2022

An examination of alignments and misalignments of music teacher and student attitudes about music technology in and out of school

BOSTON UNIVERSITY

COLLEGE OF FINE ARTS

Dissertation

AN EXAMINATION OF ALIGNMENTS AND MISALIGNMENTS OF MUSIC TEACHER AND STUDENT ATTITUDES ABOUT MUSIC TECHNOLOGY IN AND OUT OF SCHOOL

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Submitted in partial fulfillment of the

requirements for the degree of

Doctor of Musical Arts

2022

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ACKNOWLEDGEMENTS

First, I would like to thank my family for supporting me during this long and emotional rollercoaster of a ride and helping me achieve a project that ultimately defines my passion as an educator and researcher. I also wish to thank my best friend Susan, who consistently motivated me to keep going until I finally made it to this point.

Finally, I want to thank my advisor, Dr. Jay Dorfman, who has been patient, forthright, and supportive over the course of this study. Without him I would not have finished my dissertation. In addition to Dr. Dorfman, both Dr. Smith and Dr. Kellum offered guidance that improved my study, allowing for a more clear and resonant exploration of those who participated in it.

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ABSTRACT

I examined what a music educator considered critical for students to achieve and maintain autonomous musicianship (Tobias, 2013) with the aid of current music technology, thereby seeking ways that their viewpoints did or did not blend with those of students in their classroom. I sought to record one teacher's attitudes about music technology implementation in an Advanced Placement Music Theory classroom, a branch of the "secondary student population…traditionally excluded from music programs" (Tobias, 2010, p. 559). Next, I searched for ways that participating students' uses of music technology revealed alignments or misalignments between their informal and formal learning environments. Finally, I explored the ways in which the teacher's and students' attitudes revealed a cooperative learning environment, defined according to pure and pragmatic constructivist theories of learning.

Participants in this ethnographic case study comprised one teacher and nine students. Within one month, I interviewed students and their teacher, conducted classroom observations and collected several artifacts. Data analysis comprised *a priori* and open coding processes, as well as inductive, axial and selective application of codes to data. I organized data according to each research question and ensuing themes.

Data analysis revealed the teacher's attitudes about implementing technology into his curriculum and his students' music technology use outside of school. Students discussed a variety of ways in which they work with music technology in and out of school, and some of these ways aligned with how their teacher facilitated their classroom routine. The classroom environment revealed constructivist qualities wherein students built their knowledge with music technology while making use of their informal learning experiences. Future research could look further into the extent to which students' experiences play a role in the teacher's music technology implementation in other non-band, choir, and orchestra classrooms and the role that a teacher's assumptions play in that implementation.

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CHAPTER 1

In general, people losing touch with the cultural traditions of everyday citizens led to what Adorno (1945) called “the neutralization of culture in general and of the arts in particular” (p. 377). The latter part of my 18-year tenure as a music educator featured reflecting the everyday interactions between myself and my students in the music classroom. I believed that music classrooms could or should be “purposeful, democratic [spaces] where teachers and students come together (Allsup, 2008, p. 7). Similar to scholars beforehand (Dyndahl & Nielsen, 2014; Regelski, 2009; Spruce, 2013), I realized that gaps existed between my students’ musical practices outside of school and the formal schooling they received. It was clear that I should include students’ practices. One way to do so was through music technology, a link to the “ways of the new” (Tobias, 2010, pp. 560–561) that students deemed important. Continued interest led me to conduct a study of a music classroom that assuaged a “disconnection between the music studied at school and the hidden or private musical world of our students” (Allsup, 2003, p. 25). Collaboration between these formal and informal learning environments, would require support by a classroom music teacher through their understanding of what their students use in their private musical world.

It is well established that a variety music technology is a key component in all types of school music curricula (Tobias 2010, 2012, 2013; Webster, 2007). Researchers also found that informal learners exhibit diverse approaches to learning about music when using their choices of music technology outside of school (Crow, 2006; Dunbar-Hall, 2000; Folkestad, 2006; Kratus, 2007; Tobias, 2010). One area in which both informal and formal environments converge, the music classroom, was associated with an "authoritarian conception of learning" (Allsup, 2003, p. 27) at various levels. This is a concept that conflicts with the "assurance of the development of respect for the integrity of the individual" (Kemp, 1960, p. 71). An authoritative figure, such as a teacher, may have the ability to negotiate with students. Before a negotiation can be considered or even confirmed, it should be made clear whether or not relationships that occur between the teacher and students matter to the teacher in the first place (Webster, 2011). Considering teachers' viewpoints, my goal was to provide responses to "…what might it mean, and what would it take, to make music education more 'child-centred' [*sic*], more 'popular', more 'democratic'" (Allsup, 2012, p. 172) explicitly via the curricular integration of music technology. Observing music technology use in the classroom may expose relevant information for my study because music educators have been known to negotiate between curricular and informal learners' values in practice (Ruthman, 2006).

I understood that such a negotiation may or may not always manifest. Teachers and students may or may not have equal access to technology. Teachers may or may not understand their students' music technology savvy. For the sake of my research questions, I wanted to consider aspects of music technology that represented current values of teachers and students that would reveal any alignments between them. Tobias (2013) stated that contemporary musicianship comprised "creative processes through synthesizing songwriting, composing…and assisting music students in gaining the skills and creative musicians to record, mix, and edit their music" (p. 225). The specific contemporary music practices may be part of what links practices in or out of school.

