A STUDY OF MOBILE APPLICATIONS AND THEIR IMPACT ON THE REINFORCEMENT OF NOTE AND RHYTHM IDENTIFICATION IN THE PRIVATE PIANO TEACHING STUDIO

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Abstract

This study surveyed 33 piano teachers and gained information regarding their use of mobile applications to reinforce note and rhythm concepts in their private teaching studios. The Validating Quantitative Model was used to collect and analyze data for this project. The main data findings found that 1) A large percentage of piano teachers use mobile applications to teach note and rhythm concepts to students; 2) Not all teachers who use mobile applications in their teaching feel the need to keep current with the latest application technologies; 3) There are piano teachers who choose not to use mobile applications in their teaching studios for several reasons; and 4) Piano teachers have differing opinions regarding the usefulness of mobile applications when reinforcing note and rhythm concepts in their teaching studios.

*Keywords:* piano pedagogy, music education, note and rhythm identification, mobile applications
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Chapter I: Introduction

Over the past 10-15 years, mobile applications have been developed for almost every subject, business, and hobby. They have become a tool to aid personal development (time management, meditation, organization, physical fitness, etc.), interaction with businesses in local communities, and reinforcement of educational subjects. Many educational mobile applications have been developed for core subjects such as math, English, science, and history. Similarly, many mobile applications have been developed for music education purposes. *Note Rush, Rhythm Swing, Simply Piano, Muse Score, Flashnote Derby, Earpeggio,* and *Staff Wars* are just a few mobile applications that help reinforce music concepts such as note and rhythm identification, sightreading, ear training, and other general theory concepts.

Over the past 5 years, I have made an effort to use mobile applications to reinforce note and rhythm concepts for my beginning piano students. I have found these technologies to be beneficial in reinforcing note and rhythm concepts for students, helping students concentrate, and promoting student engagement during the lesson. I have also found that even though these technologies come with many benefits, they do not always fit each particular student’s learning needs. I have learned to use mobile application technology with discretion and sometimes have found the need to supplement physical note reading activities for students who struggle with note identification and physical rhythmic exercises for students who need more reinforcement with rhythm identification. Overall, I have observed mobile applications to be a beneficial tool that can positively aid the learning of note and rhythm concepts in private piano lessons. Interestingly, as I have discussed mobile application use with fellow piano teachers over
the years, I found a diversity of opinions in regard to the usefulness of this technology, the amount this technology is used during lessons, and the support that piano teachers give this technology. As a new piano teacher who was using this technology for the first time, I assumed that a majority of teachers would find mobile technology to be a useful tool to incorporate into their teaching space. This assumption prompted me to ask the questions, “Do piano teachers use mobile technology to reinforce note and tablet technology in their teaching space, and if so, have they found this technology to be beneficial in their private teaching?” This study is dedicated to answering these research questions. I believe this topic is important to the field of music education and piano pedagogy as a whole because it analyzes mobile application’s effectiveness in private lessons at reinforcing note and rhythm concepts. This study also uncovers whether making use of these technologies should be continued by piano teachers in the future.

**Purpose Statement**

This thesis study analyzed the use of mobile applications in private piano lessons and the impact they have had on the reinforcement of note and rhythm concepts. This study sought to answer three main research questions:

1) Do piano teachers use mobile applications to reinforce note and rhythm concepts in their private teaching?

2) Have piano teachers found mobile applications to be a useful tool for the reinforcement of note and rhythm concepts in their private teaching?

3) If piano teachers do not use mobile applications to reinforce note and rhythm concepts in their private teaching, what are their reasons for not doing so?
This study sought to answer each of these questions by surveying current piano teachers and analyzing their interaction with mobile technology and whether or not they have found this technology to be useful in their private teaching space.

**Importance of the Study**

The information in this thesis will be of value to piano teachers and general music educators. This study sought to present a framework by which piano and general music educators can evaluate the usefulness of mobile applications in the reinforcement of note and rhythm concepts in private piano lessons. This study also provided useful information that will help music educators make decisions regarding implementing mobile applications into the private teaching space.

**Definition of Terms**

This thesis study uses several key terms that are necessary for comprehending the subject of mobile application technologies and their usefulness in reinforcing note and rhythm concepts in the private piano lesson. First, *mobile applications* refer to software that is designed to run on mobile devices, such as smartphones and tablet computers (Satyra, 2018). This software allows users the ability to access information from their mobile devices without needing to connect to the internet. The terms *smartphone* and *tablet* terminology were used in this study’s survey questions in place of the term mobile. This was due to the fact that the term mobile can become ambiguous unless defined. Secondly, *piano pedagogy* refers to piano teaching. This is a specialized field of music education that focuses on piano education. Thirdly, *note and rhythm identification* and *note and rhythm reinforcement* are phrases referred to extensively in this study. *Note and rhythm identification* refers to the ability to read music notes and rhythms on the grand
staff. *Note and rhythm reinforcement* refers to activities that help reinforce music concepts for students in the lesson. Some reinforcement activities include flash cards, worksheets, music pieces, games, and music listening.

**Conclusion**

In conclusion, Chapter One outlined the importance and purpose of this study, main research questions that will be answered in this study, and a definition of key terms. Since the purpose of this study is to analyze the impact mobile applications have on the reinforcement of note and rhythm concepts in private piano lessons, this study will explore how current piano teachers use this technology, how effective they have found this technology to be at reinforcing note and rhythm concepts, and their personal reasons for why they have chosen to use or not use this technology in their current teaching. In the next chapter, I will present and discuss existing research literature relevant to this study.

**Chapter II: Review of Related Literature**

In Chapter One, the study of mobile applications and their impact on note and rhythm reinforcement in the private piano lesson was introduced. A brief overview of the purpose and importance of this study was given, and a definition of key terminology that will be used in the upcoming chapters was provided. In this chapter, literature will be reviewed in relation to the study of music technology and will provide insight into the discussion regarding the advantages and disadvantages of using technology in the music teaching space. Three studies will be outlined that analyze the effect technology has had on the learning of musical concepts primarily in the private teaching environment and further supports this study’s research. The review of the literature is organized into the
following sections: 1) Benefits of using technology in private music lessons; 2) Discernment using technology in private music lessons; and 3) Surveys that have studied teaching music concepts via technology.

**Benefits of Using Technology in Private Music Lessons**

The first section will present literature about the benefits of using music technology in private music lessons. The following sections outline how technology can aid in teaching musical concepts to students (Dumlavwalla, 2017), empower teachers to be creative in how they teach musical concepts (Partti, 2017), and allow students to continue learning outside the private lesson space (Chen, 2017).

First, the use of technology in private music lessons supports the retention of musical skills such as music notation (R. Creamata & B. Powell, 2016), rhythm, pitch, and theory (Kassner, 2006), and finally, composition and aural activities (Riley, 2013). Dumlavwalla (2017) cited a study conducted by Creamata and Powell (2016) that measured the mastery and retention of beginning piano pieces played by students who learned the pieces through online tools (eMedia software, Synthesia software, and YouTube tutorials) versus standard paper notation. Dumlavwalla summarizes, “[Creamata and Powell] discovered that the students who used the online tools had a higher level of retention seven days after they initially learned the skills” (Dumlavwalla, 2017). In addition to helping students retain information for a longer period of time, technology can also engage student learning by captivating a student’s attention through games. Kassner (2006), the developer of Music Ace Maestro, a game based, music teaching application designed for young children, states, “We want children to see the games as fun, but we know that games are not there simply to provide fun: Games
provide practice reinforcing and solidifying skills and concepts that might otherwise be forgotten” (Kassner, 2006). Riley in her article “Teaching, Learning, and Living with iPads” (2013), outlines several areas where technology can be used to reinforce musical concepts in music lessons. Composition, general instruction, modeling, creating audio feedback, and creating listening activities were a few of the areas she highlighted in her article (Riley, 2013). Technology reinforces music concepts in new ways that both engage and motivate students.

Secondly, using technology in private music lessons enables teachers and students to creatively think outside the box when teaching and reinforcing musical concepts. Mantie (2017), in his introduction to the *Oxford Handbook of Music Technology*, describes the possibilities technology opens up for music educators: “If engaged with freely and authentically, technology can liberate and wrest control away from those with monopolies on knowledge and access” (Mantie, 2017). Similarly, Partti (2017) outlines problems with approaching technology from a “tool-oriented” approach. She states that, “A tool-oriented approach to technology is problematic in music education, as it fails to provide students with resources and environments to explore and invent music, learn in social interactions, and develop creative thinking, cooperative problem solving, and initiative-taking abilities” (Partti, 2017, p. 125). What Partti advocates for is:

“[a] paradigm shift from viewing technological innovations as tools to enhance one’s learning *about* music to seeing technology as a powerful way to facilitate more possibilities to *participate* in different musical practices and musical worlds and to open up new avenues for musical interpretation” (Partti, 2017, p. 127).
Likewise, Berkovitz (2017) sees technology as a way for music educators to initiate change in the ways they present musical concepts to their students:

“Such [technological] tools become seeds for change….Change from the inside is encouraged as both teachers and students begin to use a tool on one obvious remise but then discover the alternative modes of use in front of them and begin to experiment with them” (Berkovitz, 2017, p. 146).

Kardos (2017) also advocates using technology to support creativity in music lessons:

“In creative practice research, learning occurs through the processes of making, touching, doing, working, editing, experimenting, collaborating, (insert almost any verb here, including failing) and reflecting….Music technology, as a collection of creative and interdisciplinary practices, represents a wonderful location for such learning to occur” (Kardos, 2017, p. 319).

Finally, Lum (2017) sums up the coupling of creativity and technology in the following statement:

“The availability and fluidity of technology has opened up a plethora of choices and distributed power to the learner. The active immediacy of choice and the wielding of power by the learner through technology directly impact the way teaching and learning is perceived. This power differential between the teacher and the learner given access by technology is of significance in transforming music classroom practices, as it allows both the teacher and learner to constantly reflect and question definitions of musicality, musicianship, and the expansion of musical creative work” (Lum, 2017, p. 357).
Therefore, using technology in private teaching gives liberty to teachers and students to experience musical concepts in new, creative ways.

Finally, the use of technology in private music lessons supports student learning outside the private lesson. Chen (2017) proposes this benefit in the following statement:

“Self-directed learning with interactive functions is recommended in mobile music learning to extend classroom teaching into the students’ daily lives so as to facilitate their learning outside school such disciplines as composing, listening to different repertoires, practicing aural skills, and recording one’s own performances using mobile device’s outside the classroom” (Chen, 2017, p. 169).

Likewise, Rajan in her article, “Tapping Into Technology”, outlines ways children can experience music outside the lesson by using technology. These ways include “music listening, music making, and music watching” (Rajan, 2014, p. 8-11). Therefore, technology can become a medium through which students engage in meaningful music making experiences outside the private lesson.

