❍ Other (please explain)

*** 7. I use technology in the following ways: (Check all that apply).**

❑Assessment ❑Accompaniment ❑Composition/Arrangement ❑Listening

❑Recording ❑Games ❑Visual display of notation ❑Other (please explain)

*** 8. I use technology because: (Check all that apply).**

Technology in Class		Technology in Practice
❑	It helps me reach my teaching goals.	❑
❑	It helps my students reach their performance goals.	❑
❑	It saves me time.	❑
❑	Technology is readily available.	❑
❑	Using technology is a requirement.	❑
❑	Using technology is inexpensive.	❑
❑	I am knowledgeable about using technology.	❑
❑	Using technology is easy.	❑
❑	Technology is useful in beginning instrumental music.	❑
❑	There is enough parental support to use technology.	❑
❑	Other (please explain)	❑

Please continue with Section #2, the Technology in Music Attitude Questionnaire (TMAQ).

*** 9. Please indicate your response.**

- ❍ I previously used technology for music, but I don't anymore.
- ❍ I do not use technology for music and I hope I never have to.
- ❍ I do not use technology for music, but I would like to if I could.

*** 10. Why do you *NOT* use technology in class or assign it for practice? (Check all that apply).**

Technology in Class		Technology in Practice
❑	There is not enough time.	❑
❑	The lesson schedule does not allow for me to incorporate technology.	❑
❑	I have to travel between buildings, so using technology is difficult.	❑
❑	Technology is not readily available.	❑
❑	Using technology is not a requirement.	❑
❑	Technology is too expensive.	❑
❑	I don't know enough about using technology.	❑
❑	Using technology is too difficult.	❑
❑	Technology is not useful in beginning instrumental music.	❑
❑	There is not enough parental support to use technology.	❑
❑	Other (please explain)	❑

Please continue with Section #2, the Technology in Music Attitude Questionnaire (TMAQ).

Technology Attitudes in First-Year Instrumental Music

2. Technology in Music Attitude Questionnaire (TMAQ)

Please read each statement and indicate your opinion on a scale of 1-5 (1=Strongly Disagree with the statement; 5=Strongly Agree with the statement). If you do not have enough information to provide a response, please indicate "Unable to Answer." Throughout this questionnaire, "music" refers to band or orchestra, not general music.

*** 1. Music would be more interesting with technology.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 2. I like the idea of using technology for music.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 3. Using technology for music does NOT seem enjoyable.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 4. Music would get boring quickly with technology.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 5. Using technology for music would be fun.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 6. Technology has no effect on the quality of music performance.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 7. Technology is useful for learning to play an instrument.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 8. Music students can learn more when they use technology than when they don't.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 9. Using technology for music does NOT work very well.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 10. Technology creates positive results for instrument performance.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 11. Working with technology is so complicated, it's difficult to understand what's going on.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 12. Using technology is easy.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 13. Using technology takes too much time away from other things I have to do.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 14. I can accomplish more when I use technology than when I don't.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 15. It would take too long to learn to use technology to make it worth the effort.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 16. Using technology for music would make me appear to be a better teacher.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 17. I don't have to use technology for music if I don't want to.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 18. Other teachers use technology for music, so I feel like I should, too.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 19. I use technology for music because someone else thinks I should.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 20. Using technology for music makes me more valuable to my administrators.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 21. The way music is scheduled during the day makes it really difficult to use technology.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 22. The music room is well-equipped to use technology during class.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 23. Students do NOT have everything they need to use technology when practicing their instruments at home.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 24. If I don't know enough about using technology for music, I know where I can go for help.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 25. Parents do a good job helping students use technology for practicing their instruments at home.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

Please continue with Section #3, Demographics.

Technology Attitudes in First-Year Instrumental Music

3. Demographics

* **1. My gender:** ❑ Male ❑ Female

* **2. Please indicate your age in number of years:** Years of age: _____

* **3. How many years of professional teaching experience do you have?** Years of experience: _____

* **4. How many years of experience do you have teaching first-year instrumental music students?** Years of experience: _____

* **5. My highest earned professional degree:**

❑ Bachelor's ❑ Master's ❑ Doctorate

* **6. What does your teaching assignment include? (Check all that apply).**

❑ Elementary Band ❑ Middle School Band ❑ High School Band
❑ Elementary Orchestra ❑ Middle School Orchestra ❑ High School Orchestra
❑ Elementary Choir ❑ Middle School Choir ❑ High School Choir
❑ Music Technology ❑ General Music/Music Appreciation
❑ Other (Please specify): _____

* **7. How often do you typically meet with your beginning instrumental music students for lessons?**

Number of lessons per week: _____

Number of minutes per lesson: _____

* **8. How many different schools does your teaching assignment include?** Number of schools in teaching assignment: _____

* **9. How many students are enrolled in your first-year music classes at the school(s) in which you teach? (Please enter the number of students enrolled at each school or leave blank if not applicable).**

School 1 students: _____ School 4 students: _____

School 2 students: _____ School 5 students: _____

School 3 students: _____

You have successfully completed this survey. Please return your survey in the envelope as soon as possible. Thank you for your valuable time and input.

APPENDIX E

SURVEY INSTRUMENT (STUDENT VERSION)

Technology Attitudes in First-Year Instrumental Music

1. Technology in Music Attitude Questionnaire (TMAQ)

Please read each statement and indicate your opinion on a scale of 1-5 (1=Strongly Disagree with the statement; 5=Strongly Agree with the statement). If you do not have enough information to provide a response, please indicate "Unable to Answer." Throughout this questionnaire, "music" refers to band or orchestra, not general music.

