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Dr. Eric M Pennello, Chair

Dr. Christopher Baumgartner

Dr. Lonnie Easter II

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Table of Contents

List of Tables

List of Figures

Abstract

The purpose of this quantitative study was to examine preservice music teachers' perception of their experiences and self-efficacy with music technology in Oklahoma music teacher preparation programs. Specifically, I aimed to answer (a) what experiences preservice music teachers had with music technology during their undergraduate program, (b) the various ways that preservice music teachers were provided opportunities to explore the implementation of music technology in their coursework, field experiences, and student teaching, and (c) how efficacious preservice music teachers felt about utilizing music technology in their future classrooms. Preservice music teachers ($N = 53$) across multiple universities in Oklahoma were contacted to complete an online survey regarding music technology preparation, self-efficacy, and preservice music teachers' planned future implementation of music technology.

Results from this study indicated differences among multiple variables regarding preparedness, confidence in future use, and self-efficacy regarding music technology opportunities and integration into their undergraduate coursework. Overall, preservice music teachers felt unprepared to teach using music technology post-graduation and lacked confidence in teaching music technology. However, preservice music teachers agreed their music technology skills increased after gaining professional teaching experience. Implications for music teacher preparation programs, music teacher educators, and inservice music teachers are discussed.

Chapter 1: Introduction

Technology

The last half century has seen an exponential increase in technology to the extent that it permeates our daily lives. The invention of cell phones, personal computers, laptops, and much more are used daily (Bauer, 2020). In the modern classroom, technology has seen wide usage throughout P–12 (Bowman, 2022). These technological advances have moved from supporting instruction to redefining the way educators go about teaching their classes. The technology used by teachers for developing an understanding of skills and concepts carries over to the classroom in P–12 settings (Bauer, 2020). Technology used to assist and enhance student learning will be further defined as educational technology. Educational technology can most notably be seen with the advent of smartboards. As computers and internet-based software became more relevant in general education classrooms (Hungate, 2016), so did their use in music classrooms. As music teachers began utilizing educational technology, they also looked at music-specific technologies to support and enhance their classrooms.

Music Technology

Music technology contains many overarching types with varying definitions. Bauer (2020) defines music technology as technology used to assist, enhance, and redefine student's musical learning. The music technology that will be discussed in this section will not be exhaustive and include the prominent types of music technology featured in recent (~20 years) scholarly research focused on music education aspects. The types of music technology that will be mentioned include music production

software (e.g., Ableton, Pro Tools, GarageBand, FL Studio), music notation software (e.g., Finale, Sibelius, NoteFlight), music teaching software, drill writing software, metronome, tuners, drones, audio/video playback software, and inventory management software (Aziz, 2013; Bula, 2011; Emo, 2022; English et al., 2021; Hawkins, 2018; Pondaco, 2021; Powell, 2019; Spieker, 2020; Toki, 2020; Villani, 2014).

Music Technology in Teaching

As with subject-specific technologies of other subjects in P–12, music-specific technologies developed that enhance and redefine how we create, listen, respond to, and perform music. These technologies range from audio playback software on our cell phones to digital audio workstations (DAWs) for music producers (Bauer, 2020). Music teachers have long advocated for the importance that technology could have on the teaching of our students (Bannerman & O'Leary, 2021; Dammers, 2013; Dammers, 2010; Dorfman & Dammers, 2015; Dorfman, 2008). The extant literature contains many that discuss new courses being developed that are rooted in technology or seek to find innovative ways in already existing music courses. Music technology has found benefits in various teaching settings ranging from music technology-based classes (Dammers, 2013; Dammers, 2010) to traditional music classes enhanced with technology and music technology (Bannerman & O'Leary, 2021; Dorfman, 2008; Dorfman & Dammers, 2015; Russell, et al., 2003). Music technology is employed in various settings, such as elementary school (English, et al., 2021; Powell, 2019; Tokie, 2020), middle school (Bula, 2011; English et al., 2021; Hawkins, 2018; Powell, 2019), and high school (Aziz, 2013; Bula, 2011; Emo, 2021; Hawkins, 2018; Pondaco, 2021;

Powell, 2019; Villani, 2014). Researchers have shown through their investigation that technology is not used largely for music purposes as opposed to administrative duties (Bannerman & O'Leary, 2021).

The idea of technology-based music classes (TBMCs) has been discussed and explored through numerous studies and extensive research by Dammers and Dorfman (2015). TBMCs have been found to not pull from band, orchestra, and choir classes and draw upon the nontraditional music student (Dammers, 2013). As many practicing music teachers begin to teach music technology or create TBMCs, they must be aware of the vast music-teaching software available (Hungate, 2016). Hungate (2016) created an exhaustive list of available music technologies and how they can be used in classrooms to teach students musical concepts and skills. This document (Hungate, 2016) focuses on music technologies related to the sense of time, rhythm, ear training, composition, improvisation, and general music theory.

Amongst the many teachers creating music TBMCs, there are those who use music technology to enhance their existing classes. Bauer (2015) has investigated teaching strategies employing music technology and how teachers can incorporate music technology into their classrooms supported by fine arts standards and compiled various music technologies that can be utilized to meet each of the fine arts standards (i.e., creation, performance, responding, and connecting). Dorfman (2008) found that a higher level of comfort resulted in more technology usage and revealed a disparity in technology usage between teachers and students. Additionally, Dorfman found that teachers used technology more in the classroom than the students. Furthermore, while

teachers used technology more than their students, that gap in usage came from general technology rather than music technology.

Among the music teachers that use technology, it has been found that music technology was not as frequently used as general technology and that most of the general technology usage was for administrative duties. Music teachers in Ohio were surveyed about music technology use and integration and it was found that a higher level of comfort resulted in more technology usage and revealed a disparity of technology usage between teachers and students with teachers using technology more than the students (Dorfman, 2008).

Research conducted in Massachusetts involved investigating the usage of technology by teachers (Russell et al., 2003). Researchers found that technology was mostly used for preparing and not for delivering instruction. They concluded that in order to prepare teachers to use technology, teachers need to have opportunities to see and experience the positive effects technology can have on learning (Russell et al., 2003). While some researchers have reported a lack of music technology usage in teachers other researchers have reported differently.

Practicing music teachers have reported using technology for a variety of purposes daily, but mostly in passive ways (e.g., viewing websites and streaming videos) (Bannerman & O'Leary, 2021). The rate of integration of technology in the classroom by teachers was impacted by negative attitudes (Dorfman & Dammers, 2015). These negative attitudes can be resolved by having opportunities to see and

experience the positive effects technology can have on learning (Russell et al., 2003) and professional development for in-service teachers (Meltzer, 2001).

Professional Development

Teachers have identified that they have felt left behind by the changing technologies as it was not what they were taught when they were preservice music students. Technology developments occur rapidly, often resulting in software and hardware used in classrooms becoming out-of-date. Many teachers have found difficulties in adjusting to the speed of technological changes that surround them (Bannerman & O'Leary, 2021; Powell, 2019; Zelenak, 2015). Professional development has been increasingly important to inservice teachers (Emo, 2022; Powell, 2019; West, 2021; Zelenak, 2015) who normally would lack the time and resources to train themselves in emerging music technologies.

How professional development is situated has changed in the last couple decades with the advent of the internet and the world wide web creating new ways for professional development to occur. West (2021) investigated music teacher professional development practice and policies in the United States between the years of 1993 and 2012. Findings indicated deficiencies in professional development in areas of social interaction, voluntariness/autonomy, sustained duration, and relevance. Professional development sessions regarding technology were valued as highly as music content specific professional development. West (2021) also found that professional development policy support was inadequate among music teachers.

Previous research has investigated inservice teacher professional development with music technology (Emo, 2022; Powell, 2019; West, 2021; Zelenak, 2015). Emo's (2022) research highlights the importance of bridging the gap between the music teacher's content knowledge of music production software and the idea of the "digital musician". Emo found that time, blended learning design, facilitation, and videos had impacts on learning throughout professional development of inservice music teachers. Similar success was found in Zelenak's (2015) prior research regarding the impact of professional development regarding music technology teaching practices and attitudes in K–12 teachers. As more support is drawn to professional development of music teachers that are currently teaching P–12 music classes, similar considerations and re-evaluation of what should be taught is being researched at the collegiate level for preservice music teacher (PMTs) and the faculty that teach them.

Undergraduate Music Programs

Technology has seen a steady increase in usage among faculty, staff, and students alike at the collegiate level. Within music education, undergraduates are aware of the increasing importance of music technology (Kugelman, 2021). Researchers have advocated for a push to prepare PMTs to use music technology in their future careers (Bannerman & O'Leary, 2021; Cremata, 2010; Haning, 2016; Meltzer, 2001; Parasiz, 2018; Winterson & Russ, 2009).

Student Perceptions

Researchers in multiple states have previously investigated music technology in undergraduate music programs. Haning's (2016) study found, an investigation found

that 63% (n = 29) of undergraduate music education students had taken a required technology course relating to the topics of music notation software, sound mixing, and editing with only 57% (n = 26) of participants felt prepared to teach with these technologies. A study done by Kun Li (2023) found that technological self-efficacy, attitudes towards technology, and perceived ease of use of technology were all statistically significant predictors of technology integration.

Previous researchers have investigated the impact of not having prior experiences with music technology in undergraduate music programs. Meltzer (2001) found that freshmen music majors were comfortable with technology they had used at home, but their experience of music technologies was limited and low in confidence. Prior researchers suggest that technology in music courses is underutilized and that music software (e.g., Finale, Sibelius) is utilized more than hardware (e.g., harmony directors) (Parasiz, 2018). The software used in class used by students was mainly audio and video playback software while music creation software and digital audio workstations were used the least (Parasiz, 2018). The extant research illustrates a broad issue that involves music faculty of PMTs. PMTs' level of preparedness and efficacy in teaching with music technology is often reflective of the emphasis placed on technology by their instructors.

Faculty Experiences

The design of a music technology course for PMTs has been investigated by previous researchers. Meltzer (2001) recommends the development of a curriculum for a dedicated music education technology course and strategies to incorporate technology

experiences in the music education curriculum. Meltzer's statement aligns with faculty in undergraduate music programs who want to increase the integration of music technology into the curriculum. Cremata (2010) suggested the creation of a music technology techniques course, employing a music technology specialist, and other affordable solutions for incorporating into music education. The music education programs, and faculty prepare their students for the teacher licensure exams that contain music technology competency. Similarly, Bula's (2011) dissertation consisted of informally gathering information regarding technology-based music classes taught in secondary schools for future potential curriculum. The researcher draws from the survey and related literature to develop a plan for implementing a technology-based music class.

Doherty (2021) investigated self-efficacy of music teachers using Bauer's MT-PACK. The study investigated music teachers levels of self-efficacy regarding technology implementation, areas of impact on the TPACK domain, relationship between music teacher self-efficacy and content knowledge, technological knowledge, and pedagogical knowledge, and the percentage of self-efficacy variance explainable by TPACK. Doherty found that there was a strong correlation between pedagogical self-efficacy and content self-efficacy, technological self-efficacy may be a strong predictor of overall music teacher self-efficacy, and that gender was a predictor of technological self-efficacy in this study. The perceptions and values that undergraduate music students and professors place on music technology affect not just the individual courses

but also the curriculum that structures the degree plan for undergraduate music majors within higher education.

Music Education Curriculum - Oklahoma

Integrating music technology into educational practices can impact both the teaching and learning processes. In chapter seventeen from *Musicianship-focused curriculum and assessment*, Bauer (2015) discusses the roles by which music technology can be used in teaching, learning, and assessment for teachers and students. He discusses various models of technology integration from techno-centricity, the Technological Pedagogical and Content Knowledge (TPACK) model, curricular development, Universal Design for Learning (UDL), and the SAMR (Substitution, Augmentation, Modification, Redefinition) model. This chapter also states ways that technology can be used for formative and summative assessments in written and performance-based assessment. Bauer explains how music technology can be used to enhance traditional practice like tests, performance-based assessments, and portfolios that can be easily managed and analyzed.

The examination of music technology implementation into curriculum in other universities provides important insights into how curriculum is changed and the barrier to music technology integration. Kladder (2017) examined and compared two music education degree programs in the United States where faculty had redesigned the curriculum. The limitation of surrounding secondary music programs beyond the traditional ensemble classes negatively impacted the perceptions of faculty and students on the utility of a music-specific technology course in both cases. Winterson and Russ

(2009) conducted a survey of undergraduate students that examined factors regarding their area of study. It was found that higher education should build on a wider range of music that students are now familiar with rather than Western classical music.

Mathews and Johnson's (2017) study explored pre-service music teachers' perceptions and usage of online technology. Findings highlight the importance of strategies to instruct, motivate, and evaluate these pre-service music teachers as they navigate 21st century skills and teaching skills. Authors suggest investigating effective ways that pre-service teachers integrate subject specific software in classroom instruction. As we investigate the related literature on the topic on curriculum for music teacher preparation programs, the standards that indicate what teachers should focus on and what should be taught in both public school and higher education affect the potency of music technology in both of these areas.

As PMTs reach the end of their coursework, they traditionally apply for a teacher license which consists of two professional competency-based certification exams. In Oklahoma, these two exams are the Oklahoma Subject Area Test (OSAT) and the Praxis Performance Assessment for Teachers (PPAT). The OSAT has a separate vocal/general and instrument/general exam depending on the preservice teachers' degree emphasis (Certification Examinations for Oklahoma Educators). In the OSAT, Competency 008-Understanding principles of music methodology mentions "Demonstrate knowledge of how to use technology in the music classroom (e.g., MIDI, sequencing and notational software programs, sound-system setup, recording equipment)" (Certification Examinations for Oklahoma Educators).

Standards

Standards indicate what should be the focus of teaching in our areas. These standards also indicate major concepts and skills that are to be learned by the students and encompass grades P–12. The Oklahoma State Standards for Fine Arts (2023) categorizes the standards into four processes creating/creative process, performing/production, connecting/cultural and historical perspectives, and responding/aesthetic response and critique methodologies. Music educators align educational outcomes with standards developed by NASM, NA*f*ME, CAEP and state and local agencies (e.g., Oklahoma State Department of Education).