**Discernment Using Technology in Private Music Lessons**

This section discusses literature that advocates using discernment when implementing technology into private music teaching. Mantie (2017), Lum (2017) and Waldron (2017) promote exercising caution when using technology for educational purposes. Reasons will be outlined as to why technology should be used with caution in the private music lesson. Three reasons are prominent according to the research: 1) Technology should not be used in private teaching simply because it is available (Mantie, 2017), 2) Technology should not replace interaction with musical instruments and
concepts (Lum, 2017), and finally, 3) Technology should be implemented in the lesson in a meaningful way for effective student engagement (Waldron, 2017).

First, technology should not be used in the private lesson simply because it is available. Mantie (2017) states that technology should be critically evaluated by both educator and student:

“Our professional and ethical obligations...should strive to engender critical engagement that sees students continually evaluating if and how various technologies can help them live richer and more rewarding lives in and through music. This cannot happen, however, unless music educators themselves continually question the ways in which technologies affect the musical subjectivity of our students so that we may engage freely. Just because something is possible does not make it desirable or appropriate” (Mantie, 2017, p. 25).

Likewise, Upitis (2017) raises concerns regarding the benefits of technology. She states that music technology, though beneficial, must be used with discernment. There may be some musical tasks (such as music theory) that are too cumbersome to execute with a digital application, therefore using paper and pencil may be more appropriate tools to use. Therefore, teachers must utilize discretion when considering incorporating technology into their pedagogical practices (Upitis, 2017, p. 74).

An article entitled Digital Media & Learning (2012) elaborates on the effectiveness of technology when incorporated in the learning environment with discernment: “Technology and media are tools that are effective only when used appropriately” (2012). An unknown author later states,
“Technology and media should not replace activities such as creative play, real-life exploration, physical activity, outdoor experiences, conversation, and social interactions that are important for children’s development. Technology and media should be used to support learning, not an isolated activity, and to expand young children’s access to new content” (Digital Media & Learning, 2012).

Likewise, Medvinsky (2017) states that the educator should make wise decisions when it comes to introducing technology into the lesson. “Technology integration is most effective when it provides a transparent scaffold within a musical learning experience” (Medvinsky, 2017, p. 467). Therefore, music educators should be discerning when using technology in their teaching to promote effective communication of musical concepts.

Secondly, technology should not replace physical interaction with musical instruments and concepts. A hands-on learning approach brings life to the music concepts being taught. Lum states,

“Taking the live engagement with instruments as a case in point, physically playing on a guzheng [Chinese plucked zither] is quite different from playing the guzheng on an app. The intensity and articulation of body movements and vibrations felt on the body as it engages with the instrument involved and the aural acuity and sensitivity needed to articulate particular dynamics and expressions through the instrument are never quite equivalent to its technological counterpart” (Lum, 2017, p. 52).

Teachers should be careful to not replace the “physical-ness” of learning with the latest technological innovation. Utilizing the five senses is crucial to absorbing information and allowing that information to take root in a student’s experience.
Lastly, technology should be implemented in the lesson in a meaningful way for effective student engagement. Waldron (2017) advocates for taking into consideration the role of context and culture when evaluating using technology to support learning:

“…how does technology’s evolution from “thing” to “thing and place” change our perceptions of its use(s) in music learning and teaching? How do the roles of local context, cultural assumptions, and musical genre fit into a discussion of what constitutes technology and technology in music education?” (Waldron, 2017, p. 65).

Nilsson (2017) points out that children experience new concepts through play, or “musiking” as he calls it. He states that play is very important in the creative processes of children. Technology, according to Nilsson, “should allow play and unpredictable events and should permit the users to find a balance between the challenge and their abilities” (Nilsson, 2017, p. 247). Therefore, technology, when intentionally implemented in a private music lesson, can be of great benefit to student learning.

**Studies Involving Teaching Music Concepts Via Technology**

This final section outlines literature concerning three studies that provide an overview of how technology has impacted the teaching and learning of music concepts in private music lessons. The first study conducted by Waddell (2019) focuses on student-teacher interaction when technology is involved in the lesson. The second study by Debevec (2019) outlines the benefits of using music technology to learn music theory. The last study, conducted by Riley (2013), outlines the results of a survey that analyzed a group of college music students and the way iPads benefitted their practice sessions. A brief overview of each study will be provided in the sections below.
The first study, conducted by George Waddell (2019), analyzed the attitudes of students and teachers towards technology and their use of technology in one-on-one teaching. In this unique study, Waddell focused on the impact music technology has had on the one-on-one private teaching space versus a classroom setting. Since not much research has been done in this area, Waddell’s study has become a trailblazer in regard to analyzing the impact technology as a whole has had on the private, one-on-one teaching space. Waddell sought to gauge how much music teachers use technology in their private lessons to reinforce music skills (note reading, rhythm, aural skills, etc.). Results from the study revealed that technology has the potential to be implemented in a positive way in the private teaching lesson and could make a positive impact on “student-teacher interaction and self-regulated learning” (Waddell, 2019, p. 1). Waddell states:

“Teachers were generally more receptive to technology in their roles as teachers, being more likely to report increased use, willingness to try, usefulness of, and potential future usefulness of technology than to report decreased attitudes. The only reversal was that of time to try new technologies, where there was a tendency to report the same or less time as a teacher than as a musician” (Waddell, 2019).

After analyzing the attitudes private music instructors have towards technology and the ways they interact with it on a daily basis, Waddell concludes that there are still many opportunities for technology to aide music learning both inside and outside the private music lesson (Waddell, 2010, p. 1). Waddell’s study provides a foundation for this current study since it addresses the effect technology as a whole has had on the private teaching space.
A second study, conducted by Matjaz Debevc (2019), focused primarily on learning music theory (or “Solfeggio” as he terms it) through mobile applications. Debevc surveyed a group of high school students and compared whether students who used technology to learn music theory retained the concepts better than the students who learned music theory conventionally.

Although Debevc’s study initially showed that technology did not drastically alter the test scores of students, the study did reveal that technology has a place in learning and, if used appropriately, can be a beneficial learning tool (Debevc, 2019). Debevc’s study emphasized the importance of using technology as a conduit to aid learning. Later in the study Debevc observed, “…students who used the mobile application demonstrated higher scores in notation accuracy, accuracy of proportions between intervals and rhythm, than students who practiced solfeggio only in the traditional way” (Debevc, 2019). Debevc’s analysis of technology shows that, when used appropriately, technology can be beneficial in teaching and learning musical concepts.

One final study, conducted by Patricia Riley (2013), analyzed undergraduate students who used iPads for a semester to reinforce music skills they were learning in their undergraduate music classes. Riley gave each student an iPad for the semester and restricted use to only music related activities. Once the semester ended, Riley surveyed students and categorized several areas the iPad could be used in a one-on-one teaching context. Riley separated her findings into seven specific categories: 1) Accompanying, Transcribing, and Transposing, 2) Composing and Improvising, 3) Assistance in Teaching Private Music Lessons, 4) Modeling, 5) Creating Audio and Video Recordings, 6) Music Listening, and finally 7) Organizational Tasks (Riley, 2013, p. 81-86). Each of
these categories reflect the versatility technology can have for the music educator and the positive impact technology can have on the music teaching space. As a tool, technology can be beneficial in reinforcing music concepts and providing a plethora of resources to both teacher and student (Riley, 2013).

Conclusion

In conclusion, Chapter Two includes a review of literature concerning the benefits of using music technology in private music lessons, discernment when using music technology in private music lessons, and studies involving teaching music concepts via technology. This review of existing literature shows that technology, when used discerningly by the teacher and student, can be beneficial for supporting the learning of musical concepts. The current study aims to expand upon this body of knowledge by using a mixed methods research approach to evaluate the effectiveness and usefulness of technology when used to reinforce note reading and rhythm concepts in private music lessons. In the next chapter, I will discuss the methodology used to address the primary research questions posited in Chapter 1 and present an overview of the participants, materials, and procedures used in analysis.

Chapter III: Design and Methodology

In Chapter 2, existing literature was reviewed pertaining to the study of mobile applications and their impact on note and rhythm reinforcement in private piano lessons. In Chapter 3, an overview of the design and methodology used to answer the question, “In what ways do piano teachers use mobile applications to reinforce note and rhythm concepts in private piano lessons, and do they find them effective or not?” will be outlined and explained. This chapter is divided into six sections: 1) An overview of the
process used to complete this study, 2) An overview of the participants and materials that contributed to this study, 3) An overview of a mixed-methods approach and why this approach was chosen for the study, 4) A presentation of how bias affected the research, 5) An overview of the procedures used and how data was collected, and 6) A brief synopsis regarding how the data was analyzed.

**Process**

This study surveyed several piano teachers requesting information regarding their use of mobile applications in their private teaching studio. To accomplish this survey, three prominent Facebook piano pedagogy forums were solicited in order to poll a wide population of the piano teaching community. An overview of the study, a proposal, and a survey link were posted to each forum page. Forty-three (n=43) anonymous teachers volunteered to take the survey. Each teacher was required to read an Informed Consent Statement that outlined the purpose of the study, the anonymity of data, and the researcher’s contact information in case participants had questions or concerns regarding the study (see Appendix A). The survey contained seven questions for participants to answer. The responses were collected over a six-week period.

**Participants and Materials**

The participants were selected using voluntary response sampling. This type of sampling was beneficial for this project since it is based strictly on voluntary participation and facilitates gathering responses from many people (McCombs, 2020). The various participants volunteered to take the survey of their own free will; there was no selection process implemented. The survey did not ask identifying information about
participants’ age, race, or gender. The only qualification needed to take the survey was prior piano teaching experience.

Qualtrics, an online survey generator, was used to create an anonymous survey link for this study. An announcement of the proposed research was posted along with the survey link to three prominent Facebook piano pedagogy forums: *The Art of Piano Pedagogy, Piano Teacher Central,* and the *iPad Piano Teachers Group.* A post was created for each group page giving a brief synopsis of the researcher’s background, the purpose of the survey, and a request for participants to take the survey (see Appendix B). Participants were required to read an Informed Consent Statement prior to starting the survey. This document outlined the anonymity of participant information, avoidance of risk, and the participant’s ability to exit the survey at any time. The survey included seven questions, five of which asked participants to respond using a Likert-type scale (of 1-10), while two required short answer responses (see Appendix C). The survey was estimated to take no more than 5 minutes to complete, and participants were able to complete the survey at their convenience.

**Mixed Methods Approach**

This study used a mixed-methods research approach to gain information regarding how piano instructors use mobile applications to reinforce note and rhythm comprehension in their private piano studios. Creswell defines mixed-methods research as, “a methodology for conducting research that involves collecting, analyzing, and integrating quantitative and qualitative research in a single study or a longitudinal program of inquiry” (2007). Using a mixed-methods approach for this study allowed collected data to be analyzed from two different angles. The quantitative method
formulated a framework of the data that was informed by percentage and frequency. The qualitative method elucidated a better understanding of the “why” behind the quantitative data by providing more detailed information regarding the numerical data. The analysis section below will provide more detailed information regarding the mixed-methods format and the analysis process.