Need for the Study

With this study, I sought to determine what a music educator considered critical for their students "to gain and sustain agency as contemporary musicians" (Tobias, 2013, p. 228) with the aid of music technology, and thereby seek ways their viewpoints did or did not blend with those of his students. The term *music technology* could mean a myriad of things. Regarding this particular study, music technology is any digital device the school and teacher provides for students enrolled in a public school music class. While this definition is still rather broad, it allows for all possible types of technology to be considered and subsequently discovered during data collection.

A need for the study was to find out a music teacher's perspectives about their students' contemporary technology use outside of the formal instruction environment, and how his perspectives might shape the ways in which they instruct his students. Fulfilling this need helps determine whether this particular relationship between teacher and student matters to the teacher as determined by the students' interests outside of school (Webster, 2011). Tobias (2013) argued, "Music teaching and learning ought to develop and integrate the types of skills, knowledge, and musical thinking in our classrooms and ensembles that relate to the landscape of contemporary music" (p. 228). Contemporary practices, the "ways of the new", (Tobias, 2010, pp. 560–561), include music production, recording, mixing, scoring, and editing—skills that represent music students' interests outside of the classroom. According to Xiao and Carroll (2007), students who use modern technology require fostering in the classroom in order to "address the shift in educational context" (p. 34). While the importance of incorporating and promoting students' informal music technology knowledge has been addressed, I sought to find out whether or not teachers ultimately "play a role in their students' musical education when working in informal learning situations within formal environments such as schools" (Tobias, 2010, p. 543). What music educators consider crucial for their students, determined either by their perspectives or their students' viewpoints, leads the reader to determine whether negotiations occur in the classroom (Ruthman, 2006).

An additional need for the study was continued research of specific populations of music students who do not participate in what could be considered traditional course offerings, e.g., band, choir, or orchestra (non-b/c/o) (Demski, 2010; Etherington, 2014). Do teachers of these students consider this "*broad* secondary student population…traditionally excluded from music programs" (Tobias, 2010, p. 559, emphasis added) in their curricula? This large student population, with its kaleidoscope of popular music cultural backgrounds, represents the "kind[s] of musical practice[s] that [mediate] between different phases of the continuing learning process, arising 'naturally' from the needs of the situation" (Väkevä, 2009). Researchers have discussed informal learning in depth (Allsup, 2008; Espelund, 2010; Furlong & Davies, 2012). A need for a study is additional acknowledgement of informal learners as "curriculum makers" (Finney & Philpott, 2010, p. 9). Reports have shown evidence of curricular alignments and misalignments between informal learners and their teachers within a variety of academic levels and other fields outside of music education. Grant et al. (2012) discovered that when collegiate students perceived "having casual conversation about [a] technical mathematics problem with their peers as exotic enough to merit curious inquiry," the resulting curricular agreement came in the form of student-generated exam questions (p. 5). White et al. (2013) found that immigrant students involved in a homework club outside of the formal schooling environment used self-taught English translation skills as a "pedagogical tool for teaching concepts" (p. 649). These students' teachers valued, and subsequently integrated into the curriculum, this form of peer help because it "enable[d] learners to use the knowledge they already [had]" (White et al., 2013, p. 641). Additionally, Kelly & Hagar (2015) discovered that health care simulations undertaken by nursing students reflected an informal approach to learning characterized by opportunism, e.g., "life and work experiences to achieve fulfillment irrespective of their level of formal qualification" (p. 378). This complemented the course content, thus creating curriculum that was "learner focused rather than being solely based on what information the teacher believes is important to impart to students" (White et al., 2013, p. 379). These studies demonstrate the significance of informal learning as it pertains to participants informing formal learning environments and the ways in which their teachers implement it or recalibrate curricula.

Research Questions and their Respective Theoretical Frameworks

The purpose of this study was to find out what a music educator participant considered critical for his students in order to "to gain and sustain agency as contemporary musicians" (Tobias, 2013, p. 228) with the aid of music technology, thereby seeking ways that their viewpoints did or did not blend with those of his students. The following research questions guided my investigation:

1) When instructing a broad population of secondary students enrolled in a non-b/c/o music course who also engages with music technology outside of school, what are their teacher's attitudes about music technology implementation?
2) In what ways do secondary students who use music technology informally outside of school and take part in non-b/c/o music instruction in school reveal alignment, or misalignment, between the two environments?
3) In what ways do a music teacher and his students' attitudes about music technology reveal, or not reveal, a collaborative learning environment?

Each research question has a set of frameworks that guide it. Here they are discussed briefly. Once my research questions are introduced, a section dedicated to the in-depth discussion of corresponding frameworks follows. For Research Question 1, I was curious about an individual teacher's attitudes toward lessons that are integrated with popular music culture, of which technology is component (Tobias, 2012), were cultivated by their willingness to observe and learn (Green, 2008). I refer to the theory of a problem-posing education and its comparison to a more standard generalization about common teacher-centered approaches, or what is known as a banking model (Freire, 2005). In order to gain knowledge about the broader informal learner population, Research Question 2 draws upon theoretical descriptions of informal learners, namely self-directed learning attributes (Jenkins, 2011), tangible stages of informal learning processes (Marsick & Watkins, 2001), as well as teachers' perceptions about their students' intentionality while creating music outside of school using technology (Folkestad, 2006). Research Question 3 draws upon theories about what Espelund (2010) called a semi-controlled formal learning scenario, in which students are provided the opportunity to utilize their negotiation skills while working on classroom music technology projects. Such skills echo constructivist ideals, specifically integrating new knowledge with prior knowledge (Heuwinkel, 1996) and molding future thinking based on past mistakes (Dewey, 1910). When looking for attitudes that indicate a cooperative partnership between student and teacher, I refer to constructivism's evolutionary influence over how knowledge is gained from solely in the classroom to a blend of classroom and outside the classroom, as well as the evolution of the expert-receiver division to a mentor-participant partnership (Webster, 1998, 2011). So that my third research question does not indicate a bias toward strictly constructivist ideologies when observing participants, I consider the possibility that music educators sometimes evoke pragmatic teaching approaches for the sake of the lesson's success while their students continue to integrate new knowledge into prior knowledge (Perkins, 1999).