The National Association of Schools of Music is an organization that aims "to advance the course of music in American life and especially in higher education, to establish and maintain threshold standards for the education of musicians, while encouraging both diversity and excellence, and to provide a national forum for the discussion of issues related to these purposes." Within the standards set forth by NASM, there are multiple mentions of technology and music technology. Sections III.J.2.A – G indicate that music technology has expanded possibilities for music educators in higher education.

The National Association for Music Education (NA*f*ME) has multiple sets of standards that illustrate what should be taught in music curricula in public schools on the national level. NAfME's 2014 music standards contain music standards for PK–8, composition/theory, music technology, guitar/keyboard/harmonizing instruments, and ensembles.

In the Oklahoma Academic Standards for Fine Arts (2023), technology usage is found throughout standards for music in elementary, middle, and high school settings. Within elementary school, Oklahoma requires music students to utilize technology as stated under this creation standard: "1.M.CR.1.2 Improvise melodic and rhythmic answers with or without a system of syllables, numbers or basic notation using voice, classroom instruments, or technology to demonstrate basic notation." (Oklahoma Department of Education). While the standards and music education curricula has defined the need for music technology skills in our public-school music students, there is a lack of research and teaching of that in the inservice music teachers and preservice music teacher education. The examination of the standards in music teachers and where music technology is placed within it can affect successful implementation and confidence in adherence to standards that call for music technology.

Self-Efficacy

The concept of self-efficacy is shaped and defined by Albert Bandura's social cognitive theory (Bandura, 1997). Self-efficacy is defined as one's belief in their ability to perform a given task. According to Bandura, schools are a favorable environment for developing self-efficacy beliefs (Zelenak, 2020). Self-efficacy varies in level and strength. These factors are influences by previous experiences with the task and the success and failure that is associated with these previous experiences (Bandura, 1997). The level of self-efficacy a person has regarding a given task can influence self-regulation, practice, and achievement (Zelenak, 2020). If practicing teachers and PMTs are not confident or do not see themselves as being able to successfully teach around

music technology, then there is a need to investigate music technology and PMTs perception, attitude, and general self-efficacy with music technology.

Researchers in music have investigated self-efficacy through the lens' of in-service music teacher's, piano instructors, and PMTs (Biasutti et al. 2021; Bradley 2016; Ostrosky 2023; Xu 2023). Biasutti and others (2021) examined the factors that influence to professional self-efficacy in music teachers and found difference in qualities of self-efficacy between male and female music teachers. Ostrosky (2023) studied self-efficacy in piano instructors when teaching students with neurodevelopmental disabilities. In preservice teacher education, Xu (2023) examined PMT's self-efficacy, preparedness, and commitment to incorporating popular music into their future P–12 classroom. Xu found that there is a positive correlation between a person's self-efficacy and their commitment to teach various musical genres.

Need for Study

Recently, research into music technology uses in classrooms has increased with the proliferation and accessibility of music software such as digital audio workstations, video/audio playback software, music notation software, and music instructional software (Bauer, 2020). The increasing quantity of music technologies has caused concerns in preparation and classroom instruction for inservice teachers, PMTs, and university professors (Cremata, 2010). Inservice teachers have obtained new attitudes and strategies from professional development and other continuing education regarding music technologies (Emo, 2022; Minott, 2015; Powell, 2019; West, 2021; Zelenak, 2015). PMTs and university faculty desire to incorporate additional music technology

into preservice music education and feel it is overdue (Cremata, 2010). Existing studies in the literature are either outdated (Brush et al., 2008; Meltzer, 2001; Russell et al., 2003), focus fully on inservice music teachers (Bannerman & O'Leary, 2021; Dorfman, 2008; Dorfman & Dammers, 2015; Meltzer, 2001; Russell et al., 2003), high school students (Bowman, 2022), preservice teachers in their field experience at the end of their degree (Kugelman, 2021; Parasiz, 2018), or are done in other parts of the United States (Holliman, 2021; Russell et al., 2003). There is a lack of research with PMTs in the state of Oklahoma.

Purpose of the Study

The purpose of this quantitative study was to examine preservice music teachers' perception of their experiences and self-efficacy with music technology in Oklahoma music teacher preparation programs. Preservice music teachers across multiple universities in Oklahoma were contacted to complete an online survey discussing music technology preparation, self-efficacy, and preservice music teachers planned future implementation of music technology.

Research Questions

The following three research questions guided this study:

1. What experiences did preservice music teachers have with music technology during their undergraduate program?
2. What opportunities were provided to explore the implementation of music technology during preservice education, field experiences, and student teaching?

3. How efficacious were preservice music teachers about technology in their future classrooms?

Definitions

1. The term *educational technology* refers to technology used to assist and enhance student learning.
2. *Music technology* refers to technology used to assist and enhance student's musical learning.
3. *Preservice music teacher* refers to any undergraduate music students currently enrolled in a music teacher preparation program.
4. An *in-service music teacher* is an active and working music educator in a public-school setting.
5. The term *self-efficacy* refers to one's belief in their ability to perform a given task.
6. The term *music production software* refers to digital audio software programs that contain multitrack recording and editing.
7. The term *music notation software* refers to software that is used to edit, create, play, and print sheet music.
8. The term *music teaching software* refers to software that is designed to assist with music performance skills.
9. The term *drill-writing software* refers to software used to create, visualize, and refine marching band drill parts.

Delimitations

1. Study participants included undergraduate music education students ranging from freshmen to seniors at accredited schools of music within the state of Oklahoma as determined by the National Association of Schools of Music (NASM).

Chapter 2: Review of Literature

The purpose of this quantitative study was to examine preservice music teachers' perception of their experiences and self-efficacy with music technology in Oklahoma music teacher preparation programs. This chapter aims to provide more detailed review of related research to music technology, inservice teacher relation with music technology, undergraduate music education curriculum, student and faculty perceptions, standards, and self-efficacy.

In chapter one, I provided an overview of music technology and the impact it has had on inservice teachers, undergraduate music education curriculum, students, and faculty, fine arts standards, and self-efficacy of them. In this chapter, I will explore in greater depth, the extant research related to these topics.

Music Technology

Defining what music technology is has been the subject of many researchers (Bauer, 2020; Rees, 2012). Rees (2012) proposed a more comprehensive definition of music technology to account for the vast expansion of the field in recent years, defining it as "the systematic study of tools and techniques for music production, performance, education, and research" (Rees, 2012). Bauer (2020), however, defines music technology as, "Technology that can be used to develop an understanding of concepts and skills related to creating, performing, and responding to music". These researchers address the growing field of music technology and the interdisciplinary studies that music technology plays a role in as it becomes more pervasive in public schools.

The majority of technology used by teachers has been found to be general technology and not subject specific technologies (Bannerman & O'Leary, 2021; Merrick & Joseph, 2023). Merrick and Joesph (2023) explored the types of devices and technologies that teachers used in music education and their confidence in using ICT. The findings from the survey ($N = 105$) indicated that laptops were used the most than any other device during the pandemic. The respondents preference for software usage showed that music software was only third in the list of software types organized by mean rating. Teachers indicated that technology is important and valuable to teacher development and that they need to have digital literacy, access to software, and more confidence and experience (Merrick & Joseph, 2023).

The types of music technology utilized in schools have been the topic of investigation for researchers (Aziz, 2013; Bowman, 2022; Bula, 2011; Hungate, 2016; Merrick & Joseph, 2023). Aziz (2013) examined the usage of music education software in high school music teachers ($N = 21$) in Tennessee and found that SmartMusic ($n = 11$), Finale ($n = 8$), and Sibelius ($n = 5$) primarily in individual lab work and group presentations. These technologies were used weekly and only for 15 minutes or less during class (Aziz, 2013). Many public schools have begun to incorporate technology-based music classes (TBMC).

Previous researchers have worked to compile a working list of music technology for inservice teacher usage. Hungate (2016) examined varying music software to provide high school music teachers with music technology software and techniques that can be used in their classrooms to enhance student learning and strengthen traditional

choir, orchestra, and band programs. The research examines currently available technologies that Windows and Apple operating systems can use on mobile, tablet, and computer devices. This list was organized alphabetically and by musicianship skills such as time, sight-reading, general music theory, singing and playing in tune, improvisation, and composition. The author's aim is that this research can be digitized for public use by teachers and students.

The Yamaha Vocaloid software was investigated for use in Japanese elementary schools by Tokie (2020). The author notes that the Vocaloid software allowed pupils to visualize and simplify musical concepts and allowed the students to easily integrate the individual and groups into the larger class project. The technology also enhanced the teacher's ability to explain difficult musical concepts.

Josh Bula (2011) compiled information regarding technology-based music classes (TBMC) (i.e., classes being taught, types of students enrolled, and resources to use in the future development of similar courses) from secondary school music teachers ($N = 307$). The TBMCs did not pull from the traditional COB classes and nontraditional music students were the majority of enrollment in these classes. The schools provided TBMCs mostly through Electronic Music and Sound Engineering classes (Bula, 2011). The majority of these classes were opened to all students regardless of previous musical knowledge ($n = 43$). The funding for these classes was primarily from school budget requests and grants.

In recent years, the COVID-19 pandemic saw an increase in technology usage by teachers to navigate distanced learning. Bowman (2022) investigated the perceptions

of secondary school music teachers ($N = 23$) of music technology integration during the COVID-19 pandemic. They had access to varying subject-specific software, but training for these programs was lacking for music teachers. The lack of training in music technologies created challenges for music teachers to teach choir, orchestra, and band classes, select specific technologies and to incorporate them into large ensemble-based courses (Bowman, 2022).

Section Summary. Researchers have explored the types of music technology in schools in the United States (Aziz, 2013; Bowman, 2022; Bulla, 2011). From their research, they found that many teachers did not teach or integrate music technology into their classes. The researchers found that a lack of training in discipline-specific hardware/software and funding attributed to reasons why teachers are unable to integrate technology in their classrooms (Bowman, 2022; Bulla, 2011). Researchers also analyzed the types of music technologies used and found that music notation software (Finale and Sibelius) and music learning software (SmartMusic) were mainly used in music classrooms that integrated technology (Aziz, 2013). Other researchers have gathered resources for music technology integration for teachers (Bulla, 2011; Hungate, 2016).

Music Technology in Teaching

The emerging importance of technology in schools has prompted researchers to investigate usage of music technology by inservice teachers more closely (Dammers, 2013; Dorfman & Dammers, 2015; Dorfman, 2008; Gilbert, 2015; Hawkins, 2018; Holliman, 2021; William & Dammers, 2014). Dammers (2013) examined 10% of

public high schools in the United States (N = 1830) to find how many offer music classes that utilize technology and the nature of these classes. Administration and teachers at these high schools were contacted to provide their experiences and offerings at their high schools.

Only (n = 74) 14% of respondents indicated that a TBMC was offered. Those that responded no (n = 444) were asked if it was possible for a TBMC to be offered at their school to which a majority (n = 249, 56%) responded "yes." Principals had positive feelings regarding these classes and these classes were attended by nontraditional music students and did not pull from choir, orchestra, and band (COB) populations. Results indicated that most of these classes were created within the previous five years, and the prior music technology experience that these teachers had were mostly from self-study. Many respondents created these classes to attract students outside of COB. The author suggests that preservice educators should graduate with technology skills pedagogically and content-wise (Dammers, 2013).

Technology usage in teachers has been investigated in various parts of the United States (Dammers, 2013; Dorfman, 2008; Dorfman & Dammers, 2015; Holliman, 2021; Russell et al., 2003), but none of my research found any studies done in Oklahoma. In Massachusetts, researchers (Russell et al., 2003) investigated how teachers (n = 4,400) use technology for professional purposes, examined the relationships between teachers' comfort and beliefs of technology, and the extent that beginning teachers align with comfort and beliefs of technology as compared to older teachers. Technology was mainly used for preparing and not for delivering instruction.

Teachers' attitudes and beliefs toward technology are important in their decision to use them in their classrooms. Dorfman (2008) found that teachers use technology more than their students in the classroom and teachers were more comfortable with using technology for non-musical tasks. School leaders were found to be unaware of how teachers use technology and ways to evaluate uses of technology (Russell et al., 2003). These studies indicate that to prepare teachers for technology, they need to have opportunities to see and experience the positive effects technology can have on learning.

The Covid-19 crisis became a point of research by past researchers in technology. Holliman (2021) investigated technology integration in K–12 classroom (*N* = 58) after Covid-19 in four southeastern states (Alabama, Arkansas, Louisiana, and Mississippi). Findings from this study (Holliman, 2021), indicate an increased use of video conferencing, online platforms, and music education apps developed for mobile and tablet devices.

Dorfman and Dammers (2015) examined the factors that lead to successful technology integration in music classrooms in several US states (*N* = 116) (Alabama, Alaska, Arkansas, California, Illinois, Iowa, Florida, Kentucky, Massachusetts, Montana, New York, and Texas). Through their research was no significance in successful integration between teachers of different geographic regions and socioeconomic status and contradicts the notion that some types of teachers are more willing to integrate technology into the classroom. From the response it was concluded that negative attitudes can impact successful integration of technology into the

classroom. Findings also indicated that the training that signified the most successful integration was training that was sought out by the teachers on their own.

Music notation software was the most common music technology used by teachers (Dorfman, 2008; Villani, 2014). Dorfman (2008) indicated that higher level of comfort resulted in more general technology usage but were less comfortable with using technology for musical tasks aside from music notation software. Dorfman, in this study, also found a disparity of technology usage between teachers and students. The author states that teachers are not comfortable enough with technology to teach it to other, limited access to hardware and software restrict the expectations that teachers can place on students, teachers lack pedagogical knowledge of using technology in classrooms, and teachers are not interested in using technology (Dorfman, 2008).