**Bias**

When conducting any type of research, preconceived biases must be set aside before collecting data for the project. The meaning of bias can be “any tendency which prevents unprejudiced consideration of a question” (Charmaz, 2014). Data must be allowed to speak for itself, especially in the area of research. Often researchers are unaware of the bias they bring to a study, and inevitably bias will be found in every research study conducted. Researchers should try to avoid bias as much as possible, since bias can affect how a researcher perceives collected data. Charmaz (2014) states, “Preconceptions that emanate from such standpoints as class, race, gender, age, embodiment, and historical era may permeate an analysis without the researcher’s awareness” (2014). Researchers, therefore, must be careful to guard against imposing biases both consciously and unconsciously when conducting research. Before addressing the procedures and data collection process used for this study, underlying biases will be acknowledged.

Before beginning this project, I had a general idea of how using mobile applications in private piano lessons could be beneficial in reinforcing note reading and rhythm concepts for piano students. I taught private piano lessons in the past and used mobile applications to reinforce note and rhythm reading on the grand staff. I
observed that digital applications encouraged students to engage with a game or visual activity and pay closer attention during lessons. I also found that retention of notes and rhythm concepts was higher for students who engaged in note reading and rhythm recognition when using smartphone and tablet applications. In the following section, the process used to gather data for this study will be presented and discussed.

**Procedures and Data Collection**

In order to begin the data collection process, a decision regarding which piano pedagogy Facebook groups to post the survey to had to be made. The primary researcher has been a member of *The Art of Piano Pedagogy*, *Piano Teacher Central*, and the *iPad Piano Teachers* for almost six years, and during that time has been able observe the comments and discussion generated by each group and the content that pertained to the field of piano pedagogy. Since each group garnered a large membership of over 5,000 active piano teachers, this provided a substantial pool for potential survey participants.

The survey questions were influenced by the mixed methods approach used for this project. Both qualitative and quantitative questions were included in the survey. These questions consisted of short answer and Likert-type scale questions, which required the participant to select an answer based on a 1-10 scaling system (see Appendix C). Simple questions were asked pertinent to the foundational research questions posited in Chapter 1. Questions were piloted by three faculty members at the University of Wisconsin Stevens Point.

Once the survey questions were complete, a post was made to each of the selected piano pedagogy Facebook groups requesting piano teachers to take the survey. The post (see Appendix B) consisted of a brief synopsis explaining the researcher’s
background, reasons why the survey was being conducted, and a general request for
volunteers to take the survey. The post included a statement stating that the survey was
completely voluntary, anonymous, and would only take 5 minutes of the participants’
time to complete. A survey link was attached to the end of the Facebook post that would
take participants directly to the survey.

Six weeks was allowed for data collection. The initial survey was posted online
June 15, 2020 and was closed July 27, 2020. Preliminary data analysis began at the onset
of data collection. The goal was to study the data and begin sorting it into different
coding systems (see the analysis section below). The next section will outline the analysis
process as it pertained to this study.

Analysis

The data analysis plan for this study included using a mixed methods model
(specifically, the Triangulation Validating Quantitative Data model) to gather information
for this project, and a coding system to analyze data and categorize findings. This final
section of Chapter 3 will provide a definition and overview of the Triangulation
Validating Quantitative Data model, why this method was chosen for this project, a
definition and overview of coding, and the specific coding system developed in order to
analyze the data gathered from the piano teacher survey.

There are many mixed-method models that could be used to facilitate a mixed
methods research study. This current study used the Triangulation Validating
Quantitative Data model to analyze data collected by the piano teacher survey. The
Triangulation model analyzes information from both a quantitative and qualitative angle
and combines the information from each angle to build a holistic understanding of
gathered data. A specific subset of the Triangulation model is the Validating Quantitative Data model which allows the researcher, “to evaluate and expand on the quantitative findings from a survey by including a few open-ended qualitative questions” (Creswell, 2006). This study’s survey used quantitative and qualitative questions to gather data. Instead of making both sets of questions equal, the qualitative data results helped inform the quantitative data results. The decision to use the Validating Quantitative Data model for this project allowed examination of the participant’s reasonings for using (or not using) mobile music applications for reinforcing note and rhythm concepts in their studios. This model provided better insight into the numerical statistics derived from the data along with explanations as to the reason teachers have found mobile applications to be helpful in their teaching.

After using the Validating Quantitative Data model to gather data for this study, an analysis of both the quantitative and qualitative data was conducted by using a system called coding. Kathy Charmaz (2014) defines coding as, “naming segments of data with a label that simultaneously categorizes, summarizes, and accounts for each piece of data. Coding is the final step in moving beyond concrete statements in the data to making analytic interpretations” (2014).

Researchers can use coding in several ways to separate the data and make sense of the collected information. Before commencing the coding of this project, all survey responses were examined while some were eliminated that had not provided any information on the survey form. Once accomplished, the researcher examined data compilation errors while accounting for any questions improperly filled out by participants. After completing this review, the coding process began. The quantitative
data was divided into percentages to reflect how many teachers used apps, how many teachers did not use apps, and how many teachers found apps helpful in their teaching. Next, the qualitative data was analyzed to determine why teachers do not use mobile applications in their teaching. This data was broken into categories and labeled. Once the data was coded, the findings of the data were summarized. These findings will be presented in Chapter 4.

**Conclusion**

In Chapter 3, an explanation was given regarding the methodology and data collection process used to gather data for this current study. An overview of the process, participants, materials, research method, bias, procedures, and analysis process were presented, defined, and discussed. The mixed method research model employed in this study, the Triangulation Validating Quantitative Data Model, was defined, and explanation was given as to how it was implemented into the study. The coding process and specific steps taken to analyze the data were explained as well. In Chapter 4, the findings from the study will be presented and discussed.

**Chapter IV: Findings**

The purpose of this study has been to analyze the impact mobile applications have on the reinforcement of note and rhythm concepts in private piano lessons. In the last chapter, an overview of the methodology and design of this study was provided, including the methods used to analyze the data, the design of the survey, and an overview of the Triangulation Validating Quantitative Data Model. In Chapter 4, the findings from the survey data will be presented and a detailed explanation of how the data was analyzed
and coded will be explained. This study’s foundation is grounded upon the three main research questions presented in Chapter 1:

1) Do piano teachers use mobile applications to reinforce note and rhythm concepts in their private teaching?

2) Have piano teachers found mobile applications to be a useful tool for the reinforcement of note and rhythm concepts in their private teaching?

3) If piano teachers do not use mobile applications to reinforce note and rhythm concepts in their private teaching, what are their reasons for not doing so?

These research questions serve as the basis for data analysis, and this chapter includes three separate sections for discussion: 1) An overview of the research methodology, 2) An analysis of the quantitative data results, and 3) An analysis of the qualitative data results.

An Overview of the Research Methodology

In order to conduct this study, an anonymous online survey link was created and posted to three prominent piano pedagogy forums via the social media platform, Facebook. Data was collected for the analyzation process after the initial survey was posted for 6 weeks. Overall, 43 responses (n=43) were gleaned from the data. Out of the 43, 10 either did not accept the Informed Consent Document provided at the beginning of the survey or choose not to answer any survey questions. Therefore, the remaining 33 responses were used for analysis.

To review from Chapter 3, the questions asked on the survey specifically reflected the Triangulation Validating Quantitative Data Model. This model follows the Triangulation Mixed Methods approach which uses both quantitative and qualitative
questions to analyze data. However, the Triangulation Validating Quantitative Data Model differs from the classic mixed methods approach in that the collected qualitative data serves to better understand the quantitative data (Creswell, 2009). The piano teacher survey consisted of both quantitative and qualitative questions. Seven questions were used for data collection. Five of the seven questions were quantitative questions and two were qualitative. Both of the qualitative questions were used to better understand the data gathered from Question 2, “Do you currently use smartphone and tablet applications in your lessons to reinforce note reading and rhythm identification?” and had respondents give their answers in a short answer format. The quantitative questions allowed respondents to choose their answers using a Likert-type scale. The five-point scale ranges from one to five, with one indicating extremely likely or effective and five indicating extremely unlikely or ineffective. See Figure 1.
A STUDY OF MOBILE APPLICATIONS IN THE PIANO TEACHING STUDIO

Figure 1

Likert Scaling System

Based on this scaling system, a wide range of responses were analyzed and categorized into various data sets. These data sets helped inform the answers to the research questions posited in Chapter 1. The following sections of this chapter will detail the data that was gleaned from each survey question and how the data was analyzed based on the Validating Quantitative Data Model.

The Quantitative Data Results

Quantitative data analysis entailed calculating the frequency and percentage of participants’ selections for the Likert-type questions. This section will give an overview of the process used to analyze the quantitative data results and a detailed description of the findings procured from each quantitative survey question.
To calculate the data and demonstrate the frequency of occurrence for the Likert-type questions, the number of responses for each inquiry were tabulated. For example, the second survey question elicited responses from 32 participants (n=32), which included 27 participants selecting choice “Yes,” and five participants selecting choice “No”. See Table 1.

**Table 1**

*Question 2 Frequencies*

<table>
<thead>
<tr>
<th>Do you currently use smartphone and/or tablet applications in your lessons to reinforce note reading and rhythm identification?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>N Valid</td>
<td>27</td>
<td>5</td>
</tr>
</tbody>
</table>

After calculating the frequency of responses for each survey question, the percentage of participants that selected each option from the Likert-type scale was determined. Again, taking Question 2 for example, after the frequency was determined for each answer option (27 selected “Yes” and 5 selected “No”) a percentage was calculated for each Likert-type scale choice option. This percentage was based on the total number of responses given to the question (n=32) and the frequencies calculated (27, 5). Therefore, based on that calculation, 84% of respondents (27) selected “Yes” and 16% of respondents (5) selected “No”. See Table 2.
Next, the researcher combined the percentages of the top two Likert-type scale choices and then replicated the process for the bottom three Likert-type scale options. This was done for each quantitative survey question. For example, each survey question provided five answer choices respondents could choose from. The first two choices and the bottom three choices were similar to each other. For example, the top two choices, “Extremely Likely/Extremely Effective” and “Somewhat Likely/Somewhat Effective” reflected a positive response to the question asked. Conversely, the bottom three Likert scale choices, “Neither Likely Nor Unlikely/Moderately Effective”, “Somewhat Unlikely/Somewhat Effective”, and “Extremely Unlikely/Not Effective At All” reflected a negative response to the question asked. Using this order as a guideline, the percentages in each group were added together to produce a joint percentage for each Likert scale group. In Question 4, for example, the percentages of the top two Likert-type scale tiers were 64% for “Extremely Likely” and 21% for “Somewhat Likely”. Combined, the percentage of both tiers became 85%. Likewise, after adding the individual percentages together, the combined percentage for the bottom three tiers was 15%. This grouping of

---

**Table 2**

*Percentages for Answer “Yes” and “No”*

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid Yes</td>
<td>27 84.3</td>
</tr>
<tr>
<td>Total</td>
<td>32 100.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid No</td>
<td>5 15.6</td>
</tr>
<tr>
<td>Total</td>
<td>32 100.0</td>
</tr>
</tbody>
</table>
percentages allowed for larger data comparison between each quantitative question. See Table 3.