Framing Research Question 1

The Middle Road

Green (2008) theorized that integrating ways in which students informally learn music into the curriculum was generally favorable. She concluded that music educators' stances were nurtured by the willingness to stand back and watch how students work—specifically, in ways popular musicians work—followed by learning from these observations. The teacher-as-observer stance dissolved the dictatorial position, and a more egalitarian role was allowed to take its place. Additionally, Campbell (2010) argued that music educators should seek out a median attitude to teaching. The author wrote, "Music teachers may need to develop a more balanced way of communicating with children…moving at least to the middle of the road with regard to dimensions of introversion-extroversion, dependence-independence, and anxious-calm traits" (Campbell, 2010, p. 272). This conclusion was based on research that deemed performers as somewhat more anxious, withdrawn, and self-sufficient (Kemp, 1996, as cited in Campbell, 2010, p. 272).

For both authors, popular music culture integration stood as a kind of truce between standard curriculum delivery and observing students' interests at work. Shedding a performance-driven attitude allows for more open communication between teacher and student. When teachers indicate their attitudes about teaching music technology by means of how they teach, what about these attitudes demonstrates, or does not demonstrate, a willingness to observe students' interests and communicate with their students during music technology lessons? Potential observations that could answer this question are important to my study because in order for any cooperative relationships to be determined, I needed some clues as to what led to the relationship.

Problem-posing Education

I am looking for what teachers consider most important in terms of music technology and intend to place these attitudes in the context of the theory of a problem-posing education (Freire, 2005). Freire (2005) argued that a standard model of teaching encouraged passive reception of knowledge by the student with the teacher acting as the raconteur. Concerning the typical educator, Freire (2005) wrote, "The teacher talks about reality as if it were motionless, static, compartmentalized, and predictable. Or else he expounds on a topic completely alien to the existential experience of the students" (p. 71). One can perceive the concern for the lack of connection between the student's intentionality (Folkestad, 2006) outside of school and the teacher-as-reporter's regard for what is important for students to learn. On the subject of the student, the Freire (2005) argued:

> Narration (with the teacher as narrator) leads the students to memorize mechanically the narrated content. Worse yet, it turns them into "containers," into "receptacles" to be "filled" by the teacher. The more completely she fills the receptacles, the better a teacher she is. The more meekly the receptacles permit themselves to be filled, the better students they are. (pp. 71–72)

Freire (2005) offered a solution to the tension, namely problem-posing as a foundation for the classroom climate. The author calls the standard model of teaching "banking," or a method to mythicize reality, whereas "problem-posing education sets itself the task of demythologizing" (p. 83). Important to my study, the banking model "inhibits creativity and domesticates…the *intentionality* [emphasis in original] of consciousness by isolating consciousness from the world" (pp. 83–84).

Rather than observing teachers' convictions about music technology in the context of critical theory, I consider this specific framework when qualifying their attitudes and comparing them with what is important to their students. The issue of informal learners' music technology intentionality (Folkestad, 2006) is most important when discussing music teachers' attitudes because whatever the teacher deems significant for the informal learner/student may or may not be critical in the lives of students. To establish what, if any, partnerships exist between parties, one must be able to rely on theories that articulate the existence, or the possibility, of teacher-student relationships, as described by Freire (2005).

Framing Research Question 2

Distinctiveness of Students outside of School

Implicit to my second research inquiry was understanding how students express their informal learning within the context of formal learning as well as what an informal learner essentially is. To begin, what about students' music learning is informal, and does it somehow interact with how they learning music in school? I began with framing my second research question with scholarship that defines the informal learner in a generalized way. Jenkins (2011) supposed that an informal learner emerges as someone who is "struggling to make sense of one's environment and to get one's needs met" (pp. 180–181). They engage in self-directed activities such as "learning how to walk, to use a spoon and bowl, to tie one's shoe, and to whistle" (Jenkins, 2011, p. 181). How do their attitudes change as they get older and do these changes represent a marked contrast from their youth? Marsick and Watkins (2001) assumed that their attitudes reflect a "dissatisfaction with current ways of thinking or being" (p. 29). Having become dissatisfied, the informal learner approaches a goal with a relaxed and playful attitude (Jenkins, 2011). As they learn within the amalgamized context of these descriptions, informal learners find that the "mood of exploration and discovery may empower [them], putting them in charge of their own destinies" (Jenkins, 2011, p. 188).

What are some ways that informal learners choose to work on and complete their projects? Adding to his thoughts about empowerment through exploration, Jenkins (2011) characterized an informal learner according to efforts to complete a task without intervention or structure placed upon them. The task is personalized or attempted for the sake of their relationship with it (Jenkins, 2011). This trait is made possible by the lack of an authoritative figure so that they have the “autonomy to perform the actions as they choose”, free to “make decisions based on their own assessments of the situations in which they find themselves” and to experiment spontaneously (Jenkins, 2011, p. 184). I also noted that free thinking was not without structure. The dichotomy between these two elements is compelling. A structured approach, Jenkins (2011), a plan or method is “generally associated with a socially sanctioned educational institution, by means of which the student is to achieve certain planned goals” (p. 181). The dichotomy between both learners is of significance to my framework. On one hand the informal learner comprises exploratory and random approaches without compromising the learning process, while the formal learner sees the endgame because there is a structure already in place in order to make that possible (Jenkins, 2011).