The experiences that inservice teachers had with music notation software have been investigated by past researchers. Villani (2014) investigated music notation software being used by high school music teachers ($N = 3$). Researchers explored the experiences teachers had with music notation software in their classrooms, student learning outcomes through using music notation software, and the influence that music notation software has on teaching practices of high school music teachers. The participants from these studies indicated that music notation software was useful and that the students of these classes were positive about its inclusion.

Gilbert (2015) examined the technologies used in first-year instrumental music settings and examined the factors that influenced the attitudes of teachers ($n = 23$), students ($n = 224$), and parents ($n = 222$) towards these technologies and found that

there has not been much growth in technology usage among music teachers despite the prevalence of a wide variety of music technologies.

Among the technologies that teachers used, their purpose was relegated to accompaniment, recording, and assessment. Teachers were found to be the prominent driver of technology usage in the classroom, with the students having less interaction with the technology (Gilbert, 2015). The teachers who did not use any technology in their classes felt they lacked time, had difficulty traveling between schools, and had difficult schedules. The researcher also found that as students and parents' attitudes towards technology increased, so did perceived usefulness. This study also discovered that teachers had the highest attitude towards technology and students had the lowest attitude.

Technology integration in choral settings has been investigated by past researchers. Hawkins (2018) examined use of technology-assisted assessment tools by secondary choral music educators' ($N = 658$), their perceptions of efficacy in using technology for assessment and technology use of secondary choral music educators'. Hawkins found that choral music educators' use technology-assisted assessment tools less frequently than peers in other disciplines, with many choir educators stating that they never use technology for many aspects of choir assessment. As choir directors become familiar with technology their efficacy will increase. The researcher recommends that school administrators provide time for teachers to incorporate technological tools into their curriculum and assessment.

Researchers have compiled literature reviews compiled literature reviews surrounding the growing number and nature of technology-based music classes in the United States (Williams and Dammers, 2014; Bula, 2011). These articles briefly discuss the types of students that enroll in TBMCs and the history of research on this topic, while discussing the stories of music teachers that have built their own music technology programs and contributed to in various ways to provide music teachers with resources to assist them in building their own music technology programs.

These investigations into the status of music technology in public school teaching have brought to light the various barriers and challenges that music teachers encountered when researching music technology in the classroom (Bulla, 2011; Bowman, 2022; Gilbert, 2015; Dorfman, 2008). The reasons that researchers found for teachers not using music-related software in teaching ranged from size of school, enrollment numbers, lack of funding for additional teachers, equipment, hardware, and software, training/professional development, resources, support, and scheduling (Bula, 2011; Gilbert, 2015; Dorfman, 2008; Holliman, 2021).

Professional Development

Professional development has been examined by many researchers with some developing professional development sessions for various music technologies. Emo (2022) conducted a case study of inservice music teachers in a professional learning development based on Ableton Live and Push. This research focused on supporting secondary school music teachers who had no prior knowledge of music technology but were interested in learning music technology to teach digital musicians. The

professional learning development occurred over twenty weeks. Findings emerged in four themes: time, videos, facilitation, and use of blended learning design. The author states that the time range can be a guideline for the participants and that an area of consideration for future research is in pre-service music teacher education (Emo, 2022).

Powell (2019) examined the successes and challenges of music technology integration into popular music ensembles by music teachers ($N = 168$). The findings from this study indicated that a majority of modern band teachers used music technology in their program ($n = 142$). Of those that did incorporate music technology, the most common technology used was a SMART board or a project, with phones, GarageBand, and iPads following it. These teachers found higher student engagement and success from integrating technology into their classes. The challenges that these teachers faced include lack of access to hardware and software, lack of budget to purchase music technology, lack of training, lack of time, and the Department of Education blocking websites that these teachers used frequently (Powell, 2019).

The quality and focus of professional development for inservice music teachers has been examined by previous researchers. West (2021) examined and evaluated music teacher professional development practice and policy in the United States between 1993 and 2012. West inquired about the projection of professional development (PD) practice and policy and the effectiveness of PD. The author drew data from the Schools and Staffing Survey (SASS). Instructional technology was the most prominent nonmusic focus, with over half of music teachers reporting participation. Technology related PD was the second highest intense (i.e., 32 or more hours) PD type. From the findings,

there were improvements in content between 1993 and 2012, but there existed deficiencies in social interaction, voluntariness/autonomy, sustained duration, and relevance. Policy support from teachers was also inadequate.

The outcomes of technology related professional development have been investigated by past researchers. Zelenak (2015) examined the impact of a professional development program in technology on K–12 music teachers practices and attitudes. There was found to be significance in perceptions of participants' technology use from perceptions of non-participants, and between secondary and elementary teachers. Secondary school teachers reported higher levels of technology use than elementary level teachers (Zelenak, 2015).

The second phase of this study (Zelenak, 2015) consisted of an interview questionnaire and interviews of 40 music teachers that completed the professional development program. The questionnaire addressed their self-perceptions and attitudes about technology, opinions of instructors, program content, equipment, learning environment, learning process, and program outcomes (Zelenak, 2015). Emerging themes from this section include changes in the use of technology, changes in instructional practices, changes in attitudes about technology, and specific program feedback (Zelenak, 2015).

Section Summary. In music education research, many studies examined technologies and music-specific technologies that are utilized by inservice music teachers (Dammers, 2013; Dorfman & Dammers, 2015; Dorfman, 2008; Gilbert, 2015; Hawkins, 2018; Holliman, 2021; Russell et al., 2003; Villani, 2014). The teachers of

music technologies courses in high school were found be taken by mainly non-traditional music students and not those in band, orchestra, or choir (Dammers, 2013). The technologies that music teachers used were dependent on their familiarity and comfortability with general and subject-specific technologies (Dorfman, 2008). Barriers to incorporating music technology were found to result from lack of training, inadequate access to hardware and software, and budget constraints (Hawkins, 2018; Powell, 2019; West, 2021; Zelenak, 2015). Researchers believe the route to increasing level of comfort and confidence with teaching music technology lies in providing opportunities to positive effects and experiences that music technology can have in the classroom (Emo, 2022; Russell et al., 2003; Villani, 2014).

Undergraduate Music Programs

Student Perceptions

Music technology has been the focus of researchers in the last decade (Bannerman & O'Leary, 2021; Haning, 2016; Matthews & Johnson, 2017; Li et al., 2016) with some research being done at the turn of the century (Meltzer, 2001). Bannerman and O'Leary (2021) examined preservice music teachers' (PMTs) use, views, and experience with music technology in teaching and learning among collegiate members ($N = 360$) of National Association for Music Education (NA*f*ME).

PMTs' attitudes toward technology in music education were very positive and indicated interest in learning technology for teaching. Music technology usage was less than general technology usage and most of the technology usage was for administrative duties. The experience of music technology in respondents was greatest for music

notation software, but noticeably weak in music creation software, sharing music online, recording and editing audio, working with music teaching software, and working with MIDI interfaces. Technology was used for various purposes daily, but mostly in passive ways. PMTs were most comfortable using music technology common to undergraduate music curricula and less familiar with technology used in K–12 music classrooms. The authors indicate that teacher educators should "consider the nature of their students' technology use as they include technology in coursework" (Bannerman & O'Leary, 2021).

Haning (2016) investigated the type, quantity, and effects of technology instruction on undergraduate music education students ($N = 46$). The author felt that more research was needed to identify trends in technology instruction for PMTs. Results indicated that 63 percent of them ($n = 29$) had taken a required technology course with music notation software, sound mixing and editing to be the most common topics discussed. Participants felt they were not prepared to use the technologies in their future classrooms. Although only 43 percent of participants ($n = 20$) felt prepared to teach with these technologies (Haning, 2016).

Meltzer (2001) surveyed undergraduate music education majors ($N = 311$) to develop a tool to assess the technology beliefs of this group in universities in several states (Illinois, Iowa, Michigan, and Pennsylvania). Results from this study indicated that students were comfortable with the technology they had used at home, but their experience of music technologies needs to be improved and broadened. It was found that not many music teachers were providing an interactive technological experience

that promoted musicianship. The data in this study can be generalized across the undergraduate music curriculum, as there were no significant differences in technology experience between performance and education majors. Meltzer recommends the development of a curriculum for a dedicated music education technology course, strategies to incorporate technology experiences in the music education curriculum, and professional development for in-service teachers.

Researchers have also investigated PMTs' intentions to use technology in their future classrooms through the theory of planned behavior and the technology acceptance model (Li et al., 2016). Specifically, in this study, the researchers aimed to investigate the PMTs ($N = 79$) attitudes, self-efficacy, perceived ease of use, and barrier to adoption toward technology usage in education and sought to find any significant differences between male and female PMTs.

From data analysis, the authors found several predictors of technology adoption. Technology self-efficacy, attitudes, and perceived ease of use were statistically significant predictors of technology adoption (Li et al., 2016). There were no statistically significant differences between male and female preservice teachers. The authors discuss developing curriculum or professional development that can increase preservice and in-service teachers' technology self-efficacy and point to investigating barrier that discourage preservice teachers from using technology for further research.

Matthews and Johnson (2017) explored PMTs' ($N = 22$) perceptions of collaboration and online technology through an 11-week project to develop, teach, and assess music lesson plans with various student-selected online technologies. From this

study, it was found that the participants of this study rarely used music-specific applications such as music notation and composition software. The participants opted to instead use information management software for communication and planning (Matthews & Johnson, 2017). The authors suggest that future projects should focus on effective ways preservice teachers can incorporate discipline-specific software in their music classroom instruction and that further investigation will aid in understanding how future teachers can utilize instructional technology to promote collaboration and 21st-century skills. The exploration of PMTs perceptions of technology through project learning has led to similar research from faculty of universities with their students.

Faculty Perceptions

Dorfman (2021) examined preservice music educators' assessment and evaluation skills through a project conducted in a music production class ($N = 18$) to see how they characterize the formative feedback and consistency of scores on technology they had little prior experience with. Dorfman found that this project and peer assessment allowed students to gain a better understanding of the technology that they were learning.

Kladder (2017) investigated two music education degree programs that redesigned their undergraduate music education curriculum. Specifically, the researcher examined the process of change in music education curriculum, course modifications, methods of instruction that were in autonomous learning spaces, faculty perceptions around the implemented changes, musical styles, genres, and instruments used, changes to the admission process, and impact on students.

Students and faculty were found to be divisive about music technology. In one of the universities discussed, some students felt technology was being pushed onto them and that technology would make students less musically literate. In contrast, others saw the potential and usefulness of music technology in their field (Kladder, 2017). Students felt that there were few opportunities to practice teaching music technology in their student teaching as many schools did not provide technology-based music classes in surrounding public schools. Faculty in these universities were open to integrating technology into the music education curriculum as it would push innovation and provide a new perspective to the students (Kladder, 2017). The researcher suggests that unification and collegiality are vital in moving a new curriculum forward, that is if the department can agree upon the vision, direction, and implementation (Kladder, 2017). Researchers in this section have brought to light the effect that existing curricula has on PMTs (Kladder, 2017; Li et al., 2016; Meltzer, 2001).

Music Education Curriculum

Examining the music education curriculum has been examined by previous researchers. Cremata (2010) examined and explored two universities' incorporation of music technology into the music education curriculum for undergraduate music education students. A qualitative approach was applied to this study, and an investigation of the student's perceptions and experiences with music technology was done. Data was collected through semi-structured interviews, classroom and studio observations, and artifacts (syllabi, lesson plans, portfolios, curricular plans).

The findings were categorized into two major themes: learning technology and incorporating technology. Students' experiences learning technology varied in styles, prior experiences, and interests. A lack of music technology integration was found despite the faculty and administrative support (Cremata, 2010). Faculty wanted to increase the integration of music technology into the curriculum, although they, at the time, lacked music technology integration (Cremata, 2010). Students were aware of the increasing importance of music technology and felt it was overdue. Among the implications and suggestions in this document, creation of a music technology techniques course, employing a music technology specialist, and affordable solutions for incorporating music technology into music education.

Spieker (2020) examined how a conservatory structurally implemented digital pedagogy into music teacher training. This study sought to explain the gap in research between the potential and actual use of technology in music education. The researcher employed action research to guide this study. Data was collected through semi-structured interviews and a questionnaire that contained open-ended questions.

It was found that students' acceptance of technology depended on hands-on assignments and the examples of technology-enhanced music education given to the students. The researcher concluded that as students' attitudes towards technology were more negative, their motivation to learn new skills with technology was hindered. The insights from this study were categorized into three main themes: adapt to your students, concrete for your students, and embrace collaboration. Spieker also believes that the results from this student can be applied to other forms of higher education.

Winterson and Russ (2009) examined undergraduate students' considerations to their first experience for studying for a degree and the factors that contributed to it (e.g., entry qualifications, course choice, career prospects, obstacles of the course, and aspects that felt school prepared them for. Data was collected through surveys and interviews with lecturers and students (Winterson & Russ, 2009).

Students taking music technology expected more practical knowledge and less musicology and scientific learning. Music technology students felt better prepared by their work outside college rather than in college (Winterson & Russ, 2009). The authors believe that higher education should attempt to build on the much wider range of music the students are familiar with rather than prioritizing Western classical and contemporary music.

Section Summary. Researchers have investigated PMTs' usage, beliefs, and intentions with music technology in their future classrooms (Bannerman & O'Leary, 2021; Haning, 2016; Li et al., 2016). The researchers found that self-efficacy, attitudes, and ease of use were found to predict technology retention and future implementation (Bannerman & O'Leary, 2021; Li et al., 2016). Many PMTs do not actively use technology but instead passively use technology (i.e., grading, attendance, planning instruction) (Haning, 2016). Many PMTs felt that there were not many opportunities to gain experience teaching music technology in student teaching (Kladder, 2017). University faculty were found to have more positive attitudes towards technology and used it more than students (Kladder, 2017; Meltzer, 2001). Music technology integration is something that music faculty have made attempts to introduce to the

curriculum in music education (Cremata, 2010). Researchers suggest that higher education should build on the wider range of genres present in modern times and music technology can provide musical experiences that are familiar to students (Spieker, 2020; Winterson & Russ, 2009).