**Table 3**

*Combined Percentages*

<table>
<thead>
<tr>
<th></th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extremely likely</td>
<td>63.6</td>
<td></td>
</tr>
<tr>
<td>Somewhat likely</td>
<td>21.2</td>
<td>84.8</td>
</tr>
<tr>
<td>Somewhat unlikely</td>
<td>6.1</td>
<td></td>
</tr>
<tr>
<td>Extremely unlikely</td>
<td>9.1</td>
<td>15.2</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

To conclude, frequencies and percentages were used to analyze the quantitative data responses gathered from this survey. Using the above analysis tools, the remainder of this section will outline the data findings for each quantitative survey question. Attention will be given to the frequencies and percentages found for each question. Charts and graphs will be used to provide a visual understanding of the findings.

**Question 2: Do you currently use smartphone and/or tablet applications in your lessons to reinforce note reading and rhythm identification?**

Participants were only allowed to select “Yes” or “No” for this question. 32 (n=32) participants gave a response. The frequency of data yielded 27 responses for choice “Yes” and 5 responses for choice “No.” Therefore, 84% of participating teachers choose choice “Yes,” affirming they currently use technology in their private teaching to reinforce note and rhythm concepts, and 12% of teachers stated they do not currently use technology to reinforce note and rhythm concepts in their private teaching. The qualitative questions (see Qualitative Data Results below) provide a better understanding
of the data from Question 2 and will be explained in depth in the next section of this chapter. See Table 4.

**Table 4**

*Question 2 Frequencies and Percentages*

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid Yes</td>
<td>27 84.3</td>
</tr>
<tr>
<td>Total</td>
<td>32 100.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid No</td>
<td>5 15.6</td>
</tr>
<tr>
<td>Total</td>
<td>32 100.0</td>
</tr>
</tbody>
</table>

*Question 4: Using the scaling system below, how likely are you to use smartphone and/or tablet applications to reinforce note and rhythm concepts for beginning piano students?*

The Likert scale choices for this question included “Extremely Likely,” “Somewhat Likely,” “Neither Likely nor Unlikely,” “Somewhat Unlikely,” and “Extremely Unlikely.” 33 responses (n=33) were provided for this question. The frequency of data yielded 21 for “Extremely Likely” (64%), 7 for “Somewhat Likely” (21%), 2 for “Somewhat Unlikely” (6%), 3 for “Extremely Unlikely” (9%), and 0 responses were given for “Neither Likely nor Unlikely.” When the percentages for “Extremely Likely” and “Somewhat Likely” were combined, it was found that 85% of teachers used smartphone and tablet applications in their lessons to reinforce note and rhythm concepts. When the percentages for “Somewhat Unlikely” and “Extremely Unlikely” were combined, it was found that 15% of teachers are not likely to use
smartphone and tablet applications to reinforce note and rhythm concepts in their private lessons. See Table 5 and Figure 2.

**Table 5**

*Question 4 Frequencies and Percentages*

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td>21</td>
<td>63.6</td>
</tr>
<tr>
<td>Extremely likely</td>
<td></td>
<td>85%</td>
</tr>
<tr>
<td>Somewhat likely</td>
<td>7</td>
<td>21.2</td>
</tr>
<tr>
<td>Somewhat unlikely</td>
<td>2</td>
<td>6.1</td>
</tr>
<tr>
<td>Extremely unlikely</td>
<td>3</td>
<td>9.1</td>
</tr>
<tr>
<td>Total</td>
<td>33</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>43</td>
<td>100.0</td>
</tr>
</tbody>
</table>

**Figure 2**

*Frequencies and Percentages Bar Graph*

*Question 6: Using the scaling system below, how effective have you found smartphone and/or tablet applications to be at reinforcing note and rhythm skills in your lessons?*
The Likert scale choices for this question included “Extremely Effective,” “Very Effective,” “Moderately Effective,” “Slightly Effective,” and “Not at All Effective.” 31 (n=31) responses were provided for this question. The frequency of data yielded 13 for “Extremely Effective” (42%), 7 for “Very Effective” (22.5%), 7 for “Moderately Effective” (22.5%), 4 for “Not at All Effective” (13%), and 0 responses for “Slightly Effective.” After combining the percentages for “Extremely Effective” and “Very Effective,” it was found that 87% of teachers have found smartphone and/or tablet applications to be effective at reinforcing note and rhythm skills in lessons. After combining the percentages for “Moderately Effective” and “Not at All Effective,” it was found that 13% of teachers have not found smartphone and/or tablet applications to be effective when reinforcing note and rhythm concepts in piano lessons. See Table 6 and Figure 3.

**Table 6**

*Question 6 Frequencies and Percentages*

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Valid</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extremely effective</td>
<td>13</td>
<td>41.9</td>
</tr>
<tr>
<td>Very effective</td>
<td>7</td>
<td>22.6</td>
</tr>
<tr>
<td>Moderately effective</td>
<td>7</td>
<td>22.6</td>
</tr>
<tr>
<td>Not effective at all</td>
<td>4</td>
<td>12.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>31</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>43</td>
<td>100.0</td>
</tr>
</tbody>
</table>

87%

13%
Question 7: Using the scaling system below, how effective have you found smartphone and/or tablet applications at keeping a student’s attention span during a lesson?

The Likert scale choices for this question included “Extremely Effective,” “Very Effective,” “Moderately Effective,” “Slightly Effective,” and “Not Effective at All.” 31 (n=31) responses were provided for this question. The data frequency yielded 11 for “Extremely Effective” (35%), 6 for “Very Effective” (45%), 3 for “Moderately Effective” (10%), and 3 for “Not Effective at All” (10%). Combined, the percentages for “Extremely Effective” and “Very Effective” showed 80% of teachers have found smartphone and tablet applications to be effective at keeping a student’s attention span during lessons. Conversely, the combined percentages of “Moderately Effective” and “Not Effective at All” show 20% of teachers have not found smartphone and/or tablet applications effective at keeping a student’s attention span. See Table 7 and Figure 4.
Table 7

*Question 7 Frequencies and Percentages*

<table>
<thead>
<tr>
<th>Valid</th>
<th>Frequency</th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely effective</td>
<td>11</td>
<td>35.5</td>
</tr>
<tr>
<td>Very effective</td>
<td>14</td>
<td>45.2</td>
</tr>
<tr>
<td>Moderately effective</td>
<td>3</td>
<td>9.7</td>
</tr>
<tr>
<td>Not effective at all</td>
<td>3</td>
<td>9.7</td>
</tr>
<tr>
<td>Total</td>
<td>31</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Total | 43        | 100.0         |

Figure 4

*Frequencies and Percentages Bar Graph*

*Question 8: Using the scaling system below, how important do you think it is for you, a piano teacher, to keep up to date with the latest smartphone and/or tablet technology that complements teaching piano?*
A STUDY OF MOBILE APPLICATIONS IN THE PIANO TEACHING STUDIO

The Likert scale choices for this question included “Extremely Important,” “Very Important,” “Moderately Important,” “Slightly Important,” and “Not Important at All.” 28 responses (n=28) were given for this question. The data frequency yielded 18 for “Extremely Important” (56%), 6 for “Very Important” (19%), 4 for “Moderately Important” (13%), 2 for “Slightly Important” (6%), and 2 for “Not at All Important” (6%). Combined, the percentages of the “Extremely Important” and “Very Important” Likert tiers showed 75% of teachers were in favor of staying up to date with new pedagogical technology improvements. Conversely, the combined responses of the “Moderately Important,” “Slightly Important,” and “Not at All Important” Likert scale tiers showed 25% of teachers do not have much interest in staying current with the latest pedagogical technology in the piano teaching field. See Table 8 and Figure 5.

**Table 8**

*Question 8 Frequencies and Percentages*

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extremely important</td>
<td>18</td>
<td>56.3</td>
</tr>
<tr>
<td>Very important</td>
<td>6</td>
<td>18.8</td>
</tr>
<tr>
<td>Moderately important</td>
<td>4</td>
<td>12.5</td>
</tr>
<tr>
<td>Slightly important</td>
<td>2</td>
<td>6.3</td>
</tr>
<tr>
<td>Not at all important</td>
<td>2</td>
<td>6.3</td>
</tr>
<tr>
<td>Total</td>
<td>32</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>43</td>
<td>100.0</td>
</tr>
</tbody>
</table>
To conclude, the findings from each quantitative survey question were analyzed and presented. Frequencies, percentages, and combined percentages were used to analyze and measure the quantitative survey data taken from the piano teacher survey. In the next section, the findings from the qualitative survey questions will be presented which will better inform the data gleaned from Question 2.

The Qualitative Data Results

The second step in analyzing the research data was to examine the qualitative responses and code by measured frequency (phrase by phrase) and tendency (mean, median, and mode). Two qualitative questions were asked on the survey and both served as follow up questions to Questions 2, “Do you currently use smartphone and/or tablet applications in your lessons to reinforce note reading and rhythm identification?” Two different methods were used to analyze Question 3 and Question 5, but the intent of both
analyzation methods was the same: To discover data that would better inform the findings of Question 2 and provide a deeper understanding of why respondents selected either “Yes” or “No” for Question 2. In the following paragraphs, explanation will detail the data analysis process and provide a summary of the findings that were discovered after analysis.

**Question 3: If you selected “No” for Question 1, please briefly explain the reasons why you’ve chosen not to use smartphone and/or tablet applications in your lessons.**

Participants answered this question if they had selected “No” for survey Question 2, “Do you currently use smartphone/tablet applications in your lessons to reinforce note reading and rhythm identification?” 6 responses (n=6) were provided for this question. A specific coding system to analyze each response. First, all the responses were categorized by themes according to the respondent’s reasons for not using smartphone and tablet applications. After labeling each response with an overarching theme (or label), responses were compared with each other in order to discover the frequency of overlapping themes. Four themes were found after the data was analyzed from the six responses: 1) Priorities--teachers placed higher priorities on other activities during the lesson rather than technology; 2) Teachers use technology but not smartphone and/or tablet note reading and rhythm applications in lessons; 3) Inconvenient--teachers find technology to be an inconvenience, therefore they do not use it in lessons; and finally, 4) Lack of Knowledge--teachers have a lack of knowledge when it comes to technology.