*** 1. Music would be more interesting with technology.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 2. I like the idea of using technology for music.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 3. Using technology for music does NOT seem enjoyable.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 4. Music would get boring quickly with technology.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 5. Using technology for music would be fun.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 6. Technology has no effect on the quality of music performance.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 7. Technology is useful for learning to play an instrument.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 8. Music students can learn more when they use technology than when they don't.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 9. Using technology for music does NOT work very well.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 10. Technology creates positive results for instrument performance.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 11. Working with technology is so complicated, it's difficult to understand what's going on.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 12. Using technology is easy.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 13. Using technology takes too much time away from other things I have to do.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 14. I can accomplish more when I use technology than when I don't.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 15. It would take too long to learn to use technology to make it worth the effort.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 16. Using technology for music would make me appear to be a better student.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 17. I don't have to use technology for music if I don't want to.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 18. Other students use technology for music, so I feel like I should, too.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 19. I use technology for music because someone else thinks I should.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 20. Using technology for music makes me more valuable to my teacher.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 21. The way music is scheduled during the day makes it really difficult to use technology.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 22. The music room is well-equipped to use technology during class.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 23. I do NOT have everything I need to use technology when practicing my instrument at home.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 24. If I don't know enough about using technology for music, I know where I can go for help.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 25. My parents do a good job helping me use technology for practicing my instrument at home.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

Please continue with Section #2, Demographics.

Technology Attitudes in First-Year Instrumental Music

2. Demographics

* **1. My gender:** ❑ Male ❑ Female

* **2. Please indicate your age in number of years:** Years of age: _____

* **3. My grade in school:**

❑ 4th Grade ❑ 5th Grade ❑ 6th Grade ❑ Other

* **4. I am currently in my first year of taking:**

❑ Band ❑ Orchestra ❑ Band AND Orchestra

You have successfully completed this survey. Please return your survey in the envelope as soon as possible. Thank you for your valuable time and input.

APPENDIX F

SURVEY INSTRUMENT (PARENT VERSION)

Technology Attitudes in First-Year Instrumental Music

1. Technology in Music Attitude Questionnaire (TMAQ)

Please read each statement and indicate your opinion on a scale of 1-5 (1=Strongly Disagree with the statement; 5=Strongly Agree with the statement). If you do not have enough information to provide a response, please indicate "Unable to Answer." Throughout this questionnaire, "music" refers to band or orchestra, not general music.

*** 1. Music would be more interesting with technology.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 2. I like the idea of using technology for music.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 3. Using technology for music does NOT seem enjoyable.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 4. My child would become bored with music quickly with technology.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 5. Using technology for music would be fun for my child.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 6. Technology has no effect on the quality of music performance.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 7. Technology is useful for learning to play an instrument.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 8. Music students can learn more when they use technology than when they don't.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 9. Using technology for music does NOT work very well.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 10. Technology creates positive results for instrument performance.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 11. Working with technology is so complicated, it's difficult for my child to understand what's going on.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 12. Using technology is easy for my child.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 13. Using technology takes too much time away from other things my child has to do.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 14. My child can accomplish more when using technology than when technology is not used.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 15. It would take my child too long to learn to use technology to make it worth the effort.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 16. Helping my child use technology for music would make me appear to be a better parent.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 17. I don't have to help my child use technology for music if I don't want to.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 18. Other parents help their children use technology for music, so I feel like I should, too.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 19. I help my child use technology for music because someone else thinks I should.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 20. Helping my child use technology for music makes me more valuable to my children and their teachers.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 21. The way music is scheduled during the day makes it really difficult to use technology.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 22. The music room is well-equipped to use technology during class.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 23. My child does NOT have everything needed to use technology when practicing his/her instrument at home.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 24. If I don't know enough about using technology for music, I know where I can go for help.**

SD SA
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

*** 25. I do a good job helping my child use technology for practicing his/her instrument at home.**

❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5 ❍ Unable to Answer

Please continue with Section #2, Demographics.

Technology Attitudes in First-Year Instrumental Music

2. Demographics

* **1. My gender:** ❑ Male ❑ Female

* **2. Please indicate your age in number of years:** Years of age: _____

* **3. My child's grade in school:**

❑ 4th Grade ❑ 5th Grade ❑ 6th Grade ❑ Other

* **4. My child is currently in the first year of taking:**

❑ Band ❑ Orchestra ❑ Band AND Orchestra

You have successfully completed this survey. Please return your survey in the envelope as soon as possible. Thank you for your valuable time and input.

APPENDIX G
RELIABILITY COEFFICIENTS OF TMAQ CONSTRUCTS

To assess the internal consistency of the items in the TMAQ, Cronbach's coefficient alpha was calculated for each of the five constructs measured across all three groups of participants. Cronbach's alpha was estimated at 0.866 for attitude, 0.778 for performance expectancies, 0.722 for effort expectancies, 0.650 for social influences, and 0.564 for facilitating conditions. Because the estimated reliability coefficient was lowest for facilitating conditions, Cronbach's alpha was also calculated for this construct for each individual group of participants: teachers (0.459), parents (0.495), and students (0.671). The small group size of the teacher participants may account for the lower reliability score (Huck, 2012), as well as the possibility that the items within the facilitating conditions construct addressed a broader range of topics than other constructs. Weakened reliability for parent participants may be a result of parents having to guess at items if they did not have enough information to answer the questions. An assessment of the validity of the survey is addressed in Chapter 3.