Finally, I took an interest in the specific stages used by informal learners when engaged in a project. This helped my understanding of structured approaches when looking at the ways informal learners think. One of these is comparing a “new situation with prior experience” (Marsick & Watkins, 2001, p. 30–31). In order to learn what students express about the interaction between informal and formal learning environments, I needed to know how “interpretation of the context” of a formal learning task led to “choices about alternative actions” (Marsick & Watkins, 2001, p. 30).

Students recollect past solutions that are relevant to the task at hand. The moments when these "choices are guided by recollections" (Marsick & Watkins, 2001, p. 30) are opportunities for students' to express their thoughts about why or how they did so. Both Jenkins (2011) and Marsick and Watkins (2001) provide a comprehensive lens with which to identify the underlying characteristics of participating students' attitudes about using music technology across formal and informal learning environments.

Informal Music Learners and the Use of Technology

Informal music learners possess a distinct approach to learning music in terms of their intentionality, as in "the mind is directed towards *playing music (making music)* [emphasis in original]" (Folkestad, 2006, p. 138). The role of technology predominates informal learners' intentionality both at home (Furlong & Davies, 2012) and communicating from place to place (Kratus, 2007). Folkestad (2006) wrote:

> The great majority of musical learning takes place outside schools…in which the intention of the activity is not to learn *about* [emphasis in original] music, but to play music, listen to music, dance to music, or be together with music. (p. 136)

Technology has been included in informal learners' music experience with the advent of MP3 players and the Internet (Kratus, 2007). Present-day informal learners have access to more advanced music technology outside of school in conjunction with the popular music culture, such as music mixing software and recording equipment, in addition to a wide variety of playback devices (Tobias, 2012) and quicker Internet (Tobias, 2014). The characteristics of informal music learners who use technology inform popular findings, wherein they "learn principally with and from each other; they are less reliant on instruction from experts…their engagement with music making is likely to be diverse; and technology plays a significant role in their learning" (Lebler, 2012, p. 205). Because informal learners have access to some form of technology, music educators "never meet musically ignorant, untutored or uneducated pupils: on the contrary, when pupils come to school, they all possess a rich and in some ways sophisticated musical knowledge" (Folkestad, 2006, p. 136).

Folkestad's (2006) work is significant to my second research question because it portrays informal music learners explicitly according to their intentionality. Here, the intentions of the informal music learner are comprised of play, dance, and being together. The author added that an informal music learners think about making music instead of learning music. With intentionality in mind, I point out what roles music technology plays, both at home and across the Internet. Moreover, informal music learners work with technology in conjunction with their intimate knowledge of popular music culture. The collective framework outlined by those authors discussed in this section allows me to inquire about what aspects of music technology are characteristic to informal learners and observe what types of intentionality fuel these preferences. Further, it allows me to view informal learners as students—they are called students or pupils in the classroom, yet they bring the qualities of inherent intentionality into the classroom when using music technology.

Framing Research Question 3

Locating a Collaborative Classroom Environment

Labeling specific cooperative relationships between informal learners and teachers is not the aim of my third research inquiry. Instead, the aim is to carefully locate a generalized set of alignments, allowing room for potential misalignments, within the contexts articulated in the theoretical frameworks discussed thus far. When looking for alignments, one would assume that the opposite occurs, that teachers and students do not express themselves similarly in the classroom. In support of this assumption, researchers have pointed to a variety of discrepancies between the teachers' and students' feelings toward specific issues related to the classroom, including student motivation (Chase, 1991), effects of scheduling on student learning (Liu & Dye, 1998), self-directed learning activities (Hewitt-Taylor, 2001), facilitation of student-to-student communication (Jones & Jones, 2005), and teacher feedback (Zacharias, 2007).

Green (2008) completed a study regarding integrating the ways informal learners do music into the curriculum, and Folkestad (2006) discussed the intentionality of informal learners. Espelund (2010) drew upon both author's theories and argued for a deeper understanding what a partnership-nurturing music classroom consisted of. Espelund (2010) sketched a "continuum of a horizontal dimension (the setting) and a vertical dimension (the student/teacher control and degree of pedagogical sequencing)" (pp. 134–135). The author considered how five basic principles of formal education (Green, 2008, as cited in Espelund, 2010) would fit in this continuum:

1. Learning music that pupils choose, like and identify with.

2. Learning by listening and copying recordings.
3. Learning with friends.
4. Personal, often haphazard without structured guidance.
5. Integration of listening, performing, improvising and composing. (pp. 133–134)

After reading Green's (2008) work, Espelund (2010) determined that learning practices that took place in her work were typically "institutional, non-sequential and student-controlled (p. 135). However, once prescribed content was introduced into the classroom, Espelund (2010) considered the practice, like most real-life scenarios, to be mixed (p. 135). I compared Espelund's (2010) findings with theories discussed by researchers from my previous research questions. For example, an emphasis on student control during formal music projects may require skills acquired during rehearsals outside the classroom, such as negotiation (Miell & Littleton, 2008). Moreover, non-sequential projects and lessons may invite playful attitudes toward work that emphasize exploration and discovery, inspiring a few student/informal learners in the process (Jenkins, 2011).