The information from the responses to this qualitative question was determined in terms of the mode or frequency each selection generated. Both “Priorities” and “Lack of Knowledge” generated a frequency of 2, while the other two themes, “Teachers use
technology but not smartphone and/or tablet note and rhythm applications” and “Inconvenient” generated a frequency of 1. See Table 9.

**Table 9**

*Frequency and Themes*

<table>
<thead>
<tr>
<th>Uses Technology in the Lesson But Not Smartphone/Tablet Applications</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>I don’t use rhythm drill-type apps. However, I use SuperScore Music and Home Concert Xtreme with pieces that have MIDI backing tracks. These backing tracks are extremely effective in working out rhythm issues.</td>
<td>1</td>
</tr>
<tr>
<td>I have not done enough research on what apps to use and often run out of time in lessons anyway so I have not been looking for new resources for lessons.</td>
<td>1</td>
</tr>
<tr>
<td>I use the iPad and apps semi regularly. But with Covid it makes using them hard as I don’t want to have to disinfect another object between lessons.</td>
<td>1</td>
</tr>
<tr>
<td>Kids are already screen dead and I am not adding anymore to their online madness</td>
<td>1</td>
</tr>
<tr>
<td>lack of knowledge about apps to use; not comfortable with technology.</td>
<td>1</td>
</tr>
<tr>
<td>Time in the lesson is valuable. I see them only once a week. They can use their tablets or smart phones at home. I make use of every minute to interact with the student.</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total Frequencies</strong></td>
<td><strong>6</strong></td>
</tr>
</tbody>
</table>

**Question 5:** If you answered “Yes” to Question 1, please list the piano levels that you often engage with smartphone and/or tablet technology (i.e., beginner, intermediate, advanced, etc.).
Question 5 was a follow-up question for participants who selected “Yes” for survey Question 2. The purpose of asking this question was to determine the age range and playing levels teachers primarily use mobile applications to reinforce note and rhythm concepts in their private teaching. 27 participants (n=27) responded to this question. To begin the analysis process, each response was identified and categorized into three groups by using a numbering system: #1= Teachers who listed “Beginners and Intermediates”, #2= Teachers who listed “All Levels”, and #3= Teachers who listed only “Beginners”. After numbering the data, the numbers were color-coded to make calculating each data percentage easier. The color Blue was assigned to #1, Orange was assigned to #2, and Yellow was assigned to #3. The data yielded frequencies of 11 for blue, 11 for orange, and 5 for yellow. Interestingly, the percentages were equal between participants who wrote down “Beginners and Intermediates” and “All Levels.” Both of these responses produced an equal percentage of 41%. Only 18% of participants (Frequency= 5) selected just “Beginners” for their response. The top two percentages were combined to find that 82% of participants use smartphone and tablet applications to teach note and rhythm concepts to all levels of students, while 18% prefer to use smartphone and tablet technology to reinforce note and rhythm learning with just beginning students. See Table 10.
Table 10

*Question 5, Frequencies and Percentages*

<table>
<thead>
<tr>
<th>Assigned Number &amp; Color</th>
<th>Frequency</th>
<th>Valid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beginner and intermediate</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Beginner, Intermediate</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Elementary to late elementary, early intermediate</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Beginner to Intermediate</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Beginner through Intermediate</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Beginner to Early Intermediate</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>All Levels</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Beginner, Intermediate, Advanced</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>K through College</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3rd graders up through adult</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Beginner</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Most younger students are introduced to Piano Maestro and Note Rush</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Beginner, late beginner</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td></td>
</tr>
</tbody>
</table>

To summarize this section, the responses for both qualitative Questions 3 & 5 help inform the “Yes” and “No” responses given for quantitative Question 2. Coding was used to analyze the data from both questions along with frequency, percentages, and labels. Question 3 presented a better understanding of the “No” responses to Question 2. This data from Question 3 was analyzed using labels, frequencies, and percentages.
Question 5 presented a better understanding of the “Yes” responses to Question 2. The data from Question 5 was analyzed using a numbering and coloring system, frequencies, and percentages. In Chapter 5, attention will be given to the results of the qualitative data and the specific themes that emerged after analyzation.

**Conclusion**

This chapter presented the quantitative and qualitative data findings from the piano teacher survey and detailed the processes used for analyzation. A brief review was provided regarding the Validating Quantitative Data Model, and explanation of how the quantitative and qualitative data was measured and analyzed was provided in detail. The quantitative data taken from Questions 2, 4, 6, 7, and 8 showed that on average, 80% of piano teachers actively use mobile applications in their private teaching to reinforce note and rhythm concepts for their piano students. Likewise, 20% of teachers either do not use technology in their teaching or have not found it to be extremely beneficial in regard to reinforcing note and rhythm concepts in their lessons. The qualitative data, taken from Questions 3 & 5 provided a better understanding of why teachers do no use or choose to use mobile applications to reinforce note and rhythm concepts. There were 6 responses provided for Question 3, and were categorized into themes: 1) Priorities, 2) Lack of knowledge, 3) Use of technology in the lesson but not smartphone or tablet applications, and 4) Inconvenience. The data provided by Question 5 was coded using a color and numbering system. Research data revealed that the majority of teachers that do reinforce note and rhythm concepts using mobile technology do so with students of all playing levels (beginner-advanced) and all ages.
Using the above findings as a launchpad, Chapter 5 will discuss the main themes discovered from the data and implications will be made regarding how the uncovered data impacts the world of piano pedagogy.

**Chapter V: Discussion, Implications, and Conclusion**

This study has analyzed the use of mobile applications in reinforcing note and rhythm concepts in the private piano lesson. Chapter 1 explained the importance of this study, provided reasons why the researcher chose to focus on this topic area, and defined important terminology. Chapter 2 established an overview of the research already completed in the field of music technology. The benefits of music technology, discernment needed when using it, and the relevant studies related to the teaching of music concepts using music technology were outlined and key writings associated with these categories were analyzed and discussed. Chapter 3 discussed the methodology used for this study and the processes used to gather and analyze data. Finally, Chapter 4 presented this study’s findings to the reader.

In Chapter 5, the various themes discovered during the analysis of quantitative and qualitative data will be discussed. Four themes were discovered after analyzing the data: 1) A large majority of piano teachers use mobile applications to reinforce note reading and rhythm concepts in their lessons; 2) Not all piano teachers who use mobile applications in their teaching find it necessary to keep up-to-date with the latest advancements in mobile technology as it pertains to music education; 3) Some piano teachers are still resistant to using mobile applications in their teaching; 4) Piano teachers are very diversified regarding the usefulness of mobile applications in their teaching experiences. Chapter 5 will provide an explanation of these themes, how they correspond
with related findings discussed in previous chapters, and the implications this research data has for the field of music education and piano pedagogy both in the current moment and with an eye towards the future.

**An Overview of the Collected Data**

The piano teacher survey yielded a plethora of data. Overall, 84.3% of participants selected “Yes” for Question 2 “Do you currently use smartphone and/or tablet applications in your lessons to reinforce note reading and rhythm identification?”, while 15.6% of participants selected “No”. This data showcases a high percentage of piano teachers that use mobile applications in their teaching. Amongst the teachers surveyed who affirmed their use of mobile applications to teach music concepts to their students, the reasons given for using the technology and keeping up to date with technology were very diverse. Many piano teachers had differing opinions regarding mobile technology’s effectiveness at keeping the students engaged during the lesson, the benefits of using mobile technology to teach note and rhythm concepts, and the need to stay informed regarding upgrades and new innovations made in the mobile application world. For those who choose to not use mobile applications in their teaching, several reasons were given. Most teachers cited either not having broad knowledge of note and rhythm mobile applications or not feeling the need to make mobile applications a priority in the lesson. For other teachers, the inconvenience of technology and the use of other technologies (such as computer programs and MIDI programs) contributed to a low or non-existent use of mobile applications in their teaching.

Analyses of the data revealed four major themes that contribute to the field of music education and piano pedagogy. Each theme will be discussed and supply evidence
from the research presented in previous chapters to help elucidate the discussion. The conclusion of this chapter will provide implications that may be useful for piano teachers and indicate possible opportunities for future research.

**Theme 1: The majority of piano teachers surveyed use mobile applications to reinforce note reading and rhythm concepts in their lessons.**

As discussed in Chapter 2 of this study, Waddell (2019) discovered that music technology was an effective tool, which could help teachers introduce and reinforce new music concepts in their private music lessons. Likewise, the results from this current study’s survey data confirm that technology, specifically mobile application technology, has gained much popularity amongst piano teachers. 84% of piano teachers claim they use mobile applications to introduce and reinforce note reading and rhythm concepts in their private lessons. The following survey questions reflect high percentages of teachers that affirm their use of mobile applications to reinforce note and rhythm concepts for students. Evidence for this will be presented below.

Survey Question 2 required participants to answer with either a “Yes” or “No” response when asked, “Do you currently use smartphone and/or tablet applications in your lessons to reinforce note reading and rhythm identification?” Out of the 33 participants that responded to this question, 84.3% selected “Yes” and 15.6% selected “No.” These results showcase a high percentage of teachers that use smartphone and tablet applications to some extent in their lessons, which is supported by existing research conducted by Cremata (2016), Kassner (2006), and Riley (2013), all discussed in Chapter 2. These studies analyzed the benefits music technology can have for teachers and
students if used to support student engagement both in the lesson and in the student's practice space.

Survey question 4 asked participants, “How likely are you to use smartphone and/or tablet applications to reinforce note and rhythm concepts for beginning piano students?” This question resulted in similar results compared to Question 2. Overall, 85% of respondents selected “Extremely or Somewhat Likely” and 15% of respondents selected “Somewhat or Extremely Unlikely.” The data from Questions 2 and 4 suggest that not only do a large majority of teachers use mobile applications in their lessons to reinforce note and rhythm concepts, but they use this technology primarily when working with beginning piano students. Further in the survey, Question 5 revealed that out of the 27 participants that gave a short answer response to the question “Please list the piano levels that you often engage with smartphone and/or tablet technology (i.e., beginner, intermediate, advanced, etc.),” all 27 affirmed they most often use mobile applications to reinforce note and rhythm concepts when teaching beginning students. Consequently, these applications are popular tools that piano teachers use when teaching music concepts, but they are most often used when working with beginning piano students.

Survey question 6, “How effective have you found smartphone and/or tablet applications to be at reinforcing note and rhythm skills in your lessons?”, also shows a high percentage of respondents that have found technology to be a useful tool in reinforcing essential music skills. 87% of respondents selected “Extremely and Very Effective” for this question, while only 13% selected “Moderately or Not at All Effective.” These numbers are made clearer when paired with results from Questions 2
and 4. Since 85% of teachers use smartphone and tablet applications in their teaching, it is understandable that they would perceive this technology to be beneficial and effective.