Standards

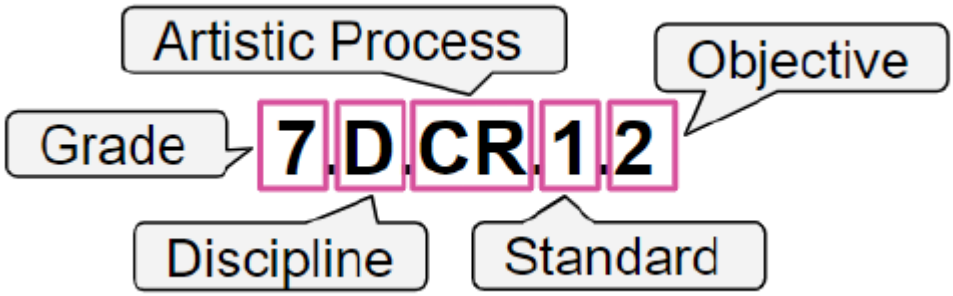
The National Association of Schools of Music (NASM) is an organization founded to establish national standards for music, music educations, and other music related degree programs. The U.S. Department of Education has appointed NASM to accredit free-standing institutions that offer music and music-related programs (National Association of Schools of Music, p.1). For a music program to receive accreditation, their content must reflect NASM standards. The NASM handbook provides clear and specific curricular structure that defines competencies for degrees in music from baccalaureate to doctorate. NASM defines standards and guidelines for liberal arts with content in music technology (National Association of Schools of Music, p.102), Bachelor of Music in Music Technology (National Association of Schools of Music, pp.112–117), and Bachelor of Music with studies in recording technology and/or electrical/computer engineering (National Association of Schools of Music, pp.120–121). According to NASM, music technology is "a field of study and practice characterized by integrations and fusions of musical and technological knowledge and skills to produce work for various artistic, commercial, research, educational, and other purposes" (p.208). The handbook provided music programs

curricular guidelines for graduate and specialized degree programs in music technology and recording technologies (National Association of Schools of Music).

The Oklahoma Academic Standards (OAS) for Fine Arts (Oklahoma Education, 2023) were created and updated to provide Oklahoma teachers with guidelines and specifications for what students should know and be able to do (Oklahoma Education, 2023). The Oklahoma standards are comprised of grade, discipline, artistic process, standard, and objective (see Figure 2.1). The grade levels in Oklahoma standards are categorized as Elementary (P–6) and Ensemble and/or Secondary Music (6–12). The artistic processes consist of creating (CR), performing (PR), connecting (CN), and responding (RE) (Oklahoma Education, 2023, pp.4–5).

Figure 2.1

Oklahoma Academic Standards for Fine Arts Identification Code



The OAS provided guidance for music educators to incorporate music technology in their classrooms and curricula. A few standards explicitly mention the use of technology to demonstrate notation: “1.M.CR.1.2 Improvise melodic and rhythmic answers with or without a system of syllables, numbers or basic notation using voice,

classroom instruments, or technology to demonstrate basic notation." (Oklahoma Education, 2023, p.62) and "I.M.CR.2 With guidance, select and develop melodic and rhythmic passages incorporating the characteristics of music or texts studied while preserving them through notation and/or audio/video recording" (Oklahoma Education, 2023, p.70). While not explicitly mentioning the use of technology as a singular standard, some standards can be facilitated through the use of technology.

Teacher preparation programs in Oklahoma require preservice teachers the Oklahoma Subject Area Test (OSAT). The OSAT is subject-specific with instrument and vocal exams. In the instrumental/general exam, technology is explicitly mentioned under competency 0008, "Demonstrate knowledge of how to use technology in the music class (e.g., MIDI, sequencing and notational software programs, sound-system setup, recording equipment)" (Certification Examinations for Oklahoma Educators). The framework for the vocal exam also explicitly mentions technology under competency 0007, "Demonstrate knowledge of how to use technology in the music classroom" (Certification Examinations for Oklahoma Educators).

Kugelman (2021) explores first through third-year early-career music educators' (N = 36) perceptions of the value, effectiveness, and relevance of their NASM-accredited undergraduate music students in preparation for teaching post-graduation. Data collection was done through a researcher-designed survey that used Likert-type questions. This investigation found that early-career teachers felt confident with methodologies, philosophies, but did not feel prepared for designing and implementing curriculum. Kugelman found that knowledge of music genres other than orchestral

music, knowledge of music education technologies, and instrument repair were discouragingly notable. NASM does not provide clarifying descriptors for some musical genres, including electronic music, and that descriptors may aid music teacher education programs in improving preservice teacher preparation (Kugelman, 2021).

Bauer (2020) aligns music technology with fine arts standards and provides ways of reaching these standards with technology and examples of how this would be accomplished. To use technology to meet these artistic processes (creating, performing, responding, connecting), he suggests using a variety of music technologies, including digital audio workstations, auto-accompaniment software, audio recording software, music notation software, and mobile apps to meet the various standards within this process.

Section Summary. State and national standards provide examples and guidelines for music technology and its incorporation into music education (National Association for Schools of Music; Oklahoma Education, 2023). NASM provides standards for including music technology in the music curriculum and guidelines for degrees in music technology at the undergraduate and graduate levels. Music teacher preparation programs in Oklahoma require PMTs to take subject-specific examinations that address music technology knowledge in the music classroom (Certification Examinations for Oklahoma Educators). The Oklahoma Academic Standards for Fine Arts provides ways of including technology, with researchers providing examples and recommendations for technologies to meet these standards (Bauer, 2020).

Self-Efficacy

Self-efficacy levels of inservice music teachers and PMTs in various aspects of their career have been investigated by previous researchers. Allen (2023) examined high school band directors' self-efficacy levels and their ability to prepare marching band students for college. Ten participants were selected for this study ($N = 10$) with seven in the focus group ($n = 7$). The findings from this study were presented through the emergent themes that arose inadequate resources, vicarious learning experiences, fundamentals and musicianship, and assessment and evaluation. While technology was not the main focus of this study, the author mentions the importance of music notation and drill writing software in the marching band curriculum through participants' experiences with software such as Pyware 3D and Finale. This study found that marching band directors' self-efficacy levels were based on years of experience, self-reflection, formal and informal feedback from administration, students, and competitions ratings.

Music teachers' self-efficacy analysis has been investigated to find successful predictors (Biasutti et al., 2021). Biasutti and others (2021) surveyed 335 music teachers ($N = 335$) in European countries to measure their self-efficacy, motivation, satisfaction, resilience, coping strategies, and self-esteem. The findings from this study indicate that self-efficacy was predicted by satisfaction, intrinsic motivation, regulation attitudes towards teaching, perceived resilience, coping strategies that involved planning solutions, and self-esteem.

Ostrosky (2023) investigated piano instructors' perceived confidence, success, and preparation levels in teaching students with neurodevelopmental disabilities through self-efficacy. Data was collected for this study through a researcher-design survey. After the window for data collection concluded, 814 respondents completed the survey ($N = 749$). The respondents reported the lowest levels of confidence and self-efficacy in unfamiliar, unaware, and inexperienced areas.

Regier (2016) examined self-efficacy in Oklahoma secondary band directors ($N = 133$) in concert, jazz, and marching ensemble pedagogy. Regier found that school classifications, professional teaching experiences, conference/workshop attendance, individual study, and community band participation influenced self-efficacy beliefs in marching band. Jazz band pedagogy self-efficacy was influenced by gender, professional teaching experiences, undergraduate experiences, conference/workshop attendance, individual study, and community ensemble participation and those that participated in an undergraduate jazz course had higher beliefs in their ability to teach jazz than those who did not.

PMT self-efficacy about popular music has been studied by Xu (2023). In addition to their self-efficacy, Xu studied their preparedness and commitment to incorporating popular music into their P–12 music classrooms. The participants for this study consisted of 81 undergraduate music education majors ($N = 81$). The results of this study indicate that popular music is often learned and experienced through informal means and is self-directed.

Zelenak (2020) studied self-efficacy and several strategies to promote its development in music education. Zelenak found that self-efficacy strategies can be applied to any music learning environment to better prepare music educators and assist their students in reaching higher achievement. Zelenak describes self-efficacy is determined by enactive mastery experience, vicarious experience, verbal/social persuasion, and physiological and affective state. Experiences can shape self-efficacy, whether those are positive or negative experiences. As music educators, the author writes, "we must strive to provide interpretations of success or failure through three dimensions (i.e., strength, level of difficulty, and generality)" (Zelenak, 2020, pp.44). Students can build self-efficacy through vicarious experiences where they observe others completing challenging activities without suffering adverse consequences and seeing others like themselves struggle. Comments, suggestions, and words of praise were noted to also contribute to the development of self-efficacy. This researcher also provides a way of measuring self-efficacy and provides a researcher-designed scale for measuring music performance self-efficacy.

Section Summary. The limited research focused on music technology self-efficacy supports the findings found in general music education research in previous sections (Bannerman & O'Leary, 2021; Li et al., 2016). Studies conducted by Allen (2023), Biasutti (2021), and Xu (2023) found that self-efficacy is dependent on experience, motivation, satisfaction, and self-direction.

Conclusion

As students transition from high school to universities, they are drawn to music technology courses as they are familiar with and relevant to the experiences and interests they formed during high school. Music technology is a tool that is not used actively by in-service teachers due to a lack of resources and adequate training in subject-specific music technology outside of music notation software (e.g., digital audio workstations, music learning software, digital instruments). When in-service music teachers are given proper and relevant professional development with music technologies, they have found greater success and motivation for integration into their music classrooms. PMTs have found themselves with limited experience teaching music technologies due to the shortcoming of teachers using it in their music classrooms or having technology-based music classes. As PMTs do not have these opportunities to experience teaching music technologies, they feel less capable of designing curricula and assessment for TBMCs or embedding it into their existing music classes. The perceptions of their experiences and self-efficacy with music technology that PMTs have a considerable impact on whether they will use music technology as music teachers.

Chapter 3: Methodology

Purpose of the Study

The purpose of this quantitative study was to examine preservice music teachers' perception of their experiences and self-efficacy with music technology in Oklahoma music teacher preparation programs. Specifically, I asked:

1. What experiences did preservice music teachers have with music technology during their undergraduate program?
2. What opportunities were provided to explore the implementation of music technology during preservice education, field experiences, and student teaching?
3. How efficacious were preservice music teachers about technology in their future classrooms?

To answer these research questions, preservice music teachers across multiple universities in Oklahoma were contacted to complete an online survey discussing music technology preparation, self-efficacy, and preservice music teachers' planned future implementation of music technology.

Research Design

To capture the perceptions, attitudes, and general self-efficacy of participants across a large geographical distance, I employed survey methodology in this study. Survey research is used when interest is towards institutions, institutional policy, educational policy, and the overall status of the profession (Miksza & Elpus, 2018). Electronic surveys were employed to cover the large geographical distance of participants.

Participants Selection

Participants were selected from universities in Oklahoma with NASM-accredited music education programs. I then visited those accredited institution's websites to determine a contact person with the music education area. Professors responsible for instruction of music education courses and those with access to preservice music teachers (PMTs) were contacted through email (See Appendix B) and asked to participate in the study. PMTs who are currently enrolled in an undergraduate teacher preparation program were invited to participate in the study.

Research Questionnaire

Participants completed a research-designed questionnaire informed by the extant research on the subject (Bannerman & O'Leary, 2021; Holliman, 2021; Li, et al., 2016; Spieker, 2021; Waddell & Williamon, 2019). The *Preservice Music Teacher Attitudes, Perceptions, and Self-Efficacy* survey consisted of four sections: Section 1 (Demographic Information), Section 2 (Prior Experiences with Technology), Section 3 (Current Technology/Music Technology Instructional Experiences), and Section 4 (Future Classroom Application). Data was collected through an electronic web-based survey instrument accessible through the University of Oklahoma (Qualtrics 2023). This software was the most accessible and convenient for graduate student researcher work in the University of Oklahoma School of Music. The survey contained both quantitative (rank order, multiple choice, and Likert-type) and qualitative (open-ended) prompts. The informed consent section was shown acknowledged by the participants at the beginning of the survey.

Section 1: Demographic Information

Section One contained the following items to collect participant's demographic and degree information:

- Gender
- Race/Ethnicity
- Year in college
- Degree Emphasis
- Field Experience Progress
- Enrollment in Student Teaching

These items were in the form of multiple choice, multiple answers, and open-ended responses. These items were reported with frequencies and used with other scale items from previous sections.

Section 2: Prior Experiences with Technology

I designed this section to gather information regarding the prior experience that participants had with music technology and where they attained it. These questions were in the form of multiple choice and open-ended questions. This section contained Likert-type questions detailing level of comfort and likelihood of which was anchored by 1 (*very uncomfortable*/*very unlikely*) to 5 (*very comfortable*/*very likely*).

In survey question eight, I asked "Do you have any prior experience with music technology outside of your undergraduate music coursework?" If yes was selected, then they were asked "Where was this prior experience from?" (survey question nine). Lastly

in this block, respondents were prompted to answer an open-ended prompt "Provide details about your prior experiences with music technology" (survey question ten).

Section 3: Current Technology/Music Technology Instructional Experiences

This section was designed to describe the respondents' enrollment in music technology courses, the embedding of content in undergraduate classes, types of music technology covered, comfortability using music technology, and perceived importance of music technology. This section contained Likert-type prompts detailing level of agreement and confidence, which was anchored by 1 (*strongly disagree*/*no confidence*) to 5 (*strongly agree*/*strongly confident*).

In question eleven, I asked respondents "Have you taken/will you take a stand-alone music-technology course?". The following question expanded the scope to if music technology topics/activities were embedded into any of their undergraduate classes (survey question twelve). Question thirteen then prompted respondents to check all the music technologies that they have covered in their music courses with 12 options to choose from. If "Option" was selected, an open-ended prompt would be available for respondents too add additional details about music technology classes or opportunities not included in this list. The next few survey questions contained Likert-style prompts regarding the respondents' comfort level, perceived importance, and practicality of various music technologies. The various music technologies listed were:

- Music Notation Software (e.g., Finale, Sibelius)
- Music Production Software (e.g., FL Studio, Ableton)
- Music Teaching Software (e.g., SmartMusic, Aurelia)

- Auto-accompaniment Software
- Metronome
- Tuner/Drone
- Audio/Video Recording Software (e.g., Audacity)
- Electronic/Digital Instruments (e.g., Harmony Director, EWI)
- Drill Writing Software (e.g., Pyware 3D, Drill Quest)
- Digital Inventory and Management Software (e.g., Charms, CutTime)

Section 4: Future Classroom Application

This section contained prompts that sought insight into self-efficacy, self-reflection, and identity with integration, preparation, and implementation of music technology throughout their undergraduate coursework and beyond graduation. This section contained Likert-type and open-ended questions with 5-point anchors for each. The response items for the subscale were created from existing response items by Holliman (2021) and Li et al. (2021). Modifications of statements are in italics. Question twenty asked respondents "How much do you agree with the following statements regarding your undergraduate music program?". The statements for this survey item were:

- I consider the integration of *music* technology as an important component to music education.
- There is adequate technology access in my music classes.
- My *undergraduate program* prepared me to implement technology integration in my classroom.

- My *undergraduate program* considered it important to provide me with adequate technology training for new tools and software they require me to use for *teaching*.
- My undergraduate program adequately prepared me to *teach with a variety of music technologies.*
- I had opportunities to teach with music technologies covered in my classes.
- Knowledge about *music* technology will improve my teaching.
- Learning about a variety of music technologies is important for teaching.
- Support from faculty has helped me in learning music technology.
- Support from my peers has helped me in learning music technology.
- I have seen others be successful using music technology in their teaching.

Question twenty-one asked respondents to "Please indicate your level of confidence with the following statements regarding your future use of music technology in your classroom." Respondents provided their level of confidence to the following statements:

- I can imagine myself embedding *music technology* in my classes successfully.
- I will be able to identify issues and provide solutions to students that have questions regarding music technology.
- My mastery of music technology skills will improve post-graduation as I begin teaching.

- The music technologies seen or taught in my undergraduate program will be relevant in my teaching career post-graduation.
- I feel prepared to teach *music technology* in my P–12 music classes.
- I can create effective lessons for *music technology* concepts.
- I can create lessons plans about *music technology* that adhere to state or national music standards.
- I will be able to evaluate my students' music technology knowledge.

Question twenty-two had respondents to "Please indicate your agreement level with the following statements." Question twenty-three prompted respondents with the statement, "According to your answers to the above items, please describe why you will or will not incorporate music technology in your future music classes." Respondents identified their level of agreement with the following statements:

- I am continually learning better approaches to teach *music technology*.
- I have the necessary skills to teach *music technology*.
- I want to be a *music* teacher who incorporates *music technology* into their teaching.
- I can imagine myself teaching a music technology-centric class successfully.
- I can see myself incorporating *music technology* in my teaching 5 years from now.
- I am not sure if I want to incorporate *music technology* into my teaching.

- Incorporating *music technology* into my teaching will be satisfying for me.

After this question, the survey would end, and the respondent would be thanked for their participation.

Pilot Testing

After receiving IRB approval (See Appendix A), I visited university websites' to determine and acquired the email addresses of music education faculty or the chair of the department from selected accredited universities in Oklahoma to conduct a pilot study. The invitation form was emailed to music education professors from three universities with NASM-accredited music programs in Oklahoma that had student teachers that would be graduating in December. Utilizing this sample to student teachers to pilot would not affect population in the full survey the following semester. The invitation to participate was sent to music education professors on December 8th, 2023. The reminder emails were issued in a similar manner approximately 11 days later. The window for data collection was closed on December 22nd, 2023. The pilot sample ($N = 5$) included participants from three accredited schools of music in the state of Oklahoma. Subscales were created from items in section 4 and tested for reliability for further analysis. The subscales were above the conventional adequacy level of .70 for Cronbach-alpha according to Cohen (1988).

Table 3.1

Reliability Analysis of Subscale

Item category	Cronbach (α)
Level of confidence regarding future use	.94
Statements regarding self-efficacy	.92

Note. $N = 5$

Procedures

Pre-Data Collection

Drafts of the survey were sent to my thesis chair and committee members for review. After securing approval, I submitted the revised version to the OU-IRB (see Appendix A). After visiting the website of universities with NASM-accredited schools of music, fourteen of the schools offered a bachelor's in music education ($N = 15$). From there, I looked for the music education faculty within the music department of each university. The emails of music education faculty were discerned and gathered into a document on February 26th, 2024. For schools that I was unable to discern which faculty members handled the music education area, I opted to get the email address for the chair of the music department.

Data Collection

On March 25th, 2024, I distributed the invitation email to music professors in fourteen Oklahoma universities. I issued survey reminders during the second week of data collection. The window for data collection was open for two and a half weeks from the day the invitation was sent.

Invitations to participate were distributed, through email, to music professors and music education professors in NASM-accredited universities in the state of Oklahoma ($N = 15$) that offered music education degrees ($n = 14$). After the end of the survey window, 53 respondents completed the survey. The completed responses ($N = 53$) were used in the final analysis.

Data Analysis

Data was collected through the use of Qualtrics software (Qualtrics 2023). After collection, data was inputted into SPSS, labeled as either categorical or continuous variables, and then descriptively analyzed. The process for analyzing data consisted of checking for outliers, non-normal distributions, missing values, errors from data input, frequency tables, and descriptive statistics (e.g., mean, standard deviation, skewness, kurtosis). All demographic and measured variables were reported to determine whether the data met assumptions for statistical tests (Russell, 2018). For research question one, I descriptively analyzed data for all items pertaining to previous experience with music technology and related coursework in their undergraduate program to determine potential significance in opportunities in prior and current music technology offerings. In addition, I used inferential statistical (e.g., *t*-test, analysis of variance) procedures to determine differences between music technology perception with designation in college (year and emphasis). For research question two, investigating opportunities that were given to PMTs to explore music technology, I used descriptive analysis (e.g., analysis of variance) for all items pertaining to availability and confidence regarding their undergraduate programs. For research question three, exploring PMT's self-efficacy in

using music technology in their classrooms, I used reliability analysis and factor analysis.

Chapter 4: Results

The purpose of this quantitative study was to examine preservice music teachers' perception of their experiences and self-efficacy with music technology in Oklahoma music teacher preparation programs. Specifically, I asked:

1. What experiences did preservice music teachers have with music technology during their undergraduate program?
2. What opportunities were provided to explore the implementation of music technology during preservice education, field experiences, and student teaching?
3. How efficacious were preservice music teachers about technology in their future classrooms?

To answer these research questions, undergraduate music education students across multiple universities in Oklahoma were contacted to complete an online survey regarding their perceptions of music technology preparation, self-efficacy, and preservice music teachers' (PMTs) planned future implementation of music technology.

During March and April 2024, the survey was distributed to email addresses associated with professors of music education at the 15 schools of music accredited by the National Association of Schools of Music (NASM) in the state of Oklahoma. I requested the recipients of the invitation to forward it to their undergraduate music education students. Data obtained from the participants ($N = 53$) were analyzed using SPSS version 29.0. After importing the dataset from Qualtrics, I used exploratory data analysis (Morgan et al., 2013) procedures to exam the data for missing or incomplete values.

Brief descriptive analyses are presented in the following section, with the results arranged by major variables. Demographic information (gender, race/ethnicity, year in college) is presented first, followed by respondents' prior experiences with music technology, then in order of the research questions.

Descriptive Analyses

Demographic Information

Gender and Race/Ethnicity. A total number of 59 respondents started the survey, but incomplete responses were excluded. From the valid responses ($N = 48$), 38% ($n = 20$) identified as male, 43% ($n = 23$) as female, 6% ($n = 3$) as genderqueer/gender non-conforming, 4% ($n = 2$) as non-binary/third gender, 2% ($n = 1$) as trans male, and 8% ($n = 4$) preferred not to say or self-describe; one of which described themselves as "trans masc nonbinary." Respondents were mostly white ($n = 39$, 74%). The open-ended race and ethnicity option comprised of Asian/White ($n = 1$, 2%). Complete gender and race/ethnicity information of respondents' can be found in Table 4.1.

Table 4.1

Respondents' Demographic Information

Demographic Category	Frequency	%
Gender		
Female	23	43
Male	20	38
Genderqueer/gender non-conforming	3	6
Prefer not to say	3	6
Non-binary / third gender	2	4
Prefer to self-prescribe	1	2
Trans male	1	2
Race/Ethnicity		
White (not Hispanic or Latino)	39	74
American Indian or Alaska Native (Not Hispanic or Latino)	3	6
Two or More Races (Not Hispanic or Latino)	3	6
Black or African American (not Hispanic or Latino)	2	4
Hispanic or Latino	2	4
I prefer not to answer	2	4
Asian (not Hispanic or Latino)	1	2
Prefer to describe	1	2

Note. $N = 53$.

College Status and Degree Emphasis. Respondents' year in college consisted of an even distribution by classification with most respondents having an instrumental/general degree emphasis ($n = 39$, 74%). The majority of respondents ($n = 26$, 54%) had either completed field experience or were currently in it and were not in student teaching ($n = 42$, 88%). Complete information about respondents' year and degree emphasis in college can be found in Tables 4.2.

Table 4.2

Respondents' Year in College

	Frequency	%
Year		
Senior (Fourth year or beyond)	12	23
Junior (Third year)	15	29
Sophomore (Second year)	12	23
Freshman (First year)	14	26
Degree Emphasis		
Instrumental / General	39	74
Vocal / General	14	26

Note. $N = 53$.

Opportunities to Implement Music Technologies

The opportunities that PMTs were given to explore the implementation of music technology were addressed by questions 18–20 of the survey (i.e., question 18, "Have you observed or utilized any of the previously defined music technologies in your field experience or student teaching?" and one of the statements from question 20, "I had opportunities to teach with music technologies covered in my classes."). A majority of respondents ($n = 18$, 36%) indicated that music technology was observed or utilized in their field experience or student teaching (See Table 4.3).

Table 4.3

Respondents' Status on Field Experience and Student Teaching

	Frequency	%
Completed or Currently in Field Experience		
No	25	47
Yes	28	53
Enrolled in Student Teaching		
No	47	89
Yes	6	11
Taken or anticipated to take stand-alone music-technology course		
No	32	60
Yes	21	40
Observed or Utilized Music Technology in Field Experience or Student Teaching?		
Yes	19	36
No	9	17

Prior Experiences with Music Technology. Most respondents (n = 32, 67%) indicated that they had no prior experience with music technology; less than half (n = 16, 33%) indicated otherwise. Of the respondents that had prior experience, the most common source was from high school classes (n = 8, 17%) followed by independent interest (n = 7, 15%), and general undergrad education courses (n = 1, 2%). Respondents' prior experiences with music technology can be found in Table 4.4.

Table 4.4

Respondents' Prior Experiences with Music Technology

	Frequency	%
Any prior experience		
No	36	68
Yes	17	32
Source of experience (n = 17)		
High school classes	9	17
Independent interest	7	15
General undergrad education courses	1	2

Note. N = 53, Sources of prior experience taken from respondents that indicated "Yes" n = 17.

Music Technologies Covered in Undergraduate Music Courses

In questions 13 and 14, I asked participants to provide information on how they experienced technology in their undergraduate curriculum. Most of the participants reported that music technology was embedded within their undergraduate coursework (n = 42, 79%). However, participants also reported that they either had not taken or did not anticipate enrolling in a stand-alone music technology course (n = 32, 60%). Complete information regarding PMTs' music technology embedment and course enrollment can be found in Tabel 4.5.

Table 4.5

Respondents' Music Technology Experience in College

	Frequency	%
Any Music Technology Embedded		
Yes	42	79
No	11	21
Have/Will take a music-technology course		
Yes	21	40
No	32	60

Note. $N = 53$.

Music Technologies Experienced in Music Courses. The majority of participants indicated that metronomes ($n = 41$, 77%), tuners/drones ($n = 37$, 70%), and music notation software ($n = 34$, 64%) were experienced in their music courses. The least commonly covered music technologies included drill writing software ($n = 5$, 9%), digital inventory and management software ($n = 5$, 10%), and auto-accompaniment software ($n = 5$, 9%). Complete information regarding the music technologies covered in respondents' music courses can be found in Table 4.6.

Table 4.6

Music Technologies Respondents' Covered in Courses

Music Technology	Frequency	%
Metronomes	41	77
Tuners/Drones	37	70
Music Notation Software (Finale, Sibelius, etc.)	34	64
Music Teaching Software (SmartMusic, Aurelia, etc.)	21	40
Audio/Video Recording Software (e.g., Audacity)	19	36
Music Production Software (Ableton Live, FL Studio, Pro Tools, etc.)	12	23
Electronic/Digital Instruments (e.g., Harmony Director, EWI)	9	17
Drill Writing Software (Pyware 3D, Drill Quest)	5	9
Digital Inventory and Management Software (e.g., Charms, CutTime)	5	9
Auto-Accompaniment Software	5	9
Other	1	2
None	8	15

Notes. $N = 53$.

Statements Regarding Undergraduate Program Music Technology Preparation

Participants were asked to provide their level of agreement regarding statements about their undergraduate program in survey question 20. Level of agreement items were anchored by a Likert-type scale of 1 (*strongly disagree*) to 5 (*strongly agree*) and had a high reliability ($\alpha = 0.87$). Responses indicated that increased knowledge about music technology would improve their teaching ($M = 4.55$, $SD = 0.67$), learning about a

variety of music technologies is important for teaching (M = 4.40, SD = 0.70). Respondents have seen others succeed using music technology for teaching (M = 4.19, SD = 0.83), and consider music technology integration important to music education (M = 4.14, SD = 0.98). Despite these positive responses, participants indicated that they disagreed with their undergraduate program's ability to provide adequate preparation for usage of a variety of music technology (M = 2.88, SD = 1.20), opportunities to teach with music technologies (M = 2.95, SD = 1.27), and music technology classroom implementation (M = 3.07, SD = 1.16). These findings indicate that respondents agreed that learning about music technology is important, but opportunities to practice what they had learned and preparation for using many different music technologies was lacking in their preservice music education experience. See Table 4.7 for a complete list of descriptive statistics regarding participants' perceptions of their undergraduate preparation.

Table 4.7

Respondents' Level of Agreement of Statements Regarding Undergraduate Program

Statement Regarding Undergraduate Program	*M* (*SD*)
Knowledge about music technology will improve my teaching.	4.55 (0.67)
Learning about a variety of music technologies is important for teaching	4.40 (0.70)
I have seen others be successfully using music technology in teaching.	4.19 (0.83)
I consider the integration of music technology as an important component to music education.	4.14 (0.98)
Support from my peers has helped me in learning music technology	3.74 (1.20)
There is adequate technology access in my music classes.	3.50 (1.20)
Support from faculty has helped me in learning music technology.	3.36 (1.12)
My undergraduate program considered it important to provide me with adequate technology training for new tools and software they require me to use for teaching.	3.12 (1.23)
My undergraduate program prepared me to implement technology integration in my classroom	3.07 (1.16)
I had opportunities to teach with music technologies covered in my classes.	2.95 (1.27)
My undergraduate program adequately prepared me to teach with a variety of music technologies	2.88 (1.20)

Note. $n = 42$ These items were answered using a five-point Likert-type scale of which was anchored from 1 (*strongly disagree*) to 5 (*strongly agree*); internal consistency $\alpha = 0.87$.

Perceptions and Self-Efficacy with Music Technology

In an attempt to answer the third research question, I asked PMTs' about their confidence with music technology. Level of confidence items were anchored by a Likert-type scale of 1 (*no confidence*) to 5 (*very confident*) and had a high reliability ($\alpha = .92$). Respondents overall felt that their mastery of music technology skills would improve after they began teaching ($M = 3.81$, $SD = 0.94$), that they could imagine themselves successfully embedding music technology into their future classes ($M = 3.76$, $SD = 0.91$), and that the music technologies they had seen or utilized throughout their undergraduate program would be relevant in their teaching after graduation ($M = 3.57$, $SD = 1.11$). The remaining statement means (e.g., preparedness, technology lessons) fell below the scale midpoint of 3.5. See Table 4.8 for the complete demographics of PMTs' confidence using technology in their future careers.

Table 4.8

Respondents' Level of Confidence Regarding Future Use

Statement Regarding Future Use	*M* (*SD*)
My mastery of music technology skills will improve post-graduation as I begin teaching	3.81 (0.94)
I can imagine myself embedding music technology in my classes successfully	3.76 (0.91)
The music technologies seen or taught in my undergraduate program will be relevant in my teaching career post-graduation	3.57 (1.11)
I will be able to evaluate my students' music technology knowledge.	3.40 (1.19)
I will be able to identify issues and provide solutions to students that have questions regarding music technology	3.21 (1.12)
I can create lesson plans about music technology that adhere to state or national music standards.	3.07 (1.18)
I can create effective lessons for music technology concepts.	2.88 (1.17)
I feel prepared to teach music technology in my P–12 music classes.	2.86 (1.16)

Note. $n = 42$. These items were answered using a five-point Likert-type scale of which was anchored from 1 (*no confidence*) to 5 (*very confident*); internal consistency $\alpha = .92$.

PMTs provided their level of agreement with various self-identifying statements regarding music technology and teaching. Respondents' saw themselves incorporating music technology into their teaching in the future ($M = 4.20$, $SD = 1.01$), being a music teacher that incorporates music technology into their teaching ($M = 4.10$, $SD = 1.04$), and continually learning better approaches to teach music technology ($M = 3.78$, $SD = 1.15$). The complete list of the statements regarding incorporating music technology into their future teaching can be found in Table 4.9.

Table 4.9

Respondents' Level of Agreement Regarding Self-Efficacy

Statement Regarding Self-Efficacy	*M* (*SD*)
I can see myself incorporating music technology in my teaching 5 years from now.	4.20 (1.01)
I want to be a music teacher who incorporates music technology into their teaching	4.10 (1.04)
I am continually learning better approaches to teach music technology.	3.78 (1.15)
Incorporating music technology into my teaching will be satisfying for me.	3.41 (1.02)
I have the necessary skills to teach music technology	3.15 (1.22)
I am not sure I want to incorporate music technology into my teaching. (-)	3.12 (1.33)
I can imagine myself teaching a music technology-centric class successfully.	2.95 (1.30)

Note. $n = 41$. These items were answered using a five-point Likert-type scale of which was anchored from 1 (*disagree*) to 5 (*agree*); internal consistency $\alpha = .80$.

Perceived Importance of Music Technology. Respondents ranked their perceived importance of various music technologies against each other. Metronome ($M = 2.02$, $SD = 1.22$) and tuner/drones ($M = 2.64$, $SD = 1.77$) were perceived as the most important, while electronic/digital instruments ($M = 8.13$, $SD = 1.71$) and music production software ($M = 7.49$, $SD = 1.86$) were perceived to be the least important by respondents. See Table 4.10 for complete information regarding respondents perceived importance of music technologies.

Table. 4.10

Respondents' Perceived Importance of Music Technology

Music Technologies	*M* (*SD*)
Metronome	2.02 (1.22)
Tuner/Drone	2.64 (1.77)
Music notation software	4.23 (1.87)
Music teaching software	4.72 (2.51)
Audio/Video recording software	5.08 (1.82)
Digital inventory and management software	6.06 (2.96)
Auto-Accompaniment software	7.26 (2.05)
Drill writing software	7.38 (2.40)
Music production software	7.49 (1.86)
Electronic/Digital instruments	8.13 (1.71)

Note. $N = 53$. These items were ranked from 1 (*most important*) to 10 (*least important*).

Comfort with Music Technology. Respondents felt most comfortable using metronomes ($M = 4.75$, $SD = 0.65$), tuners/drones ($M = 4.60$, $SD = 0.74$), and music notation software ($M = 3.62$, $SD = 1.15$). The remaining items fell under the scale midpoint of 3.5. The lowest mean scores of comfort were drill writing software ($M = 1.74$, $SD = 0.90$), digital inventory and management software ($M = 1.94$, $SD = 1.05$), and music production software ($M = 2.11$, $SD = 1.16$). Complete information regarding participants' level of comfort with music technologies can be found in Table 4.11.

Table 4.11

Respondents' Level of Comfort with Music Technologies

Music Technologies	*M* (*SD*)
Metronome	4.75 (0.65)
Tuner/Drone	4.60 (0.74)
Music Notation Software	3.62 (1.15)
Audio/Video Recording Software	3.09 (1.18)
Electronic/Digital Instruments	2.40 (1.12)
Music Teaching Software	2.38 (1.01)
Auto-Accompaniment Software	2.34 (1.22)
Music Production Software	2.11 (1.16)
Digital Inventory and Management Software	1.94 (1.05)
Drill Writing Software	1.74 (0.90)

Note. $n = 48$. These items were anchored by a level of comfort scale ranging from 1 (*very uncomfortable*) to 5 (*very comfortable*).

Likelihood of Teaching with Music Technologies. Participants responded to a question regarding their likelihood of teaching with music technology in the future. PMTs reported an overall higher likelihood of teaching with a metronome ($M = 4.79$, $SD = 0.58$), tuners/drones ($M = 4.69$, $SD = 0.75$), music notation software ($M = 3.73$, $SD = 1.01$), and audio/video recording software ($M = 3.69$, $SD = 1.06$) than other music technologies listed. The complete list of PMTs likeliness to teach with various music technologies can be found in Table 4.12.

Table 4.12

Respondents' Likeliness to Teach with Music Technologies

Music Technologies	*M* (*SD*)
Metronome	4.77 (0.58)
Tuners/Drones	4.68 (0.73)
Audio/Video Recording Software	3.74 (1.02)
Music Notation Software	3.68 (1.05)
Digital Inventory and Management Software	3.17 (1.20)
Music Teaching Software	3.17 (1.33)
Auto-Accompaniment Software	2.96 (1.13)
Electronic/Digital Instruments	2.83 (0.98)
Drill Writing Software	2.70 (1.37)
Music Production Software	2.38 (1.13)

Note. $n = 48$. These items were anchored by a level of likeliness scale ranging from 1 (*very unlikely*) to 5 (*very likely*).

Interaction Between Variables

Undergraduate preparedness, confidence, and self-efficacy were each measured in distinct sets of questions in the researcher-designed questionnaire. Using Cronbach's Alpha to measure the reliability of the statements, I found that confidence ($\alpha = .92$), self-efficacy ($\alpha = .80$) and undergraduate preparedness ($\alpha = 0.87$) all surpassed the acceptable value of 0.70. Since these variables were highly reliable, there might be cause for investigating possible interactions between efficacy, preparedness, and confidence. Examining these interactions can reveal whether levels of preparedness affect confidence, if self-efficacy is linked to levels of preparedness, and how these influence future teaching outcomes.

Preparedness, Efficacy, and Confidence

To examine if relationships existed between undergraduate preparedness, self-efficacy, and confidence with music technologies, I conducted a Pearson correlation after meeting the assumptions (i.e., both variables are continuous, approximately normally distributed). A significant ($p < .001$) and moderate correlation was found between undergraduate preparedness and efficacy ($r = .62$) and between confidence ($r = .60$) and efficacy ($r = .69$).

Table 4.13

Results for Pearson Correlation between Preparedness, Efficacy, and Confidence

		Efficacy	Confidence	Prep
Efficacy	Pearson Correlation	--		
	Sig (2-tailed)			
	N	41		
Confidence	Pearson Correlation	.689**	--	
	Sig (2-tailed)	<.001		
	N	41	42	
Prep	Pearson Correlation	.624**	.599**	--
	Sig (2-tailed)	<.001	<.001	
	N	41	42	42

Year in College and Confidence

In order to determine if differences existed in levels of confidence and the respondents' year in college, I employed an independent samples *t*-test. The independent variable of year in college was grouped into lower (consisting of freshmen and sophomore years) and upper (junior and senior years). I was able to establish the

homogeneity of variance through the Levene's test of equality of variance (p = .45). Juniors and seniors in college were found to have slightly higher confidence (M = 28.17, SD = 6.34) than freshmen and sophomores (M = 24.63, SD = 6.34). However, there was no significant differences between upper-class and lower-class PMTs; $t(40)$ = -1.65, p = .11 (see Table 4.14 for complete information).

Table 4.14

Results for t-Test Comparing the Differences between Year in College on Confidence

	n	*M*	*SD*	*t*	*df*	*p*
				-1.65	40	.11
Freshmen/Sophomore	19	24.63	6.34			
Junior/Senior	23	28.17	7.39			

Year in College and Preparedness

To determine if differences existed between year in college and preparedness, I administered an independent samples t-test. I was unable to establish the homogeneity of variance through the Levene's test of equality of variance (p = .02), which could result in Type I error. However, there were no significant differences between freshman, sophomore, junior, and senior PMTs; $t(38)$ = .50, p = .60 (see Table 4.15 for complete information).

Table 4.15

Results for t-Test Comparing the Differences between Year in College on Preparedness

	n	*M*	*SD*	*t*	*df*	*p*
				.50	38	.60
Freshmen/Sophomore	19	40.58	6.00			
Junior/Senior	23	39.35	9.15			

Year in College and Efficacy

To determine if differences existed between respondents' year of college and efficacy, I again utilized an independent samples *t*-test to compare the two variables. I was able to establish the homogeneity of variance through the Levene's test of equality of variance ($p = .97$). While there were no significant differences $t(39) = .93$, $p = .36$ between year in college and efficacy, freshmen and sophomores ($M = 40.58$, $SD = 6.00$) felt more prepared to use technology than did junior and seniors ($M = 39.35$, $SD = 9.15$).

Table 4.16

Results for t-Test Comparing the Differences between Year in College on Efficacy

	n	*M*	*SD*	*t*	*df*	*p*
				.93	39	.36
Freshmen/Sophomore	18	23.72	4.80			
Junior/Senior	23	25.04	4.32			

Prior Experience and Confidence

To determine if differences existed between PMTs who had prior experience and confidence with music technology and those without any previous experience, I used an independent samples *t*-test to compare the two groups. I was able to establish homogeneity of variance through the Levene's test of equality of variance ($p = .19$). There were statistically significant differences between respondents that had prior experience with music technology outside of undergraduate course work $t(40) = 2.17$, $p = .04$. It was found that those with prior experience ($M = 29.79$, $SD = 5.38$) were more confident than those with no prior experience ($M = 24.96$, $SD = 7.36$).

Table 4.17

Results for t-Test Comparing the Differences between Prior Experience on Confidence

	n	*M*	*SD*	*t*	*df*	*p*
				2.17	40	.04
No Prior Experience	28	24.96	7.36			
Yes Prior Experience	14	29.79	5.38			

Prior Experience and Preparedness

To determine if differences existed in PMTs that had prior experience and preparedness, an independent samples *t*-test was employed. I was able to establish homogeneity of variance through the Levene's test of equality of variance ($p = .24$). There were no statistically significant differences between respondents that had prior

experience with music technology outside of undergraduate course work $t(40) = .89$, $p = .38$. However, those with prior experience ($M = 41.43$, $SD = 6.43$) felt more prepared than those with no prior experience ($M = 39.14$, $SD = 8.43$).

Table 4.18

Results for t-Test Comparing the Differences between Prior Experience on Preparedness

	n	*M*	*SD*	*t*	*df*	*p*
				.89	40	.38
No Prior Experience	28	39.14	8.43			
Yes Prior Experience	14	41.43	6.43			

Prior Experience and Efficacy

To determine if differences existed in level of efficacy and prior experience, an independent samples *t*-test was administered. I was able to establish homogeneity of variance through the Levene's test of equality of variance ($p = .88$). There were statistically significant differences between respondents that had prior experience with music technology outside of undergraduate course work $t(39) = 3.00$, $p = .01$. Respondents that had prior experience ($M = 27.31$, $SD = 4.17$) reported higher efficacy levels than those with no prior experience ($M = 23.14$, $SD = 4.17$).

Table 4.19

Results for t-Test Comparing the Differences between Prior Experience on Efficacy

	n	*M*	*SD*	*t*	*df*	*p*
				3.00	39	.01
No Prior Experience	28	23.14	4.17			
Yes Prior Experience	13	27.31	4.05			

Chapter 5: Discussion

Music technology integration has been an emerging research topic in the field of music education since the early 2000s (e.g., Dammers, 2013; Dorfman & Dammers, 2015; Dorfman, 2008; Gilbert, 2015; Hawkins, 2018; Holliman, 2021; Russell et al., 2003; Villani, 2014). Advancements in music-specific hardware and software (Bannerman & O'Leary, 2021; Dorfman, 2008; Dorfman & Dammers, 2015; Russell, et al., 2003) have impacted music education research by illuminating the music technology available to teachers. Given increased investigations into music technology, few researchers have examined the topic in the state of Oklahoma. Extant research lacks data regarding preservice music teachers' (PMTs') perceptions of and general self-efficacy towards various music technologies.

The purpose of this quantitative study was to examine preservice music teachers' perception of their experiences and self-efficacy with music technology in Oklahoma music teacher preparation programs. Specifically, I asked:

1. What experiences did preservice music teachers have with music technology during their undergraduate program?
2. What opportunities were provided to explore the implementation of music technology during preservice education, field experiences, and student teaching?
3. How efficacious were preservice music teachers about technology in their future classrooms?

Summary of Major Findings

Data was collected from PMTs at NASM-accredited schools of music in Oklahoma during the spring of 2024. Respondents ($N = 53$) completed a researcher-designed survey—informed by extant research findings (Bannerman & O'Leary, 2021; Holliman, 2021; Li, et al., 2016; Spieker, 2021; Waddell & Williamon, 2019)—on their experiences with and perceptions of technology in music education. The survey consisted of 4foursections: Section 1 (Demographic Information), Section 2 (Prior Experience with Technology), Section 3 (Current Technology/Music Technology Instructional Experiences), and Section 4 (Future Classroom Application). Basic descriptive analyses were presented, with results arranged by major variables and their organization within the survey. I employed inferential statistical procedures to determine the extent of differences between groups regarding year in college, prior experiences, undergraduate preparedness, confidence, and efficacy.

Music Technology Experiences in Undergraduate Programs

Music technologies are becoming more extensive and encompass many facets of music education (Aziz, 2013; Bowman, 2022; Bula, 2011; Hungate, 2016; Merrick & Joseph, 2023). Still, extant literature provides limited insights into the various types of music technologies and experiences offered to PMTs (Bannerman & O'Leary, 2021; Haning, 2016; Li et al., 2016). In this study, I sought to examine the experiences that PMTs had with music technology in their undergraduate program. The first research question was, "What experiences did preservice music teachers have with music technology during their undergraduate program?" Data collected revealed that a

majority of PMTs (62%) in Oklahoma had not taken or did not anticipate taking a stand-alone music-technology course in their undergraduate program. A majority of the PMTs that were either enrolled in or completed field observation and student teaching (n = 19, 36.0%) stated that they had observed music technology being used by their cooperating teachers. Previous researchers (Bannerman & O'Leary, 2021; Haning, 2016; Kladder, 2017; Li et al., 2016) reported that PMTs who were not exposed to a variety of music technologies lacked confident in teaching with those technologies and seemed discouraged from exploring them.

The types of music technologies that were found to be most experienced by Oklahoma PMTs were metronomes, tuners/drones, and music notation software. Music production software was found to be lower on respondents' likeliness to teach and level of comfort. These findings appear to align with those by previous researchers in music education (Aziz, 2013; Bula, 2011; Emo, 2022; English et al., 2021; Hawkins, 2018; Pondaco, 2021; Powell, 2019; Spieker, 2020; Toki, 2020; Villani, 2014) who reported that music notation software, metronomes, and tuners were the most popular music technology used by PMTs. However, other music technologies should not be neglected. PMTs can benefit from learning about other music technologies (e.g., drill writing software, electronic instruments for marching band, and digital inventory and management software for administration and communication). This finding highlights the importance of integrating diverse music technologies into music teacher preparation programs. By providing PMTs with experiences with a diverse range of music

technologies, PMTs can foster greater confidence to integrate music technology into their teaching practices.

Music Technology Opportunities in Undergraduate Program

PMTs responded to items regarding opportunities to utilize music technology in their undergraduate music education program. The survey question, "Have you had music technology topics/activities embedded into any undergraduate classes?" was designed to gain insights into this research question. A majority of respondents (n = 41, 79.0%) indicated that they have music technology embedded into undergraduate classes.

Preservice music students also indicated their level of agreement with statements regarding music technology preparation by their undergraduate music program. Several of these statements were designed to determine opportunities that PMTs had in their undergraduate program to use music technologies to enhance their learning experience. Overall, respondents mostly disagreed with these statements (e.g., "My undergraduate program adequately prepared me to teach with a variety of music technologies" and "I had opportunities to teach with music technologies covered in my classes"). The lack of preparation felt by Oklahoma PMTs' in their undergraduate program was consistent with previous researcher findings Haning (2016) who examined type, quantity, and effects of technology instruction on undergraduate music education students in Ohio. The lack of perceived preparation has been linked to limited teaching opportunities (with music technology) afforded PMTs in their undergraduate program (Kladder, 2017). These low levels of agreement and confidence in PMTs' music technology skills

and teaching ability may impact their perceived success in using music technologies in their classrooms post-graduation.

Preservice Music Teacher Self-Efficacy with Music Technology

In order to understand the level of confidence and self-efficacy that Oklahoma PMTs had with music technology led me to the design the third research question: "How efficacious were preservice music teachers about technology in their future classrooms?" To determine PMTs' self-efficacy levels, I asked respondents to report their level of agreement with several statements regarding music technology. Although PMTs initially disagreed with several statements regarding their ability to teach music technology successfully (e.g., "I can imagine myself teaching a music technology-centric class successfully", "I have the necessary skills to teach music technology"), they reported higher levels of confidence in their abilities after gaining teaching experience. Specifically, they reported higher levels of agreement with the following statements, "I can see myself incorporating music technology in my teaching 5 years from now" and "My mastery of music technology skills will improve post-graduation as I begin teaching." These findings are similar to those reported by previous investigators (Bannerman & O'Leary, 2021; Biasutti et al., 2021; Li et al., 2016) who investigated self-efficacy in PMTs. The lack of perceived ability and skills by PMTs to teach music technology could negatively impact their decision to integrate music technology into their classrooms post-graduation as teachers may not use tools they are uncomfortable with.

PMTs' undergraduate preparation, confidence, and self-efficacy with music technology may be correlated. In the questionnaire, respondents rated their agreement with statements designed to investigate PMTs' undergraduate preparedness to use, confidence in future use of, and self-efficacy with music technologies. These aspects of PMTs development may provide valuable insights into how well PMTs feel prepared by their undergraduate program, their confidence in applying music technology in their future teaching, and their overall self-efficacy—the latter which impacts their effectiveness and willingness to integrate music technology into the classroom (Haning, 2016; Li et al., 2016). Undergraduate preparedness refers to how PMTs perceived their undergraduate music program *prepared them* to use technology in their future classrooms. PMTs' confidence in future use refers to their perceived *ability* to integrate and implement music technology in their post-graduation teaching successfully. Self-efficacy refers to PMTs' perceived ability to *successfully teach* with music technology. After analyzing the variables undergraduate preparedness, confidence, and self-efficacy for correlations, the success of undergraduate preparation affects future confidence and teaching implementation. There were significant, moderate direct correlations between preparedness and efficacy ($r = .62$) and between confidence ($r = .60$) and efficacy ($r = .69$). Significant differences were found in the self-efficacy and confidence levels of PMTs with prior music technology experience, which exhibited higher confidence and self-efficacy.

Similarly, previous researchers (Haning, 2016; Kladder, 2017; Li et al., 2016) found that the more unprepared PMTs felt by their undergraduate music program to

teach music technology, the less confidence they would be in music technology teaching. Successful and positive experiences and opportunities with music technology enhance efficacy (Biasutti et al., 2021; Li et al., 2016).

These findings are consistent with those by Kladder (2017) who found that PMTs' perceived attitudes towards music technology were linked to perceived opportunities and offerings in public schools observed during student teaching. Despite faculty interest in music technology integration, divided faculty views regarding this issue prevent further implementation of music technology in undergraduate music courses. PMTs should feel confident to teach with music technology in their future classrooms. These overall findings are the basis for implications and recommendations for inservice music teachers and music teacher educators to incorporate into their career.

Implications

Findings from this investigation have implication for multiple audiences. Inservice music teachers and music teacher educators all have unique perspectives and roles in how PMTs' experience music technology and the development of their perceptions of and self-efficacy towards music technology.

Suggestions for Music Teacher Preparation Programs and Music Teacher Educators

Music teacher educators prepare PMTs during their coursework and facilitate their student teaching experience along with their cooperating teacher. Previous researchers found that many student teachers are unable to find opportunities to teach using music technologies due to reasons that predominantly involve either

interpersonal, financial, time, or access (Hawkins, 2018; Powell, 2019; West, 2021; Zelenak, 2015).

- The music teacher educator and cooperating teacher should be in dialogue with the student teaching about their interest in using music technology during their student teaching period.
- Music teacher educators' classrooms should focus more on developing music technology pedagogical skills, ensuring that PMTs are equipped to integrate music technology effectively into their future classrooms. PMTs should focus on discussing ways that music technology can be integrated into curriculum, used in assessment, adapting technology for various purposes, and collaboration can provide a better framework for preservice teachers to effectively use music technology in their teaching careers.
- Music teacher educators should spark discussion about music technology and possible avenues for integration in future teaching. Classroom assignments and projects with music technology alternative options will assist in generating hands-on opportunities for students and incorporating discipline-specific software in class instruction.
- As faculty members, discussion about music technology implementation in curricula should be held with peers and colleagues at the university-level.

Suggestions for Inservice Music Teachers

Inservice music teachers should self-assess their abilities, identify the gaps in their knowledge of music technology, and seek resources, professional development opportunities, and related training that can teach them how music technology might support and redefine their teaching and students' learning. Maintaining a high level of knowledge and mastery with recent and relevant music technologies in their respective classrooms will lead to more opportunities and experiences for inservice music teachers to develop their skills. The following suggestions may aid inservice music teachers whether or not they are currently utilizing music technology in their classrooms.

- Inservice music teachers should endeavor to attend music technology conferences and professional development sessions (e.g., Technology in Music Education, Music Technology Leadership Academy, National Association of Music Merchants) to develop music technology teaching practices to incorporate into their teaching and to increase awareness of best practices.
- Inservice teachers should start conversations with those more knowledgeable music educators to inquire about potential utilization of music technology in their classroom and opportunities for their students to explore music technology in their classes (e.g., using music technology for composition, chamber ensemble, individual, or larger ensemble practice).
- During student teaching and field experience, inservice music teachers provide skills, attitudes, and experiences that PMTs can use in their teaching post-graduation. When hosting student teachers or PMTs during field experience,

communicate with those students about how music technology is incorporated into your classroom and probe their thoughts on potential uses of music technology for teaching students.

Limitations

There were limitations of this study that provide opportunities for future research. The population was focused on PMTs in undergraduate music education programs contained in a single state within the United States, so generalizability is limited. The distribution of responses across NASM-accredited schools was not recorded. I did not gather specific degree plans or course offerings in NASM-accredited music education programs in the state of Oklahoma.

Suggestions for Future Research

An analysis of degree plans and course offerings could be investigated to find differences between universities instruction of music technology. Most music education programs would have at least one course to meet NASM accreditation standards. However, the types of music technologies covered may vary depending on the course instructors' experiences and skills. Further research in the expectations of music technology program outcomes and PMTs perceptions of the courses they have taken could provide greater detail into the music technology courses currently offered to PMTs.

Replicant studies can be conducted to provide more data to compare offerings and PMTs' self-efficacy levels. Such a comparison will allow for more conclusive data on how programs in other states prepare PMTs for music technology usage and demand

for music technological skills and concepts in higher education and advocacy for more use and awareness in higher education.

Inservice music teachers could be interview or surveyed for their attitudes and perceptions regarding music technology and implementation of music technology in P–12 schools and compare the results by PMTs. The music technologies that inservice music teachers use, technological skills that are most sought after, and music technology courses that are offered could be the focus of surveys or interviews. Such a study could consist of a survey over a large geographic area or focused within a single state. Similarly, music teacher educators could be interviewed or surveyed for their attitudes and perceptions about integrating music technology across various departments within the school of music, curriculum changes, and needs for their students as they prepare for teaching post-graduation. The data for these potential studies could be done through electronic questionnaires or in-person at music education conventions.

Conclusion

The last half century has seen an exponential increase in technology to the extent that it permeates our daily lives. Music technology has been an emergent topic in music education research, with numerous studies exploring its applications and impacts on teaching and learning in P–12 schools and higher education. However, the extant literature is either outdated, focused on inservice music teachers, P–12 students, PMTs in student teaching, or have been conducted in other locations. This investigation revealed that PMTs do not feel prepared by their undergraduate music program to

confidently teach with a variety of music technology in classrooms, desiring more opportunities to teach with music technology, and observing successful implementations of music technology.

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Appendix A: Institutional Review Board Documentation

Institutional Review Board for the Protection of Human Subjects

Approval of Initial Submission – Exempt from IRB Review – AP01

Date: December 06, 2023 **IRB#:** 16718

Principal Investigator: Maxwell D Sellars

Approval Date: 12/06/2023

Exempt Category: 2

Study Title: Preservice teacher attitudes, perception, and self-efficacy of music technology.

On behalf of the Institutional Review Board (IRB), I have reviewed the above-referenced research study and determined that it meets the criteria for exemption from IRB review. To view the documents approved for this submission, open this study from the *My Studies* option, go to *Submission History*, go to *Completed Submissions* tab and then click the *Details* icon.

As principal investigator of this research study, you are responsible to:

- Conduct the research study in a manner consistent with the requirements of the IRB and federal regulations 45 CFR 46.
- Request approval from the IRB prior to implementing any/all modifications as changes could affect the exempt status determination.
- Maintain accurate and complete study records for evaluation by the HRPP Quality Improvement Program and, if applicable, inspection by regulatory agencies and/or the study sponsor.
- Notify the IRB at the completion of the project.

If you have questions about this notification or using iRIS, contact the IRB @ 405-325-8110 or irb@ou.edu.

Cordially,

Aimee Franklin, Ph.D.
Chair, Institutional Review Board

Appendix B: Survey Invitation and Follow-up Forms

Survey Invitation
Send Date: March 25th, 2024
Subject Line: Survey of Preservice Music Teachers Attitudes and Self-Efficacy of Music Technology

Dear Preservice Music Teacher:

As preservice music teachers, your experiences with music technology throughout your undergraduate program can provide insight into current curriculum strengths and concerns. You have been contacted in hopes that you will provide your thoughts and experiences working with music technology during your undergraduate curriculum.

The following is a survey to investigate preservice music teachers' attitudes and self-efficacy of music technology. Completing this questionnaire should only require 10–15 minutes of your time. The greater the number of responses, the greater the confidence our profession will gain about attitudes and self-efficacy of preservice music teachers regarding music technology. The survey questionnaire can be accessed by clicking the link below (depending on your email client, you may need to "copy and paste" the link into your browser):

https://ousurvey.qualtrics.com/jfe/form/SV_0vQXk8KN7vkXvxk

Participation is entirely voluntary, and you have the right to refuse to answer questionnaire items without consequence. Your confidentiality will be maintained, as all information that is collected will be safeguarded using password-secured storage mediums that utilize a two-step verification process. Please complete the enclosed survey questionnaire by April 5th, 2024. Should you have any questions, please contact me at maxwell.d.sellars-1@ou.edu or my faculty advisor, Dr. Eric Pennello, at eric.pennello@ou.edu. Thank you in advance for taking the time to complete this survey on this important topic!

Sincerely,

Maxwell Sellars
MME Graduate Student
University of Oklahoma

IRB #: 16718
IRB Approval Date: 12/06/23

Follow-Up Reminder
Send Date: April 2nd, 2024
Subject Line: Follow-Up Reminder for Survey

Dear Preservice Music Teacher:

Recently, you were invited to participate in my thesis survey on the perceptions of cooperating music teachers as teacher educators. If you have already completed the questionnaire, thank you! If not, please complete the survey link which is provided below. Depending on your email client, you may need to "copy and paste" the link into your browser.

https://ousurvey.qualtrics.com/jfe/form/SV_0vQXk8KN7vkXvxk

Please complete the enclosed questionnaire by April 5th, 2024.

Thank you, again, for sharing your experiences on this important topic. If there are any issues or concerns, please email me at maxwell.d.sellars-1@ou.edu or my faculty advisor Dr. Eric Pennello at eric.pennello@ou.edu.

Best,

Maxwell Sellars
MME Graduate Student
University of Oklahoma

IRB #: 16718
IRB Approval Date: 12/06/23

Appendix C: Survey of Preservice Music Teachers

Start of Block: Consent to Survey

Q1
Consent to Participate in Research for University of Oklahoma
You have been invited to participate in research about preservice music teachers' attitudes, perceptions, and self-efficacy of music technology and the availability of music technology-based courses in Oklahoma. Specifically, you will be asked about what types of music technology courses are offered, (b) how preservice music teachers feel about utilizing music technology in their future classrooms, and (c) the various ways that PMTs were provided opportunities to explore the implementation of music technology in their coursework, field experiences, and student teaching.

If you agree to participate, you will complete a 10–15-minute online survey.

You may experience these minimal risks:

Data collected online or by a device and transmitted electronically: You will be asked to complete an online survey as part of this research. The organization hosting the data collection platform has its own privacy and security policies for keeping your information confidential. There is a risk that the external organization, which is not part of the research team, may gain access to or retain your data or your IP address which could be used to re-identify you. No assurance can be made as to their use of the data you provide for purposes other than this research.

To minimize the risk of deductive re-identification, we will not combine identifying variables nor analyze and report results for small groups of people with specific demographic characteristics.

There are no benefits for participating in this research.

Your participation is voluntary, and your responses will be anonymous.

We will not share your data or use it in future research.

Even if you choose to participate now, you may stop participating at any time and for

any reason. If you have questions about this research, please contact Maxwell Sellars, Principal Investigator at maxwell.d.sellars-1@ou.edu or Dr. Eric Pennello, faculty advisor at eric.pennello@ou.edu. You can also contact the University of Oklahoma – Norman Campus Institutional Review Board at 405-325-8110 or irb@ou.edu with questions, concerns, or complaints about your rights as a research participant or if you don't want to talk to the researcher. Please print this document for your records.

By providing information to the researcher, I am agreeing to participate in this research.

IRB #: 16718

IRB Approval Date: 12/06/2023

- ❍ I agree.
- ❍ I do not agree.

Skip To: End of Survey If Consent to Participate in Research for University of Oklahoma You have been invited to participat... = I do not agree.

End of Block: Consent to Survey

Start of Block: Demographic Information

Q2 **What do you identify as?**

- ❍ Female
- ❍ Male
- ❍ Genderqueer/gender non-conforming
- ❍ Non-binary / third gender
- ❍ Trans male
- ❍ Trans female
- ❍ Prefer to self-prescribe

  _____

- ❍ Prefer not to say

Q3 **Please select the category that best describes your race/ethnicity (select only one response):**

- ❍ American Indian or Alaska Native (not Hispanic or Latino)
- ❍ Asian (not Hispanic or Latino)
- ❍ Black or African American (not Hispanic or Latino)
- ❍ Hispanic or Latino
- ❍ Native Hawaiian or Other Pacific Islander (not Hispanic or Latino)
- ❍ White (not Hispanic or Latino)
- ❍ Two or More Races (not Hispanic or Latino)
- ❍ Prefer to describe _____
- ❍ I prefer not to answer

Q4 **What year are you in college?**

- ❍ Freshman (First year)
- ❍ Sophomore (Second year)
- ❍ Junior (Third year)
- ❍ Senior (Fourth year or beyond)

Q5 **What is your degree emphasis?**

- ❍ Instrumental / General
- ❍ Vocal / General
- ❍ Other _____

Q6 **Have you completed or currently in your field experience as of taking this survey?**

- ❍ No
- ❍ Yes

Q7 **Are you enrolled in student teaching?**

- ❍ No
- ❍ Yes

End of Block: Demographic Information

Start of Block: Prior Experience

Q8 **Do you have any prior experience with music technology outside of your undergraduate music coursework?**

- ❍ No
- ❍ Yes

Q9 **Where was this prior experience from?**

- ❍ General Undergrad Education Courses
- ❍ High School Classes
- ❍ Independent Interest

Q10 **Please provide details about your prior experiences with music technology.**

_____

End of Block: Prior Experience

Start of Block: Tech and Music Tech Instruction

Q11 **Have you taken/will you take a stand-alone music-technology course?**

- ❍ No
- ❍ Yes

Q12 **Have you had music technology topics/activities embedded into any undergraduate classes?**

- ❍ No
- ❍ Yes

Q13 **What music technologies have you covered in your music courses?**

- ❑ Music Notation Software (Finale, Sibelius, etc.)
- ❑ Music Production Software (Ableton Live, FL Studio, Pro Tools, etc.)
- ❑ Music teaching software (SmartMusic, Aurelia, etc.)
- ❑ Auto-accompaniment software
- ❑ Metronomes
- ❑ Tuners/Drones
- ❑ Audio/Video Recording Software (e.g., Audacity)
- ❑ Electronic/Digital Instruments (e.g., Harmony Director, EWI)
- ❑ Drill Writing Software (Pyware 3D, Drill Quest)
- ❑ Digital Inventory and Management Software (e.g., Charms, CutTime)
- ❑ Other
- ❑ None

Q14 **If other, please specify.**

_____

Q15 **Please list your level of comfort with using the following music technologies.**

	Very unlikely	Unlikely	Neutral	Likely	Very Likely
Music Notation Software (e.g., Finale, Sibelius, etc.)	o	o	o	o	o
Music Production Software (e.g., Ableton Live, FL Studio, Pro Tools, etc.)	o	o	o	o	o
Music Teaching Software (e.g., SmartMusic, Aurelia, etc.)	o	o	o	o	o
Auto-accompaniment software	o	o	o	o	o
Metronomes	o	o	o	o	o
Tuners/Drones	o	o	o	o	o
Audio/Video Recording Software (e.g., Audacity)	o	o	o	o	o
Electronic/Digital Instruments (e.g., Harmony Director, EWI)	o	o	o	o	o
Drill Writing Software (e.g., Pyware 3D, Drill Quest)	o	o	o	o	o
Digital Inventory and Management Software (e.g., Charms, CutTime)	o	o	o	o	o

Q16 **Please rank your perceived importance of different music technologies as a future music educator.**

_____ Music Notation Software
_____ Music Production Software
_____ Music Teaching Software
_____ Auto-accompaniment software
_____ Metronome
_____ Tuner/Drone
_____ Audio/Video Recording Software
_____ Electronic/Digital Instruments
_____ Drill Writing Software
_____ Digital Inventory and Management software

Q17 **How likely are you to teach with the following music technologies in your future classroom?**

	Very unlikely	Unlikely	Neutral	Likely	Very Likely
Music Notation Software (e.g., Finale, Sibelius, etc.)	**o**	**o**	**o**	**o**	**o**
Music Production Software (e.g., Ableton Live, FL Studio, Pro Tools, etc.)	**o**	**o**	**o**	**o**	**o**
Music Teaching Software (e.g., SmartMusic, Aurelia, etc.)	**o**	**o**	**o**	**o**	**o**
Auto-accompaniment software	**o**	**o**	**o**	**o**	**o**
Metronomes	**o**	**o**	**o**	**o**	**o**
Tuners/Drones	**o**	**o**	**o**	**o**	**o**
Audio/Video Recording Software (e.g., Audacity)	**o**	**o**	**o**	**o**	**o**
Electronic/Digital Instruments (e.g., Harmony Director, EWI)	**o**	**o**	**o**	**o**	**o**
Drill Writing Software (e.g., Pyware 3D, Drill Quest)	**o**	**o**	**o**	**o**	**o**
Digital Inventory and Management Software (e.g., Charms, CutTime)	o	o	o	o	o

Q18 **Have you observed or utilized any of the previously defined music technologies in your field experience or student teaching?**

- ❍ No
- ❍ Yes

Q19 **If yes, please explain.**

_____

End of Block: Tech and Music Tech Instruction

Start of Block: Future Plans

Q20 **How much do you agree with the following statements regarding your undergraduate music program?**

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
I consider the integration of music technology as an important component to music education.	o	o	o	o	o
There is adequate technology access in my music classes.	o	o	o	o	o
My undergraduate program	o	o	o	o	o

prepared me to implement technology integration in my classroom.					
My undergraduate program considered it important to provide me with adequate technology training for new tools and software they require me to use for teaching.	o	o	o	o	o
My undergraduate program adequately prepared me to teach with a variety of music technologies.	o	o	o	o	o
I had opportunities to teach with music technologies covered in my classes.	o	o	o	o	o

Knowledge about music technology will improve my teaching.	o	o	o	o	o
Learning about a variety of music technologies is important for teaching.	o	o	o	o	o
Support from faculty has helped me in learning music technology.	o	o	o	o	o
Support from my peers has helped me in learning music technology.	o	o	o	o	o
I have seen others be successfully using music technology in teaching.	o	o	o	o	o

Q21 **Please indicate your level of confidence with the following statements regarding your future use of music technology in your classroom.**

	No Confidence	Little Confidence	Somewhat Confident	Confident	Strongly Confident
I can imagine myself embedding music technology in my classes successfully.	o	o	o	o	o
I will be able to identify issues and provide solutions to students that have questions regarding music technology.	o	o	o	o	o
My mastery of music technology skills will improve post-graduation as I begin teaching.	o	o	o	o	o
The music technologies seen or taught in my undergraduate program will be relevant in my teaching career post-graduation.	o	o	o	o	o
I feel prepared to teach music technology in my P–12 music classes.	o	o	o	o	o
I can create effective lessons for music technology concepts.	o	o	o	o	o
I can create lessons plans about music technology that adhere to state or	o	o	o	o	o

national music standards.					
I will be able to evaluate my students' music technology knowledge.	o	o	o	o	o

Q22 **Please indicate your agreement level with the following statements.**

	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree
I am continually learning better approaches to teach music technology.	❍	❍	❍	❍	❍
I have the necessary skills to teach music technology.	❍	❍	❍	❍	❍
I want to be a music teacher who incorporates music technology into their teaching.	❍	❍	❍	❍	❍

I can imagine myself teaching a music technology-centric class successfully.	❍	❍	❍	❍	❍
I can see myself incorporating music technology in my teaching 5 years from now.	❍	❍	❍	❍	❍
I am not sure I want to incorporate music technology into my teaching	❍	❍	❍	❍	❍
Incorporating music technology into my teaching will be satisfying for me.	❍	❍	❍	❍	❍

Q23 **According to your answers to the above items, please describe why you will or will not incorporate music technology in your future music classes.**

_____

End of Block: Future Plans