Accounting for blurriness. Espelund (2010) also argued that theories maintained by Folkestad (2006) required rethinking when technology was involved. The author stated, "The apparent duality with a clear difference between the institutional and private setting in many instances is more complex and blurred…especially in view of the role modern technology seems to playing in this respect" (p. 134). Espelund (2010) offered the following example:

> When I go to my computer and Internet in my home to learn to play tunes on my Irish whistle from an educationally organised and sequenced series of videos provided by a staff member of a New York University, should this be regarded as an instance of formal or informal learning? (p. 134)

For my study I am concerned with formal settings in which similar indistinguishable scenarios may take place. This particular theory offers me an ideal description of how digital music technology contributes to the assimilation of formal and informal learning contexts—one that can be used to compare and contrast what I observe in the classrooms I study in which the teacher exhibits various levels of control over the students. However, there may be no clear dichotomy between the two environments. Significant to answering my third question are the possible activities in the classroom that cannot be thrown into the formal or informal designation.

Student control. The critical observations of Espelund (2010) guided my inquiries about whether what I observed in the classroom is an environment revealing alignments between the teacher and student/informal learner. According to the Espelund (2010) and Green (2008), a key component in any learning situation is student control. With student control, one may observe students' negotiating skills (Miell & Littleton, 2008). My research questions focus on attitudes, with the third question asking specifically about the moments in which both students/informal learners' and teachers' reveal some level of cooperation. Moments when students negotiate skills and moments when teachers promote a semi-controlled teaching environment may or may not indicate collaboration between the student/informal learner and their teacher; however, the theories expounded by Espelund (2010), at the very least, provide a foundation for observation and inquiry in this regard.

Constructivist Education

Constructivist educators believe "knowledge is subjective; that is, everyone creates his own meaning of any particular experience, including what he hears or reads," and "children learn through integrating new ideas into their existing knowledge structures" (Heuwinkel, 1996, p. 29). According to Heuwinkel (1996), in order for constructivist ideals to become meaningful to education in general, policymakers, administrators, teachers, and parents must reflect upon their beliefs and decide which one(s) merit(s) emphasis. The author suggested the following choices:

- Children learning through putting together separate skills, or through immersion in authentic situations.
- Children learning basic information or building their own understanding of subject matter.
- Teachers who tell children what they must know, or who trust children to learn through experience and reflection with teacher guidance.
- Teachers who are the only ones with the answers, or who engineer learning situations whereby students make their own discoveries. (Heuwinkel, 1996, p. 31)

The latter two portions of these options, particularly those that speak to the teachers, inform the premise for my research questions, in that they imply that the *teacher* has the ability to open the door to collaborative relationships with students.

Constructivism essentially challenges teachers' deep beliefs about knowledge acquisition. Shively (1995) wrote:

> Constructivists state that there is a world to be experienced and that individuals interpret and bring meaning to this experience. While this view potentially has serious implications for classroom practice, the adoption of the constructivist perspective requires the abandonment of certain assumptions that have long dominated many of our beliefs about how we know and how we come to know. (p. 18)

Significant to my study are those unchallenged beliefs that dominate standard teaching strategies and subsequent knowledge reception by their students (Freire, 2005). Concerning the students, Dewey emphasized that "(t)he child's own instincts and powers furnish the material and give the starting-point for all education" (McDermott, 1981, p. 444). Dewey (1910) further stated, "The trained mind is the one that best grasps the degree of observation, forming of ideas, reasoning, and experimental testing required in any special case, and that profits the most, in future thinking, by mistakes made in the past" (p. 62). These constructivist ideals essentially complement the standard-challenging, problem-posing education suggested by Freire (2005), in that a problem-posing education benefits from the knowledge of student/informal learners.

One factor that molds students/informal learners' trained minds—future thinking based on information gathered from past mistakes (Dewey, 1910)—is a resonating theoretical factor for my research inquiries. While it is difficult to pinpoint what Dewey meant by "trained", the descriptive elements specific to the term—observation, forming ideas, and trial testing—parallel informal learners' discontent with existing ways of thinking (Marsick & Watkins, 2001). If student/informal learners bring with them this type of dissatisfaction into the classroom, such as habits or training relative to their experience outside of school, the challenge teachers may face is, as Shively (1995) pointed out, shedding their suppositions about how people know, and come about knowing, information.

New Knowledge

Piaget (1952) believed that children constructed knowledge by applying "familiar means to new situations" (p. 268). Webster (2011) specifically referenced the Zone of Proximal Development (ZPD) in this regard as a contributing tenet of constructivist education. The ZPD (Vygotsky, 1978, p. 86) is an important concept within social cognitive theory:

> A full understanding of the concept of the zone of proximal development must result in reevaluation of the role of imitation in learning. An unshakable tenet of classical psychology is that only the independent activity of children, not their imitative activity, indicates their level of mental development. This view is expressed in all current testing systems. In evaluating mental development, consideration is given to only those solutions to test problems which the child reaches without the assistance of others, without demonstrations, and without leading questions. (pp. 87–88)

Webster (1998) recommended shifts in teachers' approaches in line with this theory, recommending that they assist, demonstrate, and provide leading questions. These shifts included teacher as expert to mentor, as well as student as passive receiver of information to active participant.