Survey Question 7, “How effective have you found smartphone and/or tablet applications at keeping a student’s attention span during a lesson?” also provides evidence that the majority of piano teachers use smartphone and tablet applications to reinforce note and rhythm concepts in their private teaching. 80% of teachers responded with “Extremely and Very Effective” while 20% responded with “Moderately and Not at All Effective.” The percentage given for “Extremely and Very Effective” (although slightly lower when compared to the percentages found for Questions 2, 4, and 6) still reflects a high percentage of piano teachers that use mobile applications in their teaching.

Mobile application use has grown popular amongst piano teachers. For myself, mobile applications are tools I use frequently in my studio when reinforcing note and rhythm concepts for students. Other colleagues in my field also use mobile applications for the same purposes. This technology is useful for three reasons: 1) It allows teachers the flexibility to teach note and rhythm concepts at each student’s music level and learning pace. Some students may not be ready for more advanced concepts or have not had the opportunity to learn them yet. With mobile technology, the teacher can tailor note and rhythm activities to the student’s individual learning needs and musical abilities and progressively increase the difficulty of the same activities in the future. 2) Mobile applications are convenient for using lesson time efficiently. Often at the end of a piano lesson, I will find myself with a few unplanned, extra minutes that are not long enough to engage the student in a physical game or a theory activity. However, with mobile application technology I can pull out my phone, open the application, and allow the
students to play a note or rhythm game until the lesson is completed. This allows the lesson time to be used efficiently and engages the student in an activity that is fun and rewarding. 3) Finally, mobile applications allow the teacher to assign “away from the piano” activities for students to practice at home. Sending a theory worksheet home for practice reinforcement has benefit, but often students either forget to complete it or it gets misplaced. Smartphone and tablet applications live in one spot on a device and can never be lost (unless they are deleted). Additionally, if students do not have access to a physical piano, they can use mobile applications to work on theory, note reading, or aural skills activities and continue to cultivate their understanding and love for music.

Overall, Theme 1 suggests that a large majority of piano teachers use mobile applications in their private teaching to reinforce note and rhythm concepts for their students. Survey questions 2, 4, 6, and 7 from the piano teacher survey provide evidence that supports this theme. Incorporating mobile applications into the piano teaching toolbox allows teachers to teach at the students learning pace and musical ability, allow the teacher to use extra lesson time efficiently, and allows teachers to assign at home practice activities for the student.

*Theme 2: Not all teachers who use mobile applications find it necessary to keep up to date with the latest technological advances in piano pedagogy.*

A discovery from the piano teacher survey data revealed that although 85% of piano teachers use mobile applications in their teaching, 25% don’t feel the need to keep current with the latest mobile application advancements in the music education field. Question 8 from the survey asked respondents to select the best response that most accurately reflected their conviction regarding keeping up to date with piano teaching
technology. 75% of teachers responded with “Extremely and Very Important”, while 25% responded with “Moderately, Slightly, and Not at All Important.” These numbers were not expected when compared with the high percentage of teachers who use mobile technology in their teaching (85%, see Theme 1).

These data findings reflect an attitude a large majority of piano teachers have towards music education technology. For many teachers, they see technology as a useful tool, but not as a total replacement for other means of music learning. Chapter 2 of this study explained why many teachers may view technology in this manner. Lum (2017) and Waldron (2017) agree that technology should not stifle hands on interaction with music and also that technology should be used to present new information in a way that will help students better understand the concepts. Lum (2017) believes that technology should not be a replacement for physical interaction with musical instruments and concepts. He summarizes that although technology is useful, it can never be used in place of a total sensory learning approach. Lum also advocates for a balance between the use of technology and the physical interaction with instruments and music concepts in private music lessons (Lum, 2017, p. 52). Similarly, Waldron (2017) suggests that technology should be implemented in the lesson in a meaningful way for effective student engagement. His belief is that strategic implementation of technology in the lesson is much better than using technology simply for the technology’s sake. This strategic mindset allows teachers to communicate music concepts clearly and effectively and helps students engage with musical concepts in a productive way (Waldron, 2017).

Based on Lum and Waldron’s assessments of technology and factors to consider before implementing technology in private music lessons, the high percentage of teachers
who do not stay up to date with the latest mobile application technology updates are better understood. This research implies that using a slightly dated version of teaching technology might be a more effective way to communicate music concepts to students. If this is the case, the need to update technology may be of less importance to music educators. A second reason teachers may choose to not to keep current with teaching technology is the time and money expense it takes to research and purchase technology. Learning how to use new mobile applications and mobile application updates takes time and sometimes requires a financial investment in order to learn the value of these new applications. It also takes time to become familiar with newer technologies, which makes keeping the older technology around much easier to understand. Teachers should remember that technology should not be used just for technology’s sake. Technology should be viewed as a tool that has potential to enhance the teaching experience if implemented appropriately.

In my own experience, I have found mobile applications to be very useful in reinforcing note reading and rhythm concepts for students. However, as a teacher, I realize that using applications to reinforce these essential music concepts may not be the best fit for my students. For some students, utilizing note reading flashcards (something they can see in person, touch, and experience aurally on the keyboard) may be the best way to learn to read music notes. Likewise, learning rhythms with something as simple as a plastic cup or requiring students to physically clap rhythms while counting out loud may be just as effective as having them tap the rhythm on a smartphone app. The teacher must be aware of the student’s learning needs and provide resources that most effectively communicate information for the student’s learning benefit.
All that said, however, technology is continuously being created, improved, and updated. Preexisting music applications are updated regularly, and new mobile applications are born each year to aid teachers and students alike. The music educator should have a working knowledge of which new applications are being created and what updates are being made to preexisting applications. This working knowledge allows the teacher to better understand what tools and resources are available to effectively communicate music concepts to students. When teachers have knowledge of what teaching tools are available to them, they are better prepared to equip their students for success.

In the next section, Theme 3 will elucidate the reasons why many piano teachers are still resistant to using mobile applications in their private teaching space.

**Theme 3: Some piano teachers are still resistant to using mobile applications in their teaching.**

Despite the high percentage of teachers who likely use mobile applications in their private piano teaching (85%), there is still a percentage of teachers (15%) who choose to not use technology in their teaching. Question 3 of the piano teacher survey fleshed out the reasons why teachers choose not to use technology in their private piano teaching. After analyzing the responses, four subthemes were found that summarized the attitudes many teachers share when it comes to using mobile applications in reinforcing note and rhythm concepts in the private music lesson. The following paragraphs analyze each theme that resulted from Question 3.

**Priorities.** The analyzation process found that teachers place a higher priority on using other activities to reinforce note and rhythm concepts during the lesson rather than
mobile applications. For example, one respondent stated, “Time in the lesson is valuable. I see [my students] only once a week. They can use their tablet and smartphone at home. I make use of every minute to interact with the student.” Likewise, another respondent stated, “Kids are already screen dead and I am not adding anymore to their online madness.” Both of these statements reveal that these teachers use other teaching methods to teach note reading and rhythm concepts in their piano lessons. These statements also reveal that due to time constraints and outside factors (such as students spending too much time on technology devices), teachers have chosen other methods to reinforce note and rhythm learning in their studios. Therefore, due to the importance of lesson time and in person student/teacher interaction, some piano teachers do not use mobile application technology in their lessons to reinforce note and rhythm concepts.

**Use of technology in the lesson but not mobile applications.** Some teachers advocate teaching note and rhythm concepts with technology; however, they choose to use other music technology mediums, rather than mobile application technologies, to reinforce these concepts. For example, one respondent stated, “I don’t use rhythm drill-type apps [in my teaching]. However, I use SuperScore Music and Home Concert Extreme with pieces that have MIDI backing tracks. These backing tracks are extremely effective in working out rhythm issues.” Even though this individual does not use smartphone or tablet applications to reinforce rhythm for his students, he does use technology as a tool that promotes the learning of these concepts in a beneficial way for both himself and his students. Many teachers find that certain music technologies fit their studio needs better than others. This statement is important primarily because the job as a teacher is to communicate information in a way that is easily accessible and
understandable for the student. It is important for teachers to be discerning when considering the different technologies available that can be supplemented into their teaching regime.

**Inconvenience.** A third reason respondents cited not using mobile applications in their teaching was due to the inconvenience they associated with the technology. For example, a respondent stated, “I use the iPad and apps semi regularly. But with Covid-19 it makes using them hard as I don’t want to have to disinfect another object between lessons.” Since the start of the Covid-19 outbreak, many teachers have been forced to find creative ways to teach their students safely from either a distance (virtual teaching) or from their studios. For these teachers, using smartphone and tablet application technology has become either a functional tool or an inconvenience they could do without. For example, since long distance teachers are no longer teaching in-person, using mobile applications may be cumbersome and harder to manipulate during the lesson due to the teacher and student not being together in-person, and potential technical issues that could arise from their internet connection. For in-person teaching, the need to sanitize surfaces (including smartphones and tablet surfaces) becomes inconvenient, and the risk of spreading germs is higher. Another reason teachers find mobile technology to be an inconvenient option for their studio is that they are not familiar enough with technology and do not feel comfortable using the technology with ease. Because of these reasons, several piano teachers choose not to use mobile applications in their lessons. However, not researching smartphone and tablet technologies may close some avenues that could be very helpful in teaching specific music concepts to students. As a teacher, it
is beneficial to view technology as an option that could be explored for their teaching space.

**Lack of Knowledge.** Teachers expressed a lack of knowledge when it comes to using smartphone and tablet applications in their private teaching. For example, one respondent stated, “I have not done enough research on what apps to use and often run out of time in lessons….so I have not been looking for new resources for lessons.”

Likewise, a second respondent stated he does not use applications in lessons due to, “lack of knowledge about apps to use; not comfortable with technology.” This reason may be the most prevalent amongst teachers who choose not to use mobile applications in their teaching. For most teachers, familiarity with a particular teaching system or tool is enough to keep them from researching new ways to present information to students. For others, the busyness of teaching keeps them from finding new pathways that could benefit learning. Overall, it is important to note how prevalent this mindset it amongst teachers and see it as an additional reason why teachers do not engage with smartphone and tablet applications in their teaching.

Each of these reasons—priorities, use of technology in the lesson but not mobile applications, inconvenience, and lack of knowledge—are all reasons for not using mobile applications in the studio. It is important to note that for some teachers, not using mobile application technologies to reinforce note reading and rhythm concepts for students may be the most beneficial for their studios. However, this does not mean that these technologies could not be beneficial at some level for the vast majority of piano teachers. As noted previously in this chapter, mobile applications are tools that, if implemented into the music lesson appropriately for each student’s learning ability and needs, could
add much benefit to the communication of note and rhythm concepts. It is important that teachers be open to the possibility of using mobile applications, even if they do not meet teachers’ needs at the moment. As a tool, these technologies should be used to bring about a desired end goal, which for this study’s purposes is learning to read music.

To summarize this discussion of Theme 3, “Many teachers choose not to use mobile applications in their teaching,” four reasons were given based on the data from survey Question 5. These themes included, 1) Priorities, 2) Use of technology in the lesson but not mobile applications, 3) Inconvenience, and 4) Lack of Knowledge. Overall, 15% of teachers who responded to the piano teacher survey do not use mobile applications to teach note and rhythm concepts to their students. This section outlined the main reasons why this is the case. For most, not making mobile application technology a priority in the lesson and not having a sufficient knowledge base of the technologies available to them contributes to the lack of mobile application use in private piano lessons. In the next section, Theme 4 will discuss the diversified responses of teachers when asked how useful they have found mobile applications to be in their teaching experiences.

Theme 4: Piano teachers have very diversified responses regarding the usefulness of mobile applications in their teaching experiences.

Overall, a vast majority of piano teachers affirmed that they use mobile applications in their private teaching. Although 84% affirmed this, many are not in agreement regarding the usefulness of mobile applications when applied to note reading and rhythm reinforcement. In fact, the topic of technology’s usefulness in the field of music education has been debated amongst music educators and scholars for some time.
To review, as mentioned in Chapter 2, there are many educators who see the benefits technology has on the teaching and reinforcing of musical concepts in private music lessons. Dumlavwalla (2016) cited a study by R. Cremata and B. Powell (2016) that supported music technology as a positive tool in the retention of musical skills, such as learning music notation. Likewise, Kassner (2006) and Riley (2013) in their studies found that students had a higher retention of rhythm, pitch, music theory, composition, and aural activities when learning these concepts using technology. Another benefit of teaching music concepts with technology is the creative ‘out of the box’ thinking technology affords both music educators and students in the private music lesson. Roger Mantie (2017) further states that technology can provide liberation from monopolies on knowledge and access in music. In other words, technology has the ability to provide more opportunities for students and teachers to explore the world of music. Partti (2017) also considers technology as a benefit to the music education sphere. She summarizes that technology is a tool that can open up new musical worlds in which students (and teachers) can participate. Technology can also be used to motivate students to pursue independent learning. Chen (2017) supports technology’s use in private lessons as it allows students to compose, listen to repertoire, practice aural skills, and record their performances. Overall, Dumlavwalla, Kassner, Riley, and Chen view technology as a beneficial tool that can be used to facilitate the retention of musical skills, the creative process of music learning, and continued student learning outside of the private lesson.

Conversely, Chapter 2 also presented the viewpoint of music educators who advocate the use of discernment when it comes to introducing music technology into the private teaching space. Mantie (2017), Lum (2017), and Waldron (2017), advocate that
music educators should use technology with discernment. Mantie (2017) states that technology should not be used in private teaching simply because it is available. He states that technology should be critically evaluated by both the teacher and student before being implemented into the private lesson. Likewise, Lum (2017) states that technology should not replace interaction with musical instruments and concepts. He states that students need to engage their senses in multiple ways in order for true learning to take place. Lastly, Waldron (2017) states that technology should be implemented in the lesson in a meaningful way for effective student engagement. These scholars believe technology is a tool that should be used as a means to accomplish an end goal. Technology must be used with discernment, otherwise it cannot be an effective means to teaching specific music concepts to students. To summarize, Mantie, Lum, and Waldron all advocate viewing technology with discernment prior to introducing it into the private teaching space.

The benefits and discernment needed when using technology in the private lesson are both reflected in responses given for Questions 5, 6, and 7 from the piano teacher survey. Question 6 from the survey asks teachers to rank mobile applications based on their usefulness in teaching note and rhythm concepts to their students. Overall, 87% of teachers selected “Extremely and Very Effective” for this response. 13% selected “Moderately Effective” and “Not Effective at All.” The high percentage of teachers that responded favorably to this question shows that a large majority of teachers see the benefits of technology for teaching music concepts to students. This reflects the discussion from the “benefits” section above.
Conversely, Question 7 asks teachers how well mobile applications maintain their student’s attention span during lesson time. This question was met with a higher negative percentage rate than Question 6. Overall, 80% of teachers selected “Extremely and Very Effective” for this question. This percentage was slightly lower than that of Question 6. Likewise, the responses “Moderately Effective” and “Not Effective at All” were met with a combined percentage of 20%. This is higher than the combined responses for Question 6 (13%). This question, therefore, shows that a higher percentage of teachers do not find mobile applications to be helpful in keeping a student’s attention span. This question supports a reserved attitude regarding technology which reflects the “discernment” section above.

Finally, Question 5 (outlined in Theme 3 above) showcases a range of responses that show why piano teachers do not use mobile application technology in their teaching. The amount and variety of responses reveal that piano teachers do not use mobile application technology for several reasons which include the themes looked at in Theme 3: Priorities, Inconvenience, Lack of Knowledge, and Use of Technology in the Lesson but Not Mobile Applications. As with any teaching tool, smartphone and tablet technology should be implemented into the teaching studio in a thoughtful, intentional way. Allowing technology to be part of the piano teaching space but not using it with intention augments the impact technology can have on the communication of music concepts and student learning. To use these technologies in the teaching studio, piano teachers need to have an understanding of the various ways technology can benefit their teaching, each student’s learning needs, and be familiar with the technology to implement it effectively. Music educators will get the most benefit from smartphone and tablet
technology when they interact with it thoughtfully and discerningly. When this happens, technology can become a useful asset for communicating music concepts and aid student understanding of the material being taught.

To conclude, there is a debate amongst music educators regarding the usefulness of technology in communicating music concepts to music students. Some music educators see much benefit to using music technology in private lessons, while others have not found technology to be extremely useful. Some teachers believe in using technology as a tool and using it carefully and with discernment. Overall, there is evidence for the usefulness of technology and the need to use technology with discernment and carefulness found in the piano teacher survey. Four themes have been presented in this chapter that reflect the data discovered in the piano teacher survey and provide needed information for the initial research question posited in Chapter 1: Do piano teachers use smartphone and tablet applications to reinforce note and rhythm concepts in their teaching studios? The four themes discussed have been: 1) The majority of piano teachers use smartphone and tablet applications to reinforce note reading and rhythm concepts in their lessons, 2) Not all teachers who use smartphone and tablet applications find it necessary to keep up to date with the latest technological advances in piano pedagogy, 3) Some piano teachers are still resistant to using smartphone and tablet applications in their teaching, and 4) Piano teachers are very diversified in their response to the usefulness of smartphone and tablet applications in their teaching experiences. In the next section of this chapter, the implications this data has for the field of music education, the field of piano pedagogy, those outside the music education sphere, and areas where future research is still needed will be discussed and dealt with.
Imlications

The themes discussed above present a broad overview of the data discovered through the piano teacher survey. To review, the purpose of this survey has been to answer the question: *Do piano teachers use mobile applications to reinforce note reading and rhythm concepts in their teaching?* The themes drawn from the survey data contain many implications for the field of music education, piano pedagogy, those outside of the music education sphere, and areas for future research. This section will outline implications for each category.

First, this research impacts the field of music education. The data findings from this study show that mobile application technology have the potential to benefit the field of music education. Music educators have the opportunity to use mobile applications as a tool to promote the teaching of musical concepts to students including note and rhythm reading and identification, composition, aural skills, and theory. Smartphone and tablet technology could benefit this field by helping teachers communicate music concepts in a fun, creative, and engaging way. Likewise, mobile technology has the potential to provide practice motivation for students outside the private music lesson. Music educators, however, should use smartphone and tablet technology with discernment. Viewing technology as a tool improves its usefulness in the classroom. A discerning mindset allows teachers to critically think about how technology can be used to meet their end goal. When used with discernment, smartphone and tablet technology can be a great resource for music educators and music education as a whole.

Secondly, this research has implications for the field of piano pedagogy. The research from the piano teacher survey showed that a high percentage of piano teachers
use smartphone and tablet technology in their teaching and that this technology has proven to be useful in the retention of those skills. These data findings reveal that mobile application technology is helpful for reinforcing note reading and rhythm concepts in the private lesson. Mobile applications can also be beneficial in promoting self-learning at home. Since smartphones and tablets are very common in the majority of households across the country, utilizing these tools could help educators provide more motivation for students who struggle with practicing at home. A third implication suggests that the attitude of piano teachers towards keeping current with new emerging technologies in the piano teaching world may hinder the potential ways this technology could continue to benefit students. One of the benefits of technology is that it does continually require updates and upgrades in order to provide the highest quality performance for consumers. Piano teachers need to be discerning regarding upgrading and improving technology, however refusing to not educate themselves on the current technologies and upgrades available may be depriving students of helpful tools that could make their musical journey more effective. Therefore, if mobile applications are found to be a useful tool in the teaching studio, piano teachers should continue to educate themselves on the best technologies available so as to ensure these tools are being utilized to their highest potential for both the teacher and student.

Mobile technology can benefit piano educators when used discerningly in the private lesson space. However, implementing mobile technology into the private lesson can be daunting, especially if the music educator is unfamiliar with the technology. Below I suggest 10 ways music educators, particularly piano educators, can utilize
technology in their teaching studio. These 10 tips are suggestions for how to implement technology into the teaching studio in thoughtful, meaningful ways.

1) **Play games.** Mobile application technology allows for some fun to be had in the lesson while at the same time reinforcing lesson objectives, like note reading and rhythm concepts. Applications like *Note Rush*, *Flash Note Derby*, and *Rhythm Swing* engage the student in timed games that help reinforce beginning note and rhythm concepts. Additionally, the use of these apps can help keep the student’s attention span during the lesson and promote student interaction with the concepts being taught.

2) **Identify notes.** *Note Rush* and *Flash Note Derby*, two prominent note reading smartphone applications, are designed to benefit note reading reinforcement either for a private music lesson or practice at home. Both applications allow the teacher to tailor note review to the student’s individual needs. *Note Rush* also allows the student to name and play specific notes on the keyboard which connects both the visual, aural, and kinesthetic components needed to learn to read notes on the keyboard.

3) **Identify rhythms.** Smartphone and tablet applications also allow students to learn to count and sightread rhythms. *Rhythm Swing* is a fun smartphone application that gives students an opportunity to play various rhythms with a MIDI track accompaniment. The teacher can also select the difficulty of each rhythm and tailor it to the student’s individual needs.

4) **Listen, tap, and visualize rhythms.** Rhythm mobile applications, such as *Rhythm Swing*, allow for students to experience rhythms, not just identify
them. Specific applications allow students to feel rhythms through tapping, listening to metronome beats/MIDI backing tracks, and visualize the rhythm by seeing it on the screen. Teachers have the flexibility of isolating each of these sensory learning modes or combining them depending on their student’s musical abilities and learning needs.

5) *Engage students in the lesson.* When used effectively, smartphone and tablet applications can help capture a student’s attention and provide ways for them to engage with the material being taught. For most students, piano lessons consist of doing what the teachers asks them to do and answering questions when prompted. Engaging in a smartphone application game could help reinforce lesson material and allow the student to be creative and have fun in the process.

6)* Allow students to take charge of at home practice sessions.* Not only are mobile applications beneficial for teacher-student interaction in the lesson, but they also can be used to promote student practice at home. If the student is on vacation or has a week where physical piano practice isn’t possible, the mobile application option is helpful since most applications can be accessed remotely away from a piano or other musical instrument.

7) *Promote creativity in the lesson.* Smartphone and tablet applications allow for teachers and students to engage in creativity during the lesson time. Composition, aural skills, asking music history trivia questions, and listening to repertoire videos via music streaming applications are a few creative ways teachers can use smartphone and tablet applications to promote a creative
learning environment in the lesson. Mobile applications such as *Note Rush*, *Rhythm Swing*, *Simply Piano*, *Muse Score*, *Flashnote Derby*, *Earpeggio*, *Staff Wars*, and many others are tools that help reinforce specific music skills and concepts in fun, creative ways.

8) *Provide creative outlets for learning music theory concepts.* There are several smartphone and tablet applications that promote the learning of theory concepts such as note and rhythm identification, sight reading, interval training, differentiating between major and minor soundscapes, and composing original musical excerpts. Many teachers use worksheets to teach these concepts which are helpful but can sometimes stifle student learning by not offering a challenge. Using smartphone and tablet applications to reinforce these concepts adds a fresh perspective for students and teachers.

9) *Provide a productive activity when left with extra lesson time.* Many teachers have experienced a feeling of panic when they realize they have extra time in the music lesson that they did not plan for. Mobile applications are a great way to utilize leftover lesson time and give students a fun reward for listening and participating in the music lesson. Teachers can either let students engage with the mobile application on their own or join them in a game or activity. These activities can be a great way to review concepts learned in the lesson as well as give teachers an opportunity to go back and solidify material that may not have been communicated clearly to the student.

10) *Enhance listening skills.* Using mobile applications to enhance a student’s listening ability is very beneficial. With mobile applications, students can
listen to either the pieces they are currently working on or participate in general music listening. Myriads of pieces can be found through these applications. Allowing students to utilize these mobile application options may open up opportunities for students to perfect their listening abilities and engage with music in an independent way.

This research has implications for those outside the music education sphere. First, this research shows that using mobile applications to communicate information can be beneficial. Smartphone and tablet applications are convenient and engaging for most elementary and middle school students. Due to the plethora of information that has been developed for smartphone and tablet applications, almost any subject could be taught and reinforced by using a smartphone or tablet application. Like most other technology mediums, however, smartphone and tablet applications must be used as a means to an end. They should be the conduit by which concepts are communicated, not the end goal in themselves. For those outside the music education sphere this research is beneficial because it shows that technology is always advancing. Therefore, keeping up to date with technological advancements allows for better communication and reinforcement of subject areas.

Finally, this research has clear implications for future research. A large number of teachers who use mobile applications in their teaching studio do not find it beneficial to keep up to date with the latest technological updates and advancements. It would be interesting to research the specific reasons why piano teachers feel this should not be a priority for both themselves and their students. Another area for potential research would be for teachers who do use mobile application technology. It would be interesting to
research which applications do they use most often in their teaching and why they choose
to use those specific applications. This research also has the potential to shed light on
which note and rhythm applications are the most beneficial for piano teachers in order to
help inform up and coming piano teachers who are new to the field. It would be
beneficial to do more research regarding the reasons why there are still many piano
teachers who do not use smartphone and tablet applications in their teaching. A more in-
depth study of this might be helpful in revealing why teachers are not willing to utilize
this tool in their teaching space. A final area of potential research in this field would be
researching the age range of teachers who do not use mobile application technology in
their teaching. The age range of these teachers could shed further light onto their reasons
for not using mobile application technology to reinforce note and rhythm concepts in
their private lessons.

The implications from this research extend to the field of music education, the
field of piano pedagogy, teachers in general, and for future research. Many of the
implications overlap, however there were several specific ones that pertained to each
category. Overall, mobile applications are beneficial and need to be viewed as a tool that
can help educators communicate concepts to students more clearly and effectively. When
used as a tool, technology can be very beneficial for students, teachers, and the future of
piano teaching.

Conclusion

To conclude, Chapter 5 covered the major themes gleaned from the piano teacher
survey and also touched on the implications these themes have for the field of music
education, the field of piano pedagogy, teachers outside the music education field, and
opportunities for future research. Overall, the themes discovered in this research reveal
the two sides of the music technology debate amongst educators, namely, those who see
the benefits of using technology in the lesson and those who see the need to view
technology with discernment. Technology should be viewed as a tool that can be
beneficial when appropriately used in the lesson to communicate key concepts. When
technology is implemented discerningly in the music lesson, the teacher has the freedom
to use it in an effective way that engages the student and aids the communication of
music concepts being taught.

The purpose of this study was to answer the question, “Do piano teachers use
mobile applications in their lessons to reinforce note reading and rhythm concepts for
student?” Chapter 1 addressed this question by explaining the importance of this study
and presenting the definition of key terminology found throughout this paper. Chapter 2
explored writings that covered the benefits of music technology and the discernment
needed when implementing it into the music education sphere. Chapter 3 addressed how
the researcher would answer the main research question posited in Question 1. A detailed
explanation of the piano teacher survey and the method used for data collection and
analyzation was presented and explained. Chapter 4 presented the data findings gleaned
from the piano teacher survey. Chapter 5 commenced a discussion of the data results and
the implications the data has on the fields of music education, piano pedagogy, those
outside the music education field, and future research.

Technology provides many benefits for the piano teaching space. It can aid the
retention of music concepts and allow for more creativity in the weekly music lesson.
Many teachers have differing opinions when it comes to using technology in piano
teaching. Both opinions are useful and valid. The important thing to remember when considering utilizing technology in the private music lesson is the fact that technology, like any other teaching medium, is not an end in itself but a potentially beneficial teaching tool. Just because one uses technology to teach specific concepts does not mean that technology is the most useful tool to use. Technology is just that—a tool—and as such must be used with discernment amongst teachers and music educators. When used effectively, technology has the potential to be a means of reinforcing note and rhythm concepts for students as well as providing a fun conduit for student learning and musical involvement. When smartphone and tablet applications are employed discerningly by thoughtful and well-prepared teachers, they have the potential to benefit the student and teacher in many good ways.
References


Appendix A. Informed Consent Documentation

Aileen Huizinga, fellow piano teacher and graduate student at the University of Wisconsin-Stevens Point, would appreciate your participation in a research study designed to evaluate the effect smartphone and tablet applications have had on note and rhythm recognition in private piano lessons. You are being asked to complete an anonymous survey that should take no more than 15 minutes of your time to complete. Your participation is completely voluntary. The goal of this study is to research the pros and cons of using smartphone and tablet applications in the private piano lesson to reinforce note and rhythm reading skills.

No risk is anticipated as a result of your participation in this study other than the investment of time when taking this survey.

While there may be no immediate benefit to you as a result of your participation in this study, it is hoped that valuable information may be gained regarding the benefits of using smartphone and tablet applications in the private piano teaching arena.

While this information could be obtained by interviewing you, conducting a survey is the quickest and easiest method for obtaining this information. You may also choose not to participate.

The information that you provide on the questionnaire will be anonymous. Information will not be collected that could identify you.

Your participation in this study is completely voluntary. If you want to withdraw from the study at any time, you may do so without penalty or loss of benefit entitled. Only anonymous information provided will be retained. All identifiable information will be removed from the study and destroyed or deleted.

Once the study is completed, you may retain the results of the study by clicking the link at the end of the survey to view the results. If you would like these results, or if you have any questions in the meantime, please contact:

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If you have any complaints about your treatment as a participant of this study or believe that you have been harmed in some way by your participation, please call or write:

Anna Haines, PhD.
Professor, Natural Resource Planning
Director, Center for Land Use Education
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Although Dr. Haines will ask your name, all complaints are kept in confidence.

By agreeing to take this survey, I affirm that I have read and understood the above information. I understand that this survey is voluntary, and I may stop completion at any time without penalty. I also understand that the survey is anonymous and no risk, other than loss of time, will affect me by taking this survey.

Please select, Yes, I Consent, or No, I Do Not Consent in order to commence the survey. Thank you for your time!
Appendix B. Online Survey Recruitment Form

Hello fellow piano teachers,
I’m a current graduate student at the University of Wisconsin-Stevens Point. Currently I’m finishing up a masters degree in Music Education with an emphasis in Piano Pedagogy. The culmination of my MA degree requires me to write a thesis paper, and I’ve decided to conduct a survey of piano teachers in order to evaluate how smartphone and tablet applications have aided note reading and rhythm reinforcement when teaching these skills to piano students. My purpose is to acquire information that will help piano teachers better evaluate the strengths and weaknesses of smartphone/tablet apps and how they could be of possible benefit when teaching note reading and rhythm reinforcement in the teaching studio.

If you are a piano teacher who uses note and rhythm smartphone/tablet applications to some extent in your studio, would you please consider taking my 5-minute anonymous survey and giving a brief synopsis of how smartphone and/or tablet apps have impacted the ways you teach note and rhythm skills in your lessons? Your feedback would be greatly appreciated! Please follow the link below to access the survey. This survey is completely anonymous and voluntary. I’m hoping to get a large number of teachers to respond and your help is needed! Please feel free to repost, share with other fellow piano teachers, and spread the word! Thank you for your help!

Aileen Huizinga
Appendix C. Survey Questions

2) Do you currently use smartphone and/or tablet applications in your lessons to reinforce note reading and rhythm identification?
   - Yes
   - No

3) If you selected “No” for Question 1, please briefly explain the reasons why you choose not to use smartphone and/or table applications in your lessons.

4) Using the scaling system below, how likely are you to use smartphone and or/tablet applications to reinforce note and rhythm concepts for beginning piano students?
   - Extremely likely
   - Somewhat likely
   - Neither likely nor unlikely
   - Somewhat unlikely
   - Extremely unlikely

5) If you answered “Yes” to Question 1, please list the piano levels you most often engaged with smartphone and/or tablet applications (i.e. beginner, intermediate, advanced, etc.)

6) Using the scaling system below, how effective have you found smartphone and or/tablet applications to be at reinforcing note and rhythm skills in your lessons?
   - Extremely effective
   - Very effective
   - Moderately effective
   - Slightly effective
   - Not effective at all

7) Using the scaling system below, do you find students pay better attention in lessons when smartphone and/or tablet applications are present?
   - Extremely effective
   - Very effective
   - Moderately effective
   - Slightly effective
   - Not effective at all

8) Using the scaling system below, how important do you think it is for you, as a teacher, to keep up-to-date with the latest smartphone and/or tablet technology that complements teaching piano?
   - Extremely important
   - Very important
   - Moderately important
   - Slightly important
   - Not at all important