Pedagogical Approaches in the Virtual Beginning Orchestra Classroom: Best Digital Resources for the Beginning Virtual Orchestra Classroom

By

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Abstract
This study aims to answer the research question: what are the best digital tools for teaching beginning string players in a fully virtual format? During the COVID-19 pandemic, educators across the world found themselves teaching in either a fully virtual or hybrid classroom. This thesis discusses previous research into digital tools available to string educators, remote and distance learning, and elementary string education. This research study administered a survey to string educators in the United States and internationally. Mixed-methods data analysis was used to review the data from the survey. This study concludes with a discussion of the findings from the survey and several main takeaways from this research study.

Keywords: string education, remote and distance learning, elementary string education, digital tools, TPACK, synchronous learning, asynchronous learning.
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Chapter I: Introduction

The Covid-19 pandemic has forced many public-school teachers to teach in either a fully virtual or hybrid model format for the 2020-2021 school year. I wanted to study this topic further to help myself and other string educators (who are starting string players in a fully virtual format) navigate the new digital classrooms many of us have found ourselves teaching in during the COVID-19 pandemic. Music education and instrument instruction can be particularly challenging subjects to teach in a virtual format, especially string instruments. As a string teacher myself, I feel it is important for our field to study what digital resources are out there that may or may not be working for string educators and compile a report to share with string educators to better the field. Overall, I hope my readers might discover digital tools to help them develop more effective digital teaching pedagogies and improve their students’ musicianship skills.

Purpose Statement

The purpose of this thesis is to research the topic of digital tools available to teachers of beginning string players who are teaching in a fully virtual classroom environment. There are all kinds of digital tools available to music teachers but choosing which one to use can be a challenge. This is especially true for teachers of beginning string players who are trying to show techniques such as posture and finger placement. Teaching these techniques is particularly difficult in a fully virtual classroom environment. The specific research question this thesis seeks to answer is: What are the best tools for digital instruction available for teachers of beginner string players in a fully virtual format?
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**Importance of the Study**

The information in this thesis will be of value to teachers of string teachers, parents of string students, music teachers, school administrators and fine arts coordinators, people in higher education who support teachers and future teachers, future music educators, and private lesson teachers.

**Researcher Positionality**

As a fellow string educator who had to teach beginner players in a fully virtual format during the 2020-2021 school year, I had a personal interest in the results of this study. Even though my research was into the best digital tools for use in a fully virtual beginning orchestra classroom, I do not believe that teaching orchestra in a fully virtual setting is best practice. The COVID-19 pandemic forced educators into many teaching scenarios that we had never taught in before. While there are tools we can take from this experience to blend with the instruction in our physical classrooms, I am not advocating for fully virtual orchestra classrooms, nor do I believe that would be the best pedagogically, for student outcomes, or for student experience.

**Definition of Terms**

In order to make sure that all readers can clearly understand my thesis despite their background or prior knowledge, I am defining the following terms to aid in their understanding of my thesis.

**Remote and Distance Learning:** teaching and learning from a distance. Teachers and students are not in the same physical space.

**E-Learning:** learning that takes place through electronic means, usually over the internet

**Musical Instrument Digital Interface (MIDI):** electronic connection of keyboards, synthesizers, and computers to create and edit music notation.
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**Notation Software**: software used for the creation and editing of music. Examples of such software are *Finale* and *Sibelius*.

**Learning Management System (LMS)**: a software application or web-based technology that provides an instructor with a way to create and deliver content, monitor student participation, and assess student performance.

**Technological, Pedagogical, and Content Knowledge (TPACK)**: provides educators with a framework for assessing technology and its place in their classroom.

**Technological Knowledge**: an understanding of the general technologies, digital and otherwise, that are required for teaching and learning.

**Pedagogical Knowledge**: an understanding of the general principles, practices, and methods of instruction and student learning that apply across disciplines.

**Content Knowledge**: a comprehensive understanding of the subject matter being taught.

**Learning Outcomes**: a statement that describes a specific skill or knowledge a student should know by the end of an activity, unit, or class.

**Singing Schools**: the first American music schools, they had an emphasis on note reading, note writing, and singing.

**Synchronous Teaching and Learning**: teaching and learning that takes place when teachers and students are in the same location (either virtually or physically) and happens at the same time.

**Asynchronous Teaching and Learning**: teaching and learning that takes place when teachers and students are not in the same location and can happen at the students own time, place, and pace.

**Playing Posture**: the physical set up of the body while playing an instrument.
Mixed-Methods Research: mixing both qualitative and quantitative research and data analysis into one study

Qualitative Research: collecting and analyzing non-numerical data

Quantitative Research: collecting and analyzing numerical data

Coding: naming segments of data with a label that simultaneously categorizes, summarizes, and accounts for each piece of data

Purposeful sampling: identifying and selecting individuals or groups of individuals that are especially knowledgeable about or experienced with a phenomenon of interest

Descriptive Statistics: describes the characteristics of a data set

Bow Hold: holding the bow of a stringed instrument in the right-hand

Fingerboard Placement: where to put the left-hand fingers on a string instrument

Clefs: music symbol used to tell a musician where a note sits on the music staff, examples include treble clef, bass clef, and alto clef.

In sum, in chapter one I gave information on the purpose of this study, my research question, the importance of the study, and a definition of key terms. In chapter two I will provide my review of literature related to this study.

Chapter II: Review of Related Literature

In the previous chapter, Chapter One, I introduced this study, discussed its importance, and defined terms pertaining to this study and thesis. In this chapter, Chapter Two, I will review the literature related to my study of teaching beginning string players in a virtual setting. Many scholars agree that more research needs to be done into this area of music education, especially considering the situation many educators like myself found themselves in this last year because of the COVID-19 pandemic. I have organized my review of the literature into the following
sections: Digital Tools for the Music Educator, Remote and Distance Learning, and Elementary String Teaching. In the first section on digital tools for the music educator, I will provide an overview of the existing research concerning digital tools for music teaching and learning. In the second section on remote and distance learning, I will provide a description of the research pertaining to distance learning in the music classroom. In the third section, I will discuss literature addressing pedagogical approaches to beginning string teaching and learning.

**Digital Tools for the Music Educator**

In this section, I will present information from scholars who study digital tools for music educators (Leman, Nijs, 2017; Merrick, 2017; Waldron, 2017; Stephens-Himondes, Hilley, 2017; Wan, Gregory, 2018, Bauer 2020) and from other scholars who have researched e-learning and technology in the music classroom (Bauer, 2020; Dammers, 2019; Bauer, Mito, 2017; and Gall, 2017). I will begin by talking about different categories of digital tools that are discussed in the literature. Then, I will consider the use of the Technological, Pedagogical, and Content Knowledge (TPACK) framework for choosing digital tools for music education.

Digital tools for music educators are constantly changing and evolving as technology becomes smarter, faster, and more efficient. As music teachers, it can often be difficult to know which digital tools will be the most engaging for our students, while still providing a meaningful music teaching and learning outcome. Merrick (2017) spoke to this when he said, “the challenge for music education is to develop new approaches to learning that incorporate social media and engage students in learning tasks that have relevance to them. The use of music technology should be continually justified and reviewed to ensure it is used appropriately in the educational process” (p. 176). He goes on to explain how music teachers should go about this, stating, “a good way to ensure this occurs is to embrace the notion of ‘purposeful’ learning, whereby the
reason for employing the music technology is considered thoughtfully before, during and after learning, rather than being used purely as a means through which to engage the students and hopefully keep them on task” (Merrick, 2017, pg. 176). In this literature review, while specific apps or programs will not be discussed at length, I will be describing different categories of digital tools for the music educator to explore.

**Music Education Specific Technology**

The first category of digital tools for music educators that I will discuss in this chapter consists of what I define as music education specific technology. In the research I reviewed, the most often discussed digital technology for the music education classroom was the musical instrument digital interface (MIDI). Merrick (2017) explained the importance of this technology by saying, “These developments redefined the direction of music making and allowed users to create music via multiple sound sources and instruments, sharing and collaboration digitally for the first time as a means of fostering creativity, developing composition and performance, and changing the way popular music was transmitted” (pg. 173). Bauer (2020) discussed how the data produced by a MIDI instrument can be captured on notation software for digital playback, allowing for digital music composition with real time analysis and editing by the composer. Merrick (2017) stated that while this technology was transformative in music composition, it has often proved expensive for school district to acquire and incorporate into their curriculums. Wan and Gregory (2018) conducted a study into digital tools for supporting the motivation of music students when they are practicing their instruments. In this study, they found five helpful types of music education specific tools for use in the instrumental music classroom that support motivation for practice: practice logs, note feedback tools, iScore (digital portfolio), music stand software tools, and accompaniment tools. Wan and Gregory described the effectiveness of these
tools when they stated, “All tools in the case were found to facilitate musical achievement in various ways” (Wan, Gregory, 2018, pg. 47).

**Non-Music Education Specific Technology**

The second large category of digital tools for music educators I have included in this chapter are not specific to music education but are helpful to music educators. Merrick (2017) discussed these non-music education specific technologies in detail. He begins by describing the sharing of popular music through the internet and digital media, and how this is changing the music classroom environment. A few examples of this change that he gives are: “Students and teachers are now able to access and share music (audio, video, scores) for analysis, performance, or rehearsal at any time of the day, from any location of the world; students and teachers are able to share, observe, and hear a number of different versions of performances by artists; and students can now learn music informally (through listening, observing and copying) in contrast to the didactic teaching methods that were thought to be the most effective for many years in classrooms and studios” (Merrick, 2017, pg. 174). Merrick (2017) then goes on to describe other categories of digital tools: YouTube and iTunes for listening and sharing performances; iMovie and GarageBand for creating of music portfolios; Sibelus and Finale music software for music notation; social media platforms to collaborate and communicate; and Learning Management Systems (LMS) like Edmodo for students to submit and share work with their teacher and classmates (Merrick, 2017, pg. 176-177). Merrick (2017) concluded his discussion by stating, “the combination of various music technology and popular resources in combination with LMS allows teachers and students to archive and share material related to learning in a multitude of ways. The use of these types of platforms is really only limited by the level of creativity and technical proficiency that the teacher and students have in using these tools” (pg. 178).
Many scholars also explained the importance of using the Technological, Pedagogical, and Content Knowledge (TPACK) model to determine which digital tools would be best for each individual educator and their specific learning goals for each lesson. Bauer (2020) specifically discussed the use of the TPACK model for integrating technology into music education. He outlines how the TPACK model, “is a way to conceptualize the use of technology for student learning within a specific educational context” (Bauer, 2020, pg. 10). Bauer (2020) continues to describe how “knowledge of a content area, pedagogy, and technology overlap and interact to form seven discrete types of knowledge with the central intersection being technological, pedagogical, and content knowledge” (Bauer, 2020, pg. 10). As Bauer described, within the TPACK model, these three knowledge areas (technology, pedagogy, and content) influence the way that learning takes place within different situations and contexts, which may influence the teacher’s choices about which technology will be used, what pedagogical approach they will take, and the content they will include in the lessons. For Bauer (2020), TPACK considers technology to be a tool that is in service of the students’ learning of the subject matter content, and when using it, teachers “must consider the affordances and constraints of a technology when determining whether its use is appropriate and beneficial to students’ achievement of curricular outcomes” (pg. 10).

Bauer (2020) also explained how the TPACK model has seven types of knowledge to consider when deciphering which digital tool(s) are best for your students’ goals: Content knowledge (CK), Pedagogical Knowledge (PK), Pedagogical Content Knowledge (PCK), Technology Knowledge (TK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and Technological Pedagogical Content Knowledge. He defines Content Knowledge as “a comprehensive understanding of the subject matter being taught,”
Pedagogical Knowledge as “an understanding of the general principles, practices, and methods of instruction and student learning that apply across disciplines,” and Technology Knowledge as “an understanding of the general technologies, digital and otherwise, that are required for teaching and learning” (Bauer, 2020, pg. 10-11). It is worth noting that these three main knowledges overlap, as stated above, to form the other components of TPACK.

The literature discussing the use of TPACK in the music classroom also emphasized using content and pedagogy to drive technology choices by the music educator. Dammers (2019) stated this aptly thus, “the application of grounded, thoughtful, systematic approach that is structured around pedagogy rather than responding to technology of the moment helps ensure that effect music learning (rather than technology enthusiasm) remains the core guiding principle of pedagogical decisions” (p. 3). Bauer (2020) gives examples of questions to guide teachers’ choices. He suggests music teachers should ask themselves when choosing new technological tools to use in the music classroom: “How will the technology help to address my curricular objectives and student learning outcomes? How will it help students develop their understanding and/or skill relevant to the musical content being studied? What affordances would the technology bring to the teaching/learning process? What constraints might it impose? Do I have a pedagogical strategy for how to use the technology? Is this strategy grounded in what is known about how people learn and experience music?” (pg. 42).

In our modern society, technology continues to evolve at a faster rate every year. When researching digital tools for the music educator, I expected to walk away with a list of ‘go-to’ resources. While I discussed several different types of digital tools and resources available to today’s music teacher, I believe the largest take away from my research into this topic was the discussion of TPACK and the professional educators’ ability to use content and pedagogy to
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discern which new technologies will serve their students’ learning outcomes and goals best. The evolution of technology will not slow down as we continue into the future, nor will the expectation diminish from students, parents, and administrators that we use technology in our classrooms. While digital tools will continue to change over time, it is up to us as music educators to use frameworks like TPACK to help us make meaningful pedagogical and content driven decisions about technology in our classrooms.

**Remote and Distance Learning**

This section discusses the literature and research that concerns remote and distance learning in music education. Literature on this topic was sparse; however, I will present a brief overview of the literature that does exist on remote and distance learning in the music education classroom (Koutsoupidou, 2016; Blake, 2018; Fridman, Petrik, Martinka, & Brodniansky, 2020; Kaschub, Smith, 2014). Also, I will discuss a relevant study that was conducted on remote learning in school bands during the COVID-19 shutdown (Hash, 2020).

Blake (2018) discussed the history of distance learning in music education. When speaking about this history, Blake described how, “historically, the field of music education has always included innovations that have furthered the profession and fettered it to a place of importance in American society” (pg. 3). In these early singing schools, “students were taught by a singing master for an indeterminate period, provided materials (often written by the master), and then sent home to learn them asynchronously. In turn, many students became signing masters themselves through this system” (Blake, 2018, pg. 3). Blake (2018) stated that the singing school movement provides an excellent example of music education’s tenacity and could “be the first example of distance learning in music education” (pg. 3). He goes on to discuss research that has been done so far into online distance learning in music education, both from the
viewpoint of the student and the teacher; however, he stated that research into online distance learning “represented a surprisingly small body of literature” (Blake, 2018, pg. 4), and that “more research must be completed in this area, as growth and availability have outpaced the research literature” (Blake, 2018, pg. 20).

Koutsoupido (2016) conducted a study into online distance learning in music education and the advantages and disadvantages of such courses. The study conducted by Koutsoupido (2016) found that, “access to materials as well as teacher and learner communication and peer-to-peer students’ interaction is achieved through synchronous and asynchronous programmes” (pg. 246). He gave examples of synchronous tools like Skyge and Google Hangouts to facilitate real-time learning from different locations. Koutsoupido (2016) also described asynchronous digital tools as, “open-source platforms like Blackboard and Moodle…for teaching purposes such as uploading reading material, announcements, syllabus information, podcasts, discussion boards, and student forums” (pg. 246). Koutsoupido (2016) went on to say that the programs studied in this research varied in the quality of instruction, methods and tools of delivery, and the monitoring and assessment of student progress (pg. 246).

Another study conducted by Fridman, Petrik, Martinka, and Brodniansky (2020) reported on music educator and future music educator perceptions of e-learning in the music classroom. They summarized their findings by saying “e-learning is perceived by music education teachers as a more effective way of teaching theoretical subjects compared to classical lessons. Teachers seem to be aware of the need to innovate music education” (Fridman, Petrik, Martinka, Brodniansky, 2020, pg. 240). While this study was published in 2020, it was conducted prior to the COVID-19 pandemic, so the authors conclude that their “findings can be used as a starting
point in further efforts to develop e-learning in the field of music education, even in the context of the current epidemiological situation associated with COVID-19” (Fridman, Petrik, Martinka, Brodniansky, 2020, pg. 241).

A research study conducted by Hash (2020) was the only literature I could find that had been recently completed and therefore directly addressed the COVID-19 pandemic and the nationwide shutdown of K-12 public schools that occurred in the spring of 2020. This study examined the practices, experiences, and perspectives of elementary and secondary band directors during this time period. Hash (2020) states that “unlike that discussed in the literature review remote learning, “provided during the Covid-19 shutdown was essentially emergency teaching rather than the implementation of curricula [that was] planned, organized, and designed for distance environments” (Hash, 2020, pg. 384). In the area of instruction and assessment, Hash (2020) found that most directors held video-conferencing instruction in private or small-group format, rather than a large ensemble class meeting, and allowed students to choose which asynchronous assignments they completed (Hash, 2020, pg. 391). The study also found that variables outside of teachers’ control probably affected student participation the greatest, such as equity in terms of technology and internet access that varied from district to district (Hash, 2020, pg. 392-393). A central theme common amongst all the researchers discussed in this section was that much more research needs to be done on the topic of distance and remote learning in music education in order for the field to grow and adapt to the changing digital landscape of our modern world.
Elementary String Teaching

One of the most important moments of instrumental music teaching occurs at the very beginning – setting students up for success with proper playing position and thoughtful teaching and learning strategies. In this section, I will discuss some of the pedagogy required to successfully start beginning string players (Hopkins, Pellegrino, 2019; Hamann, Gillespie, 2019; Selby, Rush, 2017), as well as proper equipment to set up a beginning string player for success (Surplus, 2005).

In their book *Strategies for teaching Strings: Building a Successful String and Orchestra Program*, Hamann and Gillespie (2019) discussed some successful pedagogical practices for teaching beginning string players. They state that “students in early instrumental classes learn the most efficiently by watching teachers model skills and then attempting to imitate on their instruments. String teachers will want to demonstrate the skill on a string instrument for the students and then give them an opportunity to try it” (Hamann, Gillespie, 2019, pg. 32). This is because the physical playing position of a beginning string player is critical in their later development of intermediate and advanced skills. Hamann and Gillespie (2019) go on to say that physical proximity of the string educator is very important in a class of beginning string players because the string teacher needs to be able to evaluate and fix any incorrect playing posture or skills (Hamann, Gillespie, 2019, pg. 33).

Hamann and Gillespie (2019) also discussed the need for review in the beginning string classroom when they said: “Research shows that typical elementary school beginning string class students can understand only one or two new ideas per class and that the most effective beginning classes incorporate much review” (Hamann, Gillespie, 2019, p. 43). Selby and Rush (2017) agreed with this statement in their book, *Habits of a Successful Orchestra Director*:
Helpful Tips and Practical Strategies for Improving String Instruction, where they describe that string teachers, “need to address the way that skill review is minimized in our current public-school culture. School academic classes focus heavily on teaching large amounts of new material to students as fast and as efficiently as possible…Musicians, on the other hand, spend a relatively small amount of time learning new skills compared to the vast majority of time practicing and refining skills” (Selby, Rush, 2017, pg. 48). Beginning string players must spend a considerable amount of time practicing and reviewing basic instrument playing posture and skills because of the physical coordination needed to play these instruments. Hopkins and Pellegrino (2019) say that “effective teachers of beginning strings understand how to separate the left – and right-handed techniques required to perform a piece into their simplest units and use teaching procedures that involve small-step increases in difficulty” (Hopkins & Pellegrino, 2019, pg. 4).

Proper equipment is critical in setting up a beginning string player for success. Surplus (2005) describes the various physical equipment a string player will need to be successful, which includes: an instrument that is the proper size for the student, strings, finger tapes for correct placement of fingers on the instrument, and a shoulder pad for violins and violas (Surplus, 2005, pg. 60-62). An instrument that is too large or too small for a student can cause improper playing position. As Surplus states, “a student who has to struggle to support an oversized instrument or who plays notes flat because of an inadequate reach can quickly become discouraged” (Surplus, 2005, pg. 60).

This review of literature has included scholarship concerning digital tools for music educators, remote and distance learning, and elementary string teaching. To better understand pedagogical approaches in the virtual beginning orchestra classroom, it is important to research the digital tools available to string educators in order to know more about which digital tools are
most beneficial for students and teachers in the virtual beginning orchestra classroom. The literature included here forms the foundation of this research because it helps to better examine my research question: What are the best tools for digital instruction available for teachers of beginner string players in a fully virtual format?

In this chapter, Chapter Two, I reviewed the literature related to this study focused on digital tools available to teachers of beginning string players in a virtual classroom. Next, in Chapter Three, I will describe the methodology I used to address my research question and the design of the study as well as the procedures used for analysis.

**Chapter III: Design and Methodology**

Last chapter, I reviewed the preexisting literature about digital tools for music educators, remote and distance learning in music education, and elementary beginning string pedagogy. In Chapter Three, I will now explain how I designed this research project and share my methods of analysis. I have created the following subsections for the ease and understanding of the reader: Process, Participants, Mixed Methods Research, Data Collection and Analysis. As I noted in Chapter One, the research question driving this study is: What are the best tools for digital instruction available for teachers of beginner string players in a fully virtual format?

**Process**

My process for conducting this research began with trying to understand what the best digital tools are for helping to teach beginning string players in a fully virtual format. With the closure of public schools in the spring of 2020 due to the COVID-19 pandemic, many string educators, including myself, found ourselves having to convert our classrooms and learning outcomes into a fully virtual format overnight. With the continuation of shutdowns or hybrid learning models into the fall, many string teachers still found themselves teaching virtually either
in part or fully. String educators were presented with the challenge of finding the best digital tools to teach very physical and kinesthetic instruments in a virtual setting with little to no professional development in doing so. Because of these hurdles and lack of professional development, I knew I wanted to survey fellow string educators about the current digital tools they use in their classrooms. I also wanted to find out what non-music digital tools string educators were using, such as different learning management systems. I compiled a list of emails for public school string educators in Wisconsin. I did this by finding the complete list of public-school districts in Wisconsin from the Wisconsin Department of Public Instruction Website and then I proceeded to go to each school districts’ website to record the name and email address(es) for all string educator(s). After compiling these emails, I sent an email explaining my survey and link to the survey to all the string educators on the list. When I did not receive enough survey responses from my email, I posted a link to my survey on the Facebook group School Orchestra and String Teachers, members of which are from all over the United States and other countries. After receiving the survey results, I used mixed-methods analysis to decipher what the data had to say.

Participants
My participants were selected using purposeful sampling. “This involves identifying and selecting individuals or groups of individuals that are especially knowledgeable about or experienced with a phenomenon of interest” (Palinkas et al., 2013). Because I was trying to understand digital tools in the string classroom, I used this type of sampling typical for educational research in a specific discipline. To help answer questions about digital tools for string teaching, I needed music educators, and in addition, these music teachers needed to teach orchestra. Once these details were confirmed, I reached out to these teachers via email (see Appendix A). I found their email addresses on their school district webpages and recorded their
email addresses if they were identified as an orchestra or strings teacher. Within the email sent to
these string educators was a link to my survey, which included as its first page the Informed
Consent form (see Appendix B). By continuing to the next page in the survey, they consented to
participating in my research. After sending a reminder email (see Appendix C), I still had not
received enough survey responses to begin my data analysis. I then posted my survey to the
Facebook group School Orchestra and String Teachers. I used the same email script as seen in
Appendix A when posting to the group. My survey was completely anonymous as it did not
collect participants’ email addresses and asked for no identifying information about the
participants.

**Mixed Methods Research**

This study uses Mixed Methods Research. Mixed Methods Research “is the type of
research in which a researcher or team of researchers combines elements of qualitative and
quantitative research approaches (e.g., use of qualitative and quantitative viewpoints, data
collection, analysis, inference techniques) for the broad purposes of breadth and depth of
understanding and corroboration” (Schoonenboom & Johnson, 2017). By using mixed methods
research, I was able to collect both qualitative and quantitative data through my survey. I was
able to focus on asking not only questions about the digital tools I currently know about but was
able to ask string educators to describe digital tools they use I may not know about yet. The
survey completed by my participants included questions where the had to select digital tools they
heard of already, rate the digital tools they currently use, and write in their own words about the
digital tools they use in their orchestra classrooms that were not already listed.

**Data Collection**

My research process required me to survey music educators, string educators specifically.
These participants had to be knowledgeable about the orchestra classroom digital tools that I was
researching. As stated above, I collected emails for teachers from school district websites and then housed this information in an Excel spreadsheet which I kept on a flash drive that was locked in my office when not in use. I used these email addresses to send an introductory email request (see Appendix A) within which they could click the link to take the research survey (see Appendix B). The survey was created on Microsoft Forms through my University of Wisconsin - Stevens Point student account. All survey results were password protected and housed on my Microsoft Office OneDrive account attached to my student email address. I sent a reminder email two weeks after the initial email (see Appendix C). As stated above, when I did not receive enough survey responses from the emails sent, I posted the survey with the email script from Appendix A on the Facebook group School Orchestra and String Teachers.

**Approach to Analysis**

My data analysis plan included both qualitative and quantitative analysis because my research employed mixed method design. For my qualitative portion of my analysis, I used coding, which Charmaz (2006, pg. 43) described as “Coding is about 'naming segments of data with a label that simultaneously categorizes, summarizes, and accounts for each piece of data.’” For the quantitative analysis portion of the study, I used descriptive statistics to analyze the data from questions where participants were asked to indicate if they had heard of certain digital tools and then to rate those digitals tools.

In Chapter Three, I described how I designed this research project, including its process, participants, and approaches to data collection and analysis. I explained each step of my process and shared my methods of analysis: narrative analysis and descriptive statistics. In Chapter Four I will report my findings.

**Chapter IV: Findings**
In the previous three chapters I introduced this study about digital tools in the beginning orchestra classroom, a review of literature related to the study, and a description of the methodology and my approach to analysis. Here, in Chapter Four, I will report the findings from the data analysis. As described in Chapter Three, I administered an anonymous survey to string teachers both in the United States and Internationally. After receiving 35 survey responses, I used mixed methods analysis to interpret the data. I coded the qualitative responses to each of the open-ended questions. I then used descriptive statistics to analyze the quantitative data from questions where participants were asked to indicate if they had heard of certain digital tools and rate them to rate those digital tools. This chapter presents the findings from data analysis and is divided into the following sections: 1) Overview of survey, 2) Quantitative analysis using descriptive statistics, 3) Coded responses to qualitative questions, and 4) Lists of digital tools recommended by fellow string educators.

**Overview of Survey**

The survey I created and conducted was divided into two sections: 1) Synchronous Teaching and Learning Tools and 2) Asynchronous Teaching and Learning Tools. Each section consisted of both qualitative and quantitative questions. There were twenty-four (24) questions in total, with fourteen (14) of the questions being quantitative and ten (10) of the questions being qualitative in nature. Overall, thirty-five (35) string educators responded to my survey and took, on average, fourteen minutes and forty-three seconds (14:43) to complete the survey questions.

**Quantitative Analysis Using Descriptive Statistics**

As previously mentioned, of the twenty-four (24) questions on the survey, fourteen (14) were quantitative. Of these fourteen (14) questions, seven (7) were from the Synchronous Teaching and Learning Tools section of the survey, and seven (7) were from the Asynchronous
Teaching and Learning Tools section. I will describe the results for the quantitative questions in the Synchronous Teaching and Learning Tools Section of the survey in the following section.

**Quantitative Results for Synchronous Teaching and Learning Tools**

The quantitative questions in the synchronous teaching and learning tools sections asked survey participants questions about video conferencing software. Question #1 asked participants ‘How many of the following video conferencing technologies have you heard of? (check all that apply), and were presented with the options of **Zoom, Google Meets, Microsoft Teams, Facetime,** and **Skype** (see Figure 1). All participants (100%) had heard of **Zoom** and **Google Meets,** thirty-three (94%) were familiar with **Facetime,** thirty-two (91%) had heard of **Skype,** and twenty-two (62%) were somewhat familiar with **Microsoft Teams.**

![Figure 1](image-url)
1. How many of the following video conferencing technologies have you heard of? (check all that apply)

- Zoom
- Google Meets
- Microsoft Teams
- Facetime
- Skype

<table>
<thead>
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<th>Technology</th>
<th>Count</th>
</tr>
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<tbody>
<tr>
<td>Zoom</td>
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</tr>
<tr>
<td>Google Meets</td>
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<tr>
<td>Microsoft Teams</td>
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<tr>
<td>Facetime</td>
<td>33</td>
</tr>
<tr>
<td>Skype</td>
<td>32</td>
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</table>

Question #2 asked participants ‘How many of the following video conferencing technologies do you use in your virtual instruction? (check all that apply),’ and were given the options of Zoom, Google Meets, Microsoft Teams, Facetime, and Skype (see Figure 2). Of the thirty-five participants, twenty-four (68%) used Zoom, twenty-two (62%) used Google Meets, eight (22%) used Facetime, four (11%) used Skype, and three (8%) used Microsoft Teams.
Question #3 asked participants ‘What video conferencing software do you primarily use for either group or individual lesson instruction? (check one option),’ and were given the options of Zoom, Google Meets, Microsoft Teams, Facetime, Skype, and Other (see Figure 3). Zoom and Google Meets were equally used by participants with both video conferencing programs being used by fifteen (42%) of survey responders. Microsoft Teams was used by two (5%) of participants. Facetime, Skype, and Other all received one (2%) each response.
For question #4, participants were asked ‘for the primary video conferencing technology above, please rate the technology on the following on a scale of 1 (unreliable/would not recommend) to 5 (excellent/little to no problems).’ Participants used this scale to rate their video conferencing technology in three categories (see Figure 4): 1) video streaming quality, 2) audio quality, and 3) user friendliness (ease of scheduling, navigation, etc.). For the category of video streaming quality, thirteen (37%) of participants gave their video conferencing software a 3 – occasional problems/works ok, nineteen (54%) rated their video conferencing software a 4 – very few problems/works well, and three (8%) of participants rated their video conferencing software a 5 – excellent/little to no problems. When rating audio quality, two participants (5%) gave their audio quality a 2 – many problems/does not work well, twenty-five (73%) gave a rating of 3 – occasional problems/works ok, and seven (8%) of participants gave a rating of 4 – very few problems/works well. Lastly, for the category of user friendliness (ease of scheduling navigation, etc.), one participant (3%) gave a rating of 2 – many problems/does not work well, six
participants (18%) gave a rating of 3 – occasional problems/works ok, nineteen participants (59%) gave a Rating of 4 – very few problems/works well, and six participants (18%) gave a rating of 5 – excellent/little to no problems.

The next question on the survey (see Figure 5) asked participants ‘are you required by your employer to use the video conferencing technology you indicated above as your primary video conferencing tool, or were you allowed to choose what video conferencing tool wanted to use?’ Participants could choose between ‘yes, I am required to use my employer sponsored video conferencing technology’ or ‘no, I was able to choose which video conferencing technology I wanted to use.’ A vast majority of participants (twenty-eight or 80%) indicated they were required to use their employer sponsored video conferencing technology, while only seven (20%) indicated that no, they could choose their video conferencing technology.
The last two quantitative questions for the synchronous teaching and learning tools section of the survey asked participants ‘If given a choice, would you use a different video conferencing tool than the one you are currently using?’ (see Figure 6) and ‘If yes, which video conferencing tool would you use?’. For question #6, if given the choice to use a different video conferencing tool, twenty-three participants (65%) indicated no, while eleven (31%) indicated yes. When asked to say which video conferencing tool they would use if they could pick, nine (9) participants said they would use Zoom while two (2) said they would use Facetime.
Quantitative Results for Asynchronous Teaching and Learning Tools

The quantitative questions in the asynchronous teaching and learning tools sections asked survey participants questions about learning management systems (LMS) they use in their string classrooms. Question #10 (see Figure 7) asked participants if their employer/school district uses a district-wide LMS. Overwhelmingly, participants (thirty-three or 94%) said yes, while only two participants (5%) said no.

The next question on the survey, question #11 (see Figure 8) asked participants ‘If yes, what learning management system (LMS) does your district/employer provide for you to use?’
Survey participants were given the options of choosing: 1) Canvas, 2) Google Classroom, 3) Schoology, 4) Blackboard, 5) Seesaw, and 6) Other, where they could write in what LMS they use. Google Classroom was the most used by survey participants with twelve (34%) indicating this was the LMS they used, followed by Canvas with eleven (31%), Schoology with seven (20%), Other with three (8%), Seesaw with one (2%), and Blackboard with zero (0%). In the other category, participants listed Infinite campus, Synergy, and Shimo.im each once.

Figure 8
Survey Question #11

11. If yes, what learning management system (LMS) does your district/employer provide for you to use?

<table>
<thead>
<tr>
<th>LMS</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canvas</td>
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</tr>
<tr>
<td>Google Classroom</td>
<td>12</td>
</tr>
<tr>
<td>Schoology</td>
<td>7</td>
</tr>
<tr>
<td>Blackboard</td>
<td>0</td>
</tr>
<tr>
<td>Seesaw</td>
<td>1</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
</tr>
</tbody>
</table>

Question #12 (see Figure 9) asked survey participants ‘How many of the following learning management systems (LMS) have you heard of? (click all that apply).’ Participants were given the options of choosing: 1) Canvas, 2) Google Classroom, 3) Schoology, 4) Blackboard, and 5) Seesaw. Twenty-five teachers (69%) had heard of Canvas, thirty-four (97%) had heard of Google Classroom, twenty-four (68%) had heard of Schoology, eighteen (51%) had heard of Blackboard, and twenty-eight (80%) had heard of Seesaw.
The next question on the survey, Question #13 (see Figure 10), asked participants to rate their district/employer provided LMS on a scale of 1 (unreliable/would not recommend) to 5 (excellent/little to know problems) in the categories of: 1) teacher navigation, 2) student navigation, 3) ease of creating assignments, 4) ease of grading online assignments, 5) content creations, and 6) connection/embedding to external content (ex. YouTube videos). In the category of teacher navigation, 9% gave a rating of 2 – many problems/does not work well, 33 % gave a rating of 3 – occasional problems/works ok, 45% gave a rating of 4 – very few problems/works well, and 12% gave a rating of 5 – excellent/little to no problems. In the category of student navigation, 9% gave a rating of 2 – many problems/does not work well, 42 % gave a rating of 3 – occasional problems/works ok, 42% gave a rating of 4 – very few problems/works well, and 6% gave a rating of 5 – excellent/little to no problems. In the category of ease of creating assignments, 3% gave a rating of 1 – unreliable/would not recommend, 8% gave a rating of 2 – many problems/does not work well, 35% gave a rating of 3 – occasional problems/works ok, 35% gave a rating of 4 – very few problems/works well, and 17% gave a
rating of 5 – excellent/little to no problems. In the category of ease of grading online
assignments, 3% gave a rating of 1 – unreliable/would not recommend, 14% gave a rating of 2 –
many problems/does not work well, 29% gave a rating of 3 – occasional problems/works ok,
38% gave a rating of 4 – very few problems/works well, and 14% gave a rating of 5 –
excellent/little to no problems. In the category of content creation, 12% gave a rating of 2 – many
problems/does not work well, 36% gave a rating of 3 – occasional problems/works ok, 39% gave
a rating of 4 – very few problems/works well, and 12% gave a rating of 5 – excellent/little to no
problems. And lastly, in the category of connecting/embedding to external content, 3% gave a
rating of 1 – unreliable/would not recommend, 6% gave a rating of 2 – many problems/does not
work well, 33% gave a rating of 3 – occasional problems/works ok, 33% gave a rating of 4 –
very few problems/works well, and 24% gave a rating of 5 – excellent/little to no problems.

Figure 10

Survey Question #13
The next several questions on the survey asked participants about music specific learning management systems. Question #14 (see Figure 11) asked ‘Do you use a music specific learning management system (ex. SmartMusic)?’ Almost 2/3rds of participants (22 responses or 64%) indicated they do not use a music specific learning management system, while twelve (or 34%) indicated they do.
Question #15 then asked survey participants that if yes, they do use a music specific LMS, which one did they use. Ten (10) participants said they use SmartMusic, while Essential Elements Interactive, Garageband, Noteflight, and Blue Guitar all were reported once (1 time).

The next question (see Figure 12) asked participants ‘Which music specific learning management system have you heard of? (click all that apply).’ Survey responders could choose from: 1) SmartMusic, 2) Essential Elements Interactive, and 3) Cuttime. SmartMusic was the most heard of with 31 (88%) responses, followed by Essential Elements Interactive with 23 (65%) responses, with Cut Time being the least heard of with 12 (34%) responses.
16. Which music specific learning management systems have you heard of? (Click all that apply)

- SmartMusic: 31
- Essential Elements Interactive: 23
- CutTime: 12

The final quantitative question in the asynchronous teaching and learning tools section asked participants to list any other music specific learning management systems they use and/or have heard of. While some of these tools listed next are not learning management systems, participants listed each of the following once: *Sightreading factory, Musictheory.net, Tone Savvy, Finale, Screencastify, Flipgrid, Upbeat app, Music Play, Blue Guitar, Musescore, and Musicfirst.*

Above, I have described in detail the results of the quantitative questions in from both sectionals of the survey: the synchronous and asynchronous sections of the survey. In the next section I will describe the codes that resulted from the responses to the qualitative questions in both sections of the survey, concerning synchronous and asynchronous learning.

**Coded Responses to Qualitative Questions**

As previously mentioned, of the twenty-four (24) questions on the survey, ten (10) were qualitative. Of these ten (10) questions, two (2) were from the Synchronous Teaching and Learning Tools section of the survey, and seven (7) were from the Asynchronous Teaching and Learning Tools section. I will describe the results for the quantitative questions in the Synchronous Teaching and Learning Tools Section of the survey next.
Qualitative Results for Synchronous Teaching and Learning Tools

The two (2) qualitative questions in the synchronous teaching and learning tools section asked survey participants to describe the positives and negatives they felt about teaching synchronously using video conferencing technology. Answers for both questions fell into the following three categories: 1) teacher perspective, 2) student perspective, and 3) technology/digital tools.

Teacher prospective

Within the teacher perspective category, survey responses for positives of synchronous teaching using video conferencing technology fell into the sub-categories of teacher/student relationships, scheduling/logistics, and other. Participants mentioned that ‘it was helpful to connect with students and actually get to learn about them individually in a different way than I would have in person at school,’ and that they were able to see their practice set up at home. Participants also talked about how it was easier to tailor instruction to individual students’ needs because lessons were individual or small group. Three different participants mentioned being able to see their students’ faces without masks on as a positive. In the sub-category of scheduling/logistics, three (3) participants mentioned not having to travel and the easier scheduling of not traveling as a positive. Two (2) survey responses listed the ability to communicate between lessons, and one (1) participant described virtual faculty meetings as ‘GREAT!!’ Survey responses in the last category consisted of: appreciated having the tools to teach synchronously over not teaching at all, n/a, and ‘None/thank God it’s over!’

Also, within the teacher perspective category, survey responses for negatives of synchronous teaching using video conferencing technology fell into the sub-categories of
teaching and learning, student engagement, and frustration with synchronous teaching using video conferencing. For teaching and learning, ten responses (ten) mentioned in some way difficulty in teaching/correcting student playing position. Two (2) survey participants mentioned student accommodations and interventions are difficult in this format. Other teaching and learning responses included not being able to hear and correct overtones, overall pacing of the lessons are much slower, and there is no way to give real feedback on group practices. In the sub-category of student engagement, seven (7) responses discussed the difficulty from the teachers perspective of knowing if students are engaged, ‘getting it’, or being able to give feedback when students’ cameras are off and microphones are muted. Other responses mentioned relationship building being more difficult and students often ‘feeling exposed or on the spot’ when asked to play something new by themselves. The last sub-category consisted of responses expressing overall frustration with teaching synchronously using video conferencing software. Responses included: staring at a screen all day, music is better taught in person, personally didn’t like it, had to offer multiple work arounds, ‘everything is just wrong with this format,’ and ‘everything else? LOL.’

**Student Perspective**

Within the student perspective category, survey responses for positives of synchronous teaching using video conferencing technology fell into the sub-categories of relationships, lessons, and student accountability. In the sub-category of relationships, participants mentioned positives of synchronous learning being inclusion of all students, easier access to teachers, and they enjoyed ‘the personal interaction during COVID when we were not able to be together in person.’ For the category of lessons, three (3) survey responses discussed how student don’t need to be in the same physical location, making lessons more accessible. Two (2) responses indicated
that students rarely missed lessons or attended more frequently virtually than they did in person. Lastly, for student accountability, participants mentioned students couldn’t rely on watching or listening to classmates, they gained independence playing at home, they could play along with others hearing them, they could hear their individual parts more, and two (2) participants mentioned students took responsibility and accountability for their learning.

Also, within the student perspective category, survey responses for negatives of synchronous teaching using video conferencing technology fell into the sub-categories of student experience, student disengagement, and student information retention. For student experience, four (4) responses mentioned not being able to play in a true ensemble experience. Responses concerning student disengagement included four (4) mentions not participating because they are not face to face, and four (4) mentioned that students who were disengaged or struggling ended up quitting. Lastly, two (2) participants stated that students had difficulty in retaining the information learned during virtual synchronous learning.

Technology/Digital Tools

In the technology and digital tools category, participants listed many positives associated with technology. Eight (8) survey responses mentioned being able to use the camera/share screen/whiteboard functions of video conferencing technology to show physical concepts (such as bowing or finger placement) or music theory up close for students. Three (3) responses mentioned students’ ability to record the meetings at watch again, as well as the live exchange of ideas and feedback in a synchronous setting. Other positives mentioned were chat function, break out rooms for sectionals, and time to work on music theory.
Also, within the technology and digital tools category, survey responses for negatives of synchronous teaching using video conferencing technology of three sub-categories: sound and video lag/latency, sound quality, and general technology glitches. Overall, twenty-one (21) participants mentioned sound and video lag/latency as a negative, and some mentioned this prevented them from playing together as a group. Thirteen (13) survey responses listed sound quality as a negative, and fourteen (14) mentioned general technology issues such as slow internet, app glitches, and technology limitations as negatives.

**Qualitative Results for Asynchronous Teaching and Learning Tools**

Of the seven (7) qualitative questions in the asynchronous teaching and learning tools section, four (4) asked survey participants to describe the positives and negatives they felt about teaching asynchronously, how they use their Learning Management System (LMS) in their classroom, and what digital tools they wish someone would invent to assist with teaching beginning string players virtually. The other three (3) questions asked responders to list digital tools they use in their orchestra classrooms and will be described in a later section of this chapter.

For positives associated with asynchronous learning, participant listed responses that fell into the categories of student habits, student resources, and other. For student habits, eleven (11) responses mentioned students being able to work at their own pace as well as increased student independence. Two (2) responses mentioned students had more access to teachers through office hours. Eleven (11) participants described student access to resources between lessons and synchronous learning as a positive. For the other category, responses included ‘I did not teach asynchronously’ and ‘Yuk. Just no.’
Question #22 of the survey asked participants what they felt were the negatives of asynchronous learning in the beginning orchestra classroom. Sub-categories for this question included: teacher perspective, student experience, and other. For teacher perspective, three (3) responses indicated loss of meaningful feedback for students. One participant wrote ‘The feedback I give them is written – not all of them read it, and therefore don’t learn from it.’ Two (2) participants mentioned difficulty in monitoring student attention. Three (3) participants described feeling disconnected from their students during asynchronous teaching and learning. Two (2) responses mentioned difficulty providing differentiation and accommodations, as well as less content being covered over the course of asynchronous teaching. Three (3) educators described not really knowing if the students are understanding the content, and three (3) also mentioned the amount of time it takes to create content and provide student feedback as a negative. Negatives of asynchronous teaching on the student experience included twelve (12) participants describing poor time management on the students’ end, three (3) responses about student retention of information, and four (4) responses about lack of student interest and social engagement without full group activities. The other category had one (1) response of ‘I did not reach asynchronously.’

In describing the use of their Learning Management System (LMS) in their classroom, participants said they utilized their LMS in the following ways: student assignments, teacher created content, and communication. For student assignments, there were twenty-five (25) mentions of video assignments, either for playing tests or practice logs. Fourteen (14) responses mentioned music theory or music appreciation assignments. Fifteen (15) educators described creating videos for their students and posting or linking them on their LMS. Three (3) responses
described posting music for students to their LMS. Lastly, ten (10) responses mentioned using their LMS to communicate with students and parents.

The next question in this section asked participants to describe what digital tools they wish someone would invent to assist with teaching beginning string players virtually. Tools described by educators fell into the following categories: instrument position/other, notation/fingerboard games, and technology tools. Six (6) responses described a need for a tool to help teach and grade instrument posture and beginning bow motions. Five (5) survey participants mentioned a need for more fingerboard placement and note reading games to help students with all three clefs (treble, alto, and bass). Thirteen (13) responses talked about wanting fixes for technology they are currently using or new technology to help with sound and video quality. Four (4) responses said they did not teach beginners this year.

In the next section I will list the digital tools participants listed as recommendations for use in the string classroom.

Lists of Digital Tools Recommended by Fellow String Educators

The last three (3) qualitative questions asked responders to list digital tools they use in their orchestra classrooms.

Question #19 asked participants to list their favorite tools for teaching tuning. Tools fell into the categories of: app based, web based, and other. For app based tuning tools, participants listed: Instatune, T1tuner, Clear Tone, Piascore Tuner Lite, Simply Tune, Tonal Energy Tuner App, Pano Tuner, Tunable, Soundcorset, Any Tune, InsTuner, and Tunerninia For web based tuning tools, participants listed: online violin tuners, online guitar tuners, the tuner function within SmartMusic, metronome websites, DroneTool.com, and Alexdemartos.ed/ wtuner/. Other
tools recommended by string educators included: teacher led coaching of tuning, *Finale*,
flashcards on *Quizlet*, physical tuners, and *SNARK tuners*.

Question #23 asked survey participants ‘If you could recommend one or two digital tools
to fellow string educators, what would they be and why?’ Answers fell into the categories of
music specific, non-music specific, and other. For music specific digital tools, educators
recommended: *Sound Trap, Smart Music, Sight Reading Factory, Upbeat Perform, TunerNinja, YouTube, Pano Tuner, FLAT Music Notation, Soundiation, Tonal Energy Tuner, Simply Tuner App, Noteflight Learn, Jamulus, Staffwars, Anytune, Kami, Stringskills.com, Garageband,* and their school orchestra Facebook group. Non-music specific digital tools recommended by
participants were: *Screencastify, Google Classroom, Toby, Evernote, Canva, Loom, Gimkit, EdPuzzle, Live Worksheets, Charms Office Suite, Canvas,* and *PearDeck*. Other responses
included ‘There are none I would recommend’ and ‘I struggled with this.’

The last question on the survey, Question #24, ask participants if there were any other
digital tools they would recommend. For music specific tools, educators recommended: making
sure students had a good microphone, teacher created videos, *BandLab for Education, Noteflight, Superstringstudio, Marco Polo, Smart Music, Soundtrap,* and teacher created websites and blogs.
Non-music specific tool recommendations included: a good LMS, *Seesaw, Google Classroom, Gimkit, Flipgrid, Stripe, Paypal, Wave, Calendly, Google Suite,* and *Kami*.

In this chapter, I presented the findings from data analysis and divided this analysis into
the following sections: 1) Overview of survey, 2) Quantitative analysis using descriptive
statistics, 3) Coded responses to qualitative questions, and 4) Lists of digital tools recommended
by fellow string educators. In the next chapter, I will discuss these findings and their impacts on string education, music education, and virtual teaching in the music classroom.

**Chapter V: Discussion and Implications**

In chapters one through four, I introduced this study about digital tools in the beginning orchestra classroom, reviewed the literature related to the study, described the methodology and my approach to analysis, and reported the findings from my data analysis. Here in chapter five, I will discuss themes presented in my data analysis, as well as how these themes connect to the literature I reviewed in chapter two, take-aways from these themes, and what the implications of this research study are on string/music education, professional development specific to music educators, and future research and development in developing digital tools for the string/music classroom.

**Discussion of Themes from Data Analysis**

In looking through the findings from my data analysis, there were several themes that presented themselves. The following themes became evident in my data: 1) Frustration with synchronous teaching through video conferencing technology, 2) curriculum impacts of virtual teaching and learning, and 3) asynchronous teaching and learning in the string classroom. In the next section, I discussed each of these themes and how they connected to my literature review from chapter two.

**Frustration with Synchronous Teaching Through Video Conferencing Technology**

String educators who participated in my survey expressed frustration with student engagement while learning synchronously through video conferencing technology. Many teachers found that students did not want to turn their cameras on while on the video conference. This coupled with students being muted left teachers feeling as if they were ‘teaching to a wall’
and not knowing if their students were ‘getting it’ or not. In my own string teaching, I encountered students keeping their videos off and sound muted as well. However, when I asked students to turn their cameras on or unmute their sound and explained that I need to be able to see and hear them play their instrument to help them the best, I found that students understood and complied. While some students may have had their cameras off because they didn’t want to engage in the content, others may have had them off because they were following classroom norms set by other teachers. In other classrooms, students may have been told to have their cameras off and microphones muted during synchronous learning. We as educators need to set the classroom norms that work best for our discipline and classrooms, both in a physical and virtual setting. As string educators, this means cameras and microphones on when told. If we don’t clearly lay out the expectations for students, we cannot properly address students when they fail to meet those expectations.

Survey participants also expressed frustrations with sound and video quality. One participant described a particularly maddening instance of this when they said, ‘the other problem (more with Facetime than with Zoom) is that I’ll see the student playing, but the sound gets very slow and laggy, then the sound gets fast as the sound catches up with the image.’ Another survey response talked about how the sound quality was directly affected by differing technology: ‘The sound quality varied by device and use of headphones, and often when a student was playing it was super quiet for me – either because Zoom cut down the volume or because their headphones didn’t pick up the sound well.’ Having taught virtually myself all the 2020-2021 school year, I experienced this shift in sound quality because of poor microphones or adjustments by the conferencing software myself and was equally as frustrated by it as this survey participant. As a fellow string educator, I know that being able to see and hear my
students well directly affects the quality of my feedback and my ability to correct any technique
issues, especially at the beginning level.

A sub-category of sound quality that survey responses mentioned more than any other
negative about teaching synchronously using video conferencing software was the presence of
audio lag/latency. One participant described this best when they said, ‘we can’t play in harmony
because one person’s sound is usually ahead of the other person’s sound, and most of the time I
can’t hear the student if I make any noise whatsoever.’ Latency in sound and video did not
facilitate playing together, even just two people, over video conferencing. I experienced this in
my own teaching and was forced to change how I would normally teach. Instead of playing
together at the same time to learn a song, techniques such as echoing small chunks of songs
needed to be used instead. Teachers who responded to the survey said it was very difficult to run
large classes over video conferencing because of the latency creating the inability to play
together at the same time. This difficulty in creating a meaningful large group experience over
video conferencing led many teachers to change how they taught their ensemble classes, leading
to the technology impacting the curriculum.

**Curriculum Impacts of Virtual Teaching and Learning**

As previously mentioned, teaching a large group ensemble in a virtual setting was very
difficult due to latency in sound and video. Many teachers who responded to my survey
mentioned this as a huge struggle for them, and some discussed how this impacted their
curriculum. One participant stated, ‘the biggest change I would say is the total change in
philosophy and curriculum. Our music program is normally very focused on ensemble
performance but with the reality of the situation I found that the most successful units and
activities were actually individualized units where everyone played their own solo. I came up
with a system that worked, but I still felt like I was a private lesson teacher to 50 string students instead of an orchestra teacher.’ I can empathize with this teacher. My large ensemble classes were taught as individual virtual lessons and asynchronous activities for most of the school year last year, and I felt like a private lesson teacher instead of an orchestra teacher. Many of my students expressed missing playing in a group while we were just having individual lessons, and several survey participants mentioned this as well. While this may not seem like a huge switch to the untrained eye, teaching a class individually to students rather than in a large collaborative group setting is a huge curriculum and philosophy switch. To become well-rounded and competent musicians, students must show proficiency at playing music together as a group with different instruments and harmony parts as well as playing as an individual. Due to video and sound latency, much of the large group ensemble curriculum was left out of or severely paired down during fully virtual, synchronous teaching.

Not only did virtual teaching impact curriculum through the changing of the group experience, but it also impacted the way teachers instructed students on instrument position, basic technique, and made accommodations for students. One participant stated ‘It is difficult to teach posture, instrument, position, bow grips, and bow use without being in the same physical space with beginners.’ Another survey response stated they ‘cannot always see the entire students so cannot respond to the posture accurately.’ Because string playing is a very physical and kinesthetic activity, string educators need to be able to see a student’s entire body position to make sure they are holding the instrument correctly, placing fingers in the correct spot on the finger board, and moving the bow in the correct manner. It is very easy at the beginning level to develop poor playing position habits that will detrimentally impact more intermediate and advanced skills the student may learn down the road. When string educators are unable to see
their student’s set up and the student can’t see all the teacher’s playing position, developing these good habits early becomes very difficult. Participants also expressed frustration with helping students in a fully virtual setting. They stated, ‘Student interventions are difficult through virtual formats, especially troubleshooting student’s mistakes,’ and ‘It’s difficult to make accommodations for students who are struggling with a skill, or students who may have other learning challenges to content with.’ All these statements by participants reiterate what Hamann and Gillespie (2019) stated back in chapter two about string educators needed to be within physical proximity to beginning string players to best have the ability to correct instrument posture and troubleshoot student hurdles. One of the ways that participants mentioned they tried to combat this issue was the use of asynchronous teaching tools.

**Asynchronous Teaching and Learning in the Strings Classroom**

Asynchronous teaching and learning was met with many positives and negatives from string educators who took my survey. Many survey participants indicated they created videos for their students to use as a reference that they then posted to their Learning Management System (LMS). As a fellow string educator, I did this as well to hopefully help fill in the gaps in knowledge that may be happening through fully virtual synchronous learning. Teachers described creating videos for students to use as examples of everything from posture to guided practice videos to how a solo piece or their part would sound. String educators described it as a positive that students had access to the resources outside of their lessons that they could reference whenever they wanted, but also expressed as a negative the huge amounts of time it would take to created and post these resources for students. I, myself, felt I spent large quantities of time creating and editing content to post for my students to complete asynchronously to help them continue to progress in their skills. Tying back to the change in curriculum mentioned in
the previous section, this was a huge change in planning and curriculum as well. Preparing lessons and content for a large ensemble class of 50 students is a completely different time commitment and planning strategy than creating and delivering individualized content to 50 students at all different playing levels each week.

Another negative of asynchronous teaching and learning that was mentioned several times by string educators was students lack of engagement with the content they were creating. Understandably so, survey participants expressed frustration at spending so much time creating resources for students that were then not used or rarely used by most of their students. Unfortunately, I believe this probably stemmed from the emergency nature of teaching virtually during a pandemic, rather than a systematic approach to curriculum, as Hash (2020) mentioned back in chapter two. If teaching in a fully virtual format, teachers may have struggled with setting virtual classroom norms when it comes to asynchronous learning. Students, while they live in such a digitized world, are not digital experts and cannot be expected to know how to use the resources given them unless taught. On a similar note, participants mentioned students lacking in time management and completing assignments late or at the very last minute quickly. Again, I believe that this was a side-effect of the emergency nature of our teaching and learning over the past year. Students need to be taught time management, not just in general, but for specific classes. This is harder to teach when in a fully virtual format, but does need to be laid out for students, just like we would work on this with them in the physical classroom.

**Take-aways from the Data Analysis**

After reviewing the data analysis from my survey and how the data connects to chapter two, I have created several takeaways for string educators to use in their classrooms moving
forward, whether that be in a fully virtual classroom, full time in a physical classroom with students, or some form of blended/hybrid classroom.

1. *Find positives in the experience of teaching fully virtual that you can use to enhance your teaching going forward into the future.* Many survey participants mentioned as a positive the resources available to students that they created. While we as string educators may have devoted hours to creating videos now, as our world slowly gets back to normal, we can continue to use these videos and resources for years to come as supplemental resources available on our LMS.

2. *Establish virtual classroom norms just like you would in a physical classroom.* Set expectations for synchronous learning on video conferencing (ex. cameras and microphones on), and teach students how to use your LMS.

3. *Use the Technological, Pedagogical, and Content Knowledge (TPACK) model to help you decide what digital tools work best for your classroom and your student outcomes.* Technology and digital tools will always be evolving, and it is up to us as educators to decide what will help out students achieve their outcomes best, and not just use new technology for the sake of using technology. Use the questions that Bauer (2020) states in chapter two to guide your decision making about digital tools.

4. *Join a community of fellow educators if you aren’t already.* One of my personal takeaways from this research was the importance of collaborating and working with other music and string educators to problem solve and get new ideas for your classroom. Many of the survey responses for digital tools suggested were tools I had never heard of and are ones I will be looking into to see if they would work in my classroom. Since joining and posting my survey to the School Orchestra and String Teachers Facebook group, I’ve also
picked up some great ideas for my classroom. Community is very important, but especially so in times when we need a little extra help.

**Implications**

There are several different implications for my research study. The implications of this research study for string/music education are that we need each other as string and music education professionals to help each other problem solve fully virtual teaching and that not one teacher has all the answers. Also an implication for string and music educators is that we need to make sure we are being diligent about the digital tools we use in our classroom, making sure they serve the need to meet student outcomes. Another implication of this research is the need for professional development specific to music educators. While string educators and music educators can collaborate within their communities for ideas, it is important for school districts and administration to provide string and music educators with professional development specific to their content area, so that educators can use their professional judgement about what digital tools are best for their classroom. Lastly, future research and development in developing digital tools for the string/music classroom needs to take place for digital tools to best serve the string educator and their classroom.

While entirely virtual teaching of beginning string players will hopefully become a thing of the past as society navigates its way out of the COVID-19 pandemic, here are some tips and first steps if a string educator finds themselves in this difficult teaching set-up:

1. *Invest the time and resources into having the proper technology set up.* Look for a microphone for you to use as the teacher to enhance your sound that is being transmitted to your students. Dynamic microphones are best for guitar amps and drums, condenser microphones pick up piano, vocals, and acoustic guitar well, and ribbon microphones are
most adept for brass, strings, and reeds. Take the time to set up your camera or computer web cam at the proper distance so that students can see all of your playing position when you are playing and demonstrating new skills.

2. *Learn the basics of your Learning Management System (LMS).* Whether that means attending a district provided professional development class or watching tutorials on YouTube, having a basic understanding of the functionality of your LMS can help you create supplemental resources for your students to use outside of the virtual classroom.

3. *Set classroom norms and expectations.* While today’s students were born into a world filled with technology, we can’t expect them to know how to use it or what the proper etiquette would be in different virtual settings. Take the time to set classroom norms for synchronous learning and to teach students how to use your LMS.

4. *Join a community of string educators.* Joining a Facebook group of fellow string educators or by joining a professional organization such as the American String Teachers Association (ASTA), you ask other string educators for ideas and help troubleshooting problems with technology or with pedagogy.

5. *Find a mentor within your district or music community.* Finding a mentor within your school district or local music community who has experience teaching in this format or who has experience with technology will help you tackle problems as they arise and support you through the process.

In this research thesis, I set out with the research question of: what are the best digital tools for use in the fully virtual beginning orchestra classroom. I presented an overview of the thesis in chapter one. I discussed current literature on this topic in chapter two. I described my data collection and analysis plan in chapter three. I used descriptive analysis and coding to
analyze my survey responses in chapter four. Lastly, in chapter five, I discussed the themes presented in my data, my takeaways from the data, and implications for my research. While the virtual teaching of the last year was an emergency response to the COVID-19 pandemic, I believe if we as string and music educators take the positives we learned along the way and incorporate them into our classrooms moving forward, we can come out of this chapter in education history being more innovative and successful educators.
References


Pedagogical Approaches in the Virtual Beginning Orchestra Classroom: Best Digital Resources for the Beginning Virtual Orchestra Classroom


Appendix A: Email Script #1

Dear Fellow String Educator,

My name is Emily Scheidegger. I am a string educator teaching 5th through 8th grade orchestra for the School District of Marshfield in Marshfield, Wisconsin, as well as a Music Education Graduate Student at the University of Wisconsin – Stevens Point.

When it came time to decide on my thesis research project for my Master’s work, I reflected upon the challenges the last year has thrust upon us all and the unique difficulties presented by teaching our discipline in a virtual format. I felt I spent so much time trying to decide which digital tools were out there and which would be the most beneficial. It is because of these reasons I decided to conduct my thesis research on what digital tools are available to string educators, what tools work well, what tools don’t work so well, and which tools other string educators would recommend.

Here is where you come in! I’ve created a short survey that I would appreciate your time in completing. The survey will take no more than 20 minutes and will be completely anonymous. Through this survey, I hope to compile a list of digital resources for string educators to be shared through the publication of my thesis at the completion of the thesis project. This survey is completely voluntary, and you may choose not to complete it.

Survey link:

https://forms.office.com/Pages/ResponsePage.aspx?id=rUucIBTfckGH3wYPhPAaERFxCCmOo9Pt55cw1DNyVUMTUzOFRZnkVRVzk5N0xET0dWQjFGSkpSTC4u

Thank you so much for you time in helping to add to the knowledge and field of virtual string education. Please reach out to me at any time with any questions you may have.

Sincerely,

Miss Emily Scheidegger
Music Education Graduate Student
String Educator – School District of Marshfield
Esche724@uwsp.edu
Appendix B: Informed Consent and Survey Questions

Digital Tools in the Virtual Orchestra Classroom
Informed Consent to Participate in Human Subjects Research

By filling out this survey, I acknowledge the following:

Ms. Emily Scheidegger, music education graduate student at the University of Wisconsin-Stevens Point under the supervision of Dr. Rachel Brashier in the Music Department, would appreciate your participation in a research study designed to determine what kinds of digital tools are best for teaching beginning orchestra students in a fully virtual orchestra classroom. You are being asked to complete an anonymous survey that should take up no more than 45 minutes of your time. Your participation is completely voluntary. The benefit of this study is that a greater knowledge about the digital tools available to teachers of beginning string players could benefit all of us who are string music educators.

We anticipate no risk to you as a result of your participation in this study, other than the possible inconvenience of the time it takes you to complete the survey. You could, however, experience some discomfort if you have had an uncomfortable experience with digital teaching tools and completing the survey causes you to remember this.

While there may be no immediate benefit to you as a result of your participation in this study, it is hoped that as a profession we all may gain valuable information about digital tools for teaching beginning string players in a virtual classroom format that will be of future value to society.

The survey is the quickest and easiest method for obtaining this information, but of course you may choose not to participate in the survey if you do not wish to.

The information that you give me on the questionnaire will be recorded in anonymous form. I will not collect any information that could identify you. Your email address will not be recorded by the survey.

Your participation in this study is completely voluntary. If you want to withdraw from the study, at any time, you may stop at any time without any penalty. No identifying information will be retained.

Once the study is completed, you are welcome to email me to receive the results of the study or view my published thesis at the UWSP library website. If you would like to see these results after the study concludes in six months, or if you have any questions in the meantime, please contact: Miss Emily Scheidegger

Music Education Graduate Student – Music Department
Synchronous Teaching and Learning Tools

In this section, the survey will ask questions about what synchronous tools you use in your virtual instruction, how you use them, and your thoughts and feelings about these tools.

1. How many of the following video conferencing technologies have you heard of? (check all that apply)

☐ Zoom

☐ Google Meets

☐ Microsoft Teams

☐ Facetime

☐ Skype
2. How many of the following video conferencing technologies do you use in your virtual instruction? (check all that apply)

☐ Zoom

☐ Google Meets

☐ Microsoft Teams

☐ Facetime

☐ Skype

3. What video conferencing software do you primarily use for either group or individual lesson instruction? (check 1 option)

☐ Zoom

☐ Google Meets

☐ Microsoft Teams

☐ Facetime

☐ Skype

☐ Other
4. For the primary video conferencing technology above, please rate the technology on the following on a scale of 1 (unreliable/would not recommend) to 5 (excellent/little to no problems)

<table>
<thead>
<tr>
<th></th>
<th>1-Unreliable/ wouldn't recommend</th>
<th>2-Many problems/ does not work well</th>
<th>3-occasional problems/ works ok</th>
<th>4-Very few problems/ works well</th>
<th>5-Excellent/little to no problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Video Streaming Quality</td>
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<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Audio Quality</td>
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<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>User friendliness (ease of scheduling, navigation, etc.)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

5. Are you required by your employer to use the video conferencing technology you indicated above as your primary video conferencing tool, or were you allowed to choose what video conferencing tool you wanted to use.

○ Yes, I am required to use my employer sponsored video conferencing technology

○ No, I was able to choose which video streaming technology I wanted to use.

6. If given the choice, would you use a different video conferencing tool than the one you are currently using?

○ Yes

○ No
7. If yes, which video conferencing tool would you use?

8. Please describe some of the positives of teaching synchronously in a virtual format with video conferencing technology.
9. Please describe some of the negatives of teaching synchronously in a virtual format with video conferencing technology.

Asynchronous Teaching and Learning Tools

In this section, the survey will ask questions about what asynchronous tools you use in your virtual instruction, how you use them, and your thoughts and feelings about these tools.

10. Does your employer/school district use a district wide Learning Management System (LMS)?

- [ ] Yes
- [ ] No
11. If yes, what learning management system (LMS) does your district/employer provide for you to use?

- Canvas
- Google Classroom
- Schoology
- Blackboard
- Seesaw

Other

12. How many of the following learning management systems (LMS) have you heard of? (click all that apply)

- Canvas
- Google Classroom
- Schoology
- Blackboard
- Seesaw
13. For your district provided learning management system (LMS), please rate this tool in the following categories on a scale of 1 (unreliable/would not recommend) to 5 (excellent/little to no problems).

<table>
<thead>
<tr>
<th></th>
<th>1-Unreliable/ would not recommend</th>
<th>2-Many problems/ does not work well</th>
<th>3-Occasional Problems/ works ok</th>
<th>4-Very few problems/ works well</th>
<th>5-Excellent/ little to no problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher Navigation</td>
<td>○</td>
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<td>○</td>
<td>○</td>
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</tr>
<tr>
<td>Student Navigation</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Ease of creating assignments</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Ease of grading online assignments</td>
<td>○</td>
<td>○</td>
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<td>○</td>
</tr>
<tr>
<td>Content creation</td>
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<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Connecting/embedding to external content (ex. Youtube videos)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
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</tr>
</tbody>
</table>

14. Do you use a music specific learning management system? (ex. SmartMusic)

- ○ Yes
- ○ No
15. If yes, which music specific learning management system do you use?


16. Which music specific learning management systems have you heard of? (Click all that apply)

☐ SmartMusic

☐ Essential Elements Interactive

☐ CutTime

17. Please list any other music specific learning management systems you've heard of and/or use.


18. Please describe the different ways you use your learning management system to teach your string players in a virtual format.

19. What are some of your "go-to" digital tools for teaching and aiding students with tuning? Do you have a favorite app? Please describe below.
20. What digital tools do you wish someone would invent to aid in teaching beginning string players virtually that you just haven't found yet?

21. Please describe some of the positives of asynchronous string teaching in a virtual format.
22. Please describe some of the negatives of asynchronous string teaching in a virtual format.

23. If you could recommend one or two digital tools to fellow string educators, what would they be and why?
24. Lastly, are there any other digital tools you would recommend to other string teachers to better aid in teaching in a virtual setting?
Appendix C: Email Script #2

Dear Fellow String Educator,

A few weeks ago, you received an email from me asking you to please complete a survey about the digital tools you use in your virtual string teaching. I am still looking for participants if you are able to complete my survey. It should take you no longer than 20 minutes to complete.

Survey link:
https://forms.office.com/Pages/ResponsePage.aspx?id=rUuclBTfckGH3wYPYPhPAaERFxCCmOo9PtP55cw1DNyVUMTUzOFRZNNkVRVz5N0xET0dWQjFGSkpSTC4u

Thank you so much for you time in helping to add to the knowledge and field of virtual string education. Please reach out to me at any time with any questions you may have.

Sincerely,

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