Pragmatic Constructivism

Teachers may turn to *practical* methods instead of following a strict constructivist regimen. In other words, teachers may exhibit some tenets of the constructivist philosophy, but there are moments when they teach according to what is most practical at the moment. Perkins (1999) argued, "The stimuli that [students] encounter, including messages from others, are never logically sufficient to convey meaning. To some extent, the individual always has to construct or reconstruct what things mean" (p. 8). The author asserted further, "active engagement in learning may lead to better retention, understanding, and active use of knowledge" (Perkins, 1999, p. 8). As with any education philosophy, these beliefs were subject to impediments in practice. Perkins (1999) maintained that implementation took time, and in order to avoid this obstacle teachers favored students arriving at "an understanding of the best theories propounded by the disciplines" (p. 8). Perkins (1999) argued:

> Troublesome knowledge of various kinds invites constructivist responses to fit the difficulties—not one standard constructivist fix. If a particular approach does not solve the problem, try another—more structure, less structured, more discovery oriented, less discovery oriented, whatever works. And when knowledge is not particularly troublesome for the learners in question, well, forget about active, social, creative learners. Teaching by telling may serve just fine. (p. 11)

Perkins (1999) highlights the possibility that strictly-constructivist methods of teaching may not fit every situation. Instead, the author points out, the teacher can serve the students sufficiently well using his or her intuition of what teaching method is best at the time from a practical perspective. This approach may not hinder students/informal learners from integrating new ideas into their existing knowledge (Heuwinkel, 1996); therefore, constructivist tenets are maintained.

The significance of this viewpoint to my dissertation was its balancing effect on observing how students and teachers work with each other. There are many potential methodologies, and once a constructivist approach manifests, I have to be able to understand that some approaches are inherently pragmatic, yet also constructivist in nature. In essence, teachers may have to do what they have to do in order for a successful lesson to occur based on their practical instincts, not that it should completely take place of prior organized curricula. When drawing conclusions, I needed to apply this factor to constructivist teaching methods (Dewey, 1910; Shively, 1995; Webster, 1998) when discussing a deeper understanding of how curricular partnerships between the teacher and their students manifest when music technology is used in the classroom.

CHAPTER 2—REVIEW OF LITERATURE

This chapter is organized according to the research questions and their associated theoretical constructs as articulated in Chapter 1. The first section includes research about music educators' attitudes when technology-specific informal music learning practices are integrated in the classroom. Studies from this section contain researchers' observations of teachers' attitudes, as well as observations of students' attitudes about technology made by the music-educator-as-researcher. Research about characteristics of informal learners, as well as informal learners who use technology, comprise the second section of this review. The last section encompasses literature about elements of collaborative learning environments and constructivist ideals.

Music Educators' Attitudes

I support the framework for my first research question with teachers' attitudes about integrating informal and formal learning methods. I asked: When instructing a broad population of secondary students enrolled in a non-b/c/o music course who also engages with music technology outside of school, what are their teacher's attitudes about music technology implementation? Green (2008) noted that music teachers' stances toward informal music learning practices were essentially nurtured by the willingness to observe how students work. In addition, Campbell (2010) argued that music educators should ultimately seek out a centered attitude toward teaching music, especially with regard to communicating with their students in a non-judgmental and proactive fashion. Both authors alluded to the importance of observing informal music learning tactics occurring within the formal classroom in order to gain insight into what teachers perceived and valued in terms of their students' informal learning with music technology.

Lessons from Informal Music Practices

Informal music practices are varied, and authors of supporting literature explicate teachers' attitudes about instructional delivery of current music culture topics and practices. The following studies establish what we have learned about teachers who discuss and implement informal learning practices. These need to be elucidated in order to provide a foundation for future literature about teachers supporting music technology, which was part of informal practice.

Springer and Gooding (2013) and McPhail (2013) observed teachers who expressed attitudes about integrating informal music learning practices in the classroom. I discovered a major theme in Springer and Gooding's (2013) study about teachers determining the appropriateness of teaching popular music culture in the classroom. Teachers considered popular music to be "more appropriate for older students than for younger students" and "more appropriate for some types of music classrooms than for others" (Springer & Gooding, 2013, p. 31). Teachers supported popular music because it could be used "as a powerful motivational tool, one that can grab students' attention, maintain students' interest, and increase students' involvement in classroom procedures" (Springer & Gooding, 2013, p. 31).

In a following study, two music instructors demonstrated ways in which they considered popular music knowledge in each of their school's curricula (McPhail, 2013). Lydia (pseudonym) taught a diverse student body and was the sole music teacher within her school. Her students' diverse musical knowledge encouraged Lydia to "provide an environment where students [could] develop personal musical tastes and skills" (McPhail, 2013, p. 48). Similar to teachers Springer and Gooding (2013) observed, Lydia considered teaching popular music practices justifiable, there were doubts as to its place in the classroom because students knew it to begin with, an attitude similar to those noted by Springer and Gooding (2013). Additionally, "there [was] a tension between wanting to validate the musical talents and interests of her students…and the need to provide access to other sorts of musical knowledge" (McPhail, 2013, p. 48). Robert (pseudonym) also taught a diverse group of students. He was part of a team of music teachers who provided him with support as well as a variety of proficiency references for the students. McPhail (2013) noticed a "strong differentiation between the everyday knowledge that students bring to school and the specialist concepts being introduced in the lessons" (p. 51). Hence, "[o]ne of Robert's key structuring techniques was the explicit introduction of the specialist technical music language required for the understanding and use of musical concepts," such as exploring rhythm through description, action, and sound (McPhail, 2013, p. 51). While Robert acknowledged the importance of popular music in terms of its political and social voice for his students, the fact remained that knowledge derived from classical music, when transferred to popular music knowledge, enriched the latter.

Next, I located some case studies conducted in secondary music classrooms. First, I looked at how informal music practices were primary driving forces for a curriculum that included elements of facilitation (Cremata, 2017). Each of these classrooms, Cremata (2017) noted, provided "diverse popular music facilitation experiences" (p. 69), with teachers exhibiting a range of management when facilitating their courses. Teachers' intervention depended on whether or not students "required their presence…in the room to resolve challenges and redirect opportunities for learning when they presented themselves" (Cremata, 2017, p. 70). In another study, a teacher related their choice of "physical placement in the room," as well as "the way he gave correction, direction, and suggestion" (Gramm, 2021, p. 149). This teacher offered students individualized advice based on what they were doing. He considered this type of presence, in conjunction with peer mentoring, to be the ideal facilitation of a music classroom (Gramm, 2021, pp. 148–149). Collectively, both authors developed a comprehensive picture of classrooms emphasizing facilitation over autocracy.

Studies conducted by McPhail (2013), Springer and Gooding (2013), and Cremata (2017) revealed ways in which popular music—in conjunction with informal learning processes—was integrated in formal music education curricula. Cremata (2017) specifically highlighted ways in which teachers offered students music technology in order to accommodate their popular music goals. Prior to Cremata (2017), Voss (2016) underlined the "potential for the use of on-demand resources to assist BPM [Bachelor of Popular Music] students with learning fundamental skills related to recording studio operation" (p. 28). His argument was that, outside the formal environment, recording software was becoming increasingly available and affordable to students. Voss (2016) argued that more than likely "a supported environment, or the provision of resources for delivering music technology coursework can be beneficial to student outcomes" (p. 27), as well as "on-demand support to develop [students'] knowledge and skills (p. 37). The result was that students were able to take their initial skill set with recording technology and expand upon that set in a learning environment that supported learning within a context of popular music.

In summary, attitudes regarding informal music learning were quite diverse among music educators. We read about teachers who deem popular music culture integration appropriate for older rather than younger students (Springer & Gooding, 2013). The trend continued when teachers appreciated their students' diverse musical backgrounds, were either apprehensive about popular music culture's place in the music classroom or appreciative of the influence of traditional music teaching, e.g., classical music culture, over popular music culture (McPhail, 2013). Notwithstanding, both Cremata (2017) and Gramm (2021) provided insight into formal learning environments without apprehensive attitudes. They researched classrooms in which popular music was already at the forefront of the curriculum and happened upon teachers who let their students work on their own. Voss (2016) recognized that on-demand resources that help students learn more about music recording were made readily available by their teachers. Perhaps this influenced other educators, such as those observed by Cremata (2017) and Gramm (2021), to let students manage their progress in the classroom, having become more comfortable letting them use materials they already have experience with or knowledge of.

Integration in Action

Researchers located intersections between student work in technology-driven music courses and participating students' work outside of school. Their research comprised thematic elements from the prior section, specifically teachers maintaining classrooms in ways that emphasized student autonomy (Cremata, 2017; Gramm, 2021). Tobias (2015) explored high school students' work in a Songwriting and Technology Class (CST), designed to "prepare students with a foundation for continuing work related to creating original music, live and studio audio production, and the skills and knowledge needed to work in the music industry" (Tobias, 2015, p. 21). The teacher participant occasionally helped students, rarely interfering with their work. Tobias (2015) conducted individual and group interviews of participants who were working on a final project—an original composition using a variety of music technology and determined that "the STC's open-ended structure allowed students to experience smooth transitions between their musical engagement and learning in and out of school" (p. 23). This observation significantly contrasted teacher's attitudes revealed in prior research (McPhail, 2013), wherein some teachers could not imagine such a bridge. Tobias (2015) further countered these teachers' viewpoints, emphasizing students' knowledge of instruments learned outside of school, which "influenced the harmonic, melodic, and rhythmic material they integrated in their original music" (p. 24). Next, Tobias (2015) turned to some of the technology-specific materials that students used during this time.

Students often used music software to create music at home. However, their software was not the same type as that used in the classroom. Unlike teachers interviewed by McPhail (2013), this was not an issue because their teacher provided opportunities for students to "translate similar concepts and processes from one to the other" (Tobias, 2015, p. 27). Furthermore, the teacher supported an accommodating environment because students were allowed to refer to their informal learning experiences while working on a formal music project.

Next, I reviewed literature about students' use of informational and mobile technology during pop ensemble rehearsals and performances (Wallerstedt & Hillman, 2015). Their teachers encouraged the use of information technology to reach a variety of musical goals. Teachers arranged students into four pop bands, directing each one to rehearse any pop song they wish in anticipation of a school performance. Teachers printed, and sometimes edited, copies of a song's chords from the Internet, either illustrated or written, for their students. Using their mobile phones, students took pictures of their instrument and used an image editor application to mark specific notes. Students also watched live performances of popular musicians, which included visuals of the performer's hands and corresponding chord symbols/tablature. Finally, their teachers suggested they use Google on their mobile phones to find websites with pop music databases, such as ultimate-guitar.com. The teachers' "invitation to use the mobile phone for information seeking…begins a reframing of the technology that involves bringing in established practices from outside the music classroom" (Wallerstedt and Hillman, 2015, p. 81). Students were surprised that they could use their mobile phones. I found it interesting that Wallerstedt and Hillman (2015) assumed "the use of the device as an educational technology in a school classroom may not be an agreed stable configuration" for these students (pp. 83–84). The use of phones was associated more with the environment outside of school, and since students' attitudes reflected uncertainty, much like those of teachers McPhail (2013) observed beforehand, it was difficult to consider mobile phones concretely as educational devices in the classroom. Consequently, the students looked to the teacher for information that could not figure out on their own:

> A key part of the students' problem is they do not know the metric structure of the song and for this they seek help from the teacher, since, despite the necessary information being readily available on the Internet, their understanding of what the mobile phone is as a resource in the context of their music class does not include a solution to this particular problem. (Wallerstedt & Hillman, 2015, p. 90)

Perhaps there were ways in which students were offered further insight into the paths through difficult aspects related to using technology in school.

During the same year, undergraduate students experienced similar apprehensions in their songwriting course (Hahn, 2015). Some students were not completely comfortable with the more detailed aspects of the software they had access to, such as GarageBand. The processes felt like work rather than enjoyment. However, some of their attitudes reflected appreciation when they were shown how to assign diverse sounds to tracks, opening the door to experimentation. They enjoyed GarageBand because it "offered both the capacity to record…live audio and add virtual sounds" (Hahn, 2015, p. 195). Playback of this recorded music inspired a sense of confidence and accomplishment. Hahn's (2015) study was the antithesis of Wallerstedt and Hillman's (2015) in that students were given additional information to help gain insight into their experimental prowess rather than merely relating moments when students ran into barriers. Hahn (2015) went even further, revealing how after students took it upon themselves to use technology—in this case an iPad or mobile phone—they critiqued it according to its practicality. Some praised the iPad's ability to type and organize lyrics.

Others enjoyed using pen and paper because it made recording lyrics “more personal”, and therefore “a more ‘real’ or primitive form of technology was preferred” (Hahn, 2015, p. 327).

A couple years later, a selection of teachers adapted their practice so that it would accommodate their students’ informal music making skills (Brook et al., 2017), such as those discussed previously. One of these teachers, who was classically trained, wanted to adjust their curricula to suit the needs of their students. The teacher’s background was deeply rooted in classical music. He noted that over time, “the music in his home had little resemblance to what he was learning at school” (Brook et al., 2017, p. 159). As he grew up, he took more opportunities to perform transcriptions, on the spot, at local restaurants and barbershops to essentially bridge this gap.

This teacher’s students played pieces of popular music, and these pieces were influenced by his suggestions. Most importantly, he addressed students’ technology knowledge, letting them make use of their iPods to listen to music in order to model components of the recordings in class, such as phrasing. Furthermore, “students came in with their media players and played a portion of the audio file for their teacher to indicate the song they wanted to learn” (Brook et al., 2007, p. 162). The teacher’s informal approach, coupled with the integration of music technology his students used on a daily basis outside of school, revealed how students participate in a formal music education while maintaining informal approaches. These approaches came from the teacher’s prior experience, tailored to the needs of his students.

Self-efficacy played a significant role in the implementation of technology into the music classroom (Diel, 2021). Collectively, select teachers were motivated because technology helped students “not only become makers of music, but encourage the music to be both beautiful and meaningful (Diel, 2021, p. 94)”. For each teacher, technology was engaging and therefore fun, which meant that, in their opinion, their students could manage and remember what they learned. These teachers also expressed different attitudes about how to introduce new technology to their students. One teacher preferred to reference national standards as a guide students’ technology use in their room, in particular the Core Arts Standards for general music. In lieu of frameworks, another teacher implemented technology with flexible planning in mind because, they mentioned, “I consider [students’] needs, musical skills, interests, and technology types available for use” (Diel, 2021, p. 116). Another teacher turned to Howard Gardner’s eight learning types because “teachers need to know their students’ interests, skills, and needs to be an effective instructor” (Diel, 2021, p. 117). Regardless of what attitude each of them championed, these teachers agreed that “one of the essential skills to have as a teacher was the ability to be flexible” (Diel, 2021, p. 120).

For this particular study, one phenomenon that stood out was “Finding a Way to Overcome Barriers” (Diel, 2021, p. 121). These teachers mentioned the essential need for them to overcome technological barriers so that their students would achieve musical growth. Unexpected updates to software, for example, prompted one teacher to come up with a backup plan for a lesson. For another, problem solving was the answer to a myriad of issues that students may encounter. Today, these and other barriers are relevant to each and every music classroom where technology is implemented. Where these teachers stood out was their resolve to learn about technology, going so far as to spend their own money and time to do so (Diel, 2021).

In summary, Tobias (2015) perceived the extent of teacher involvement came in the form of helping students with technical matters—nothing else. Wallerstedt and Hillman (2015) observed the use of mobile phones in the music classroom. Of interest are the multiple instances in which the teacher asked their students to use mobile phones to learn popular music. Students often sought information from their teacher, who in turn offered solutions using their mobile phones. Students' views about mobile phone usage essentially did not match the ways in which the teacher asked them to apply such devices during a project. Interestingly, it was in the students' best interest to look to their teacher for technology-based guidance instead of using the available technology on their own. Other students exhibited dichotomous attitudes with regard to technology, such as comfort/confidence versus uncertainty, and preference with traditional methods versus modern approaches (Hahn, 2015). A teacher reflected upon his experience as a music student who sought opportunities to perform music that he felt most connected to while participating in formal music education. His approach to teaching came in the form of a supporting role, a role that allowed students to find their path rather than having it determined for them (Brook et al., 2017). Finally, self-efficacy comes in many forms for music teachers who integrate technology into their curricula (Diel, 2021). Music educators can learn from the approaches a few teachers take. Of interest were the inevitable technology barriers a teacher encounters. Solutions to these barriers bolster teacher self-efficacy.

Collectively, the studies presented in this section of the chapter offer a glimpse into the attitudes of music educators about integrating music technology within their curriculum, whether in the form of discourse or action. The next section comprises studies that focus on the informal learner and the different aspects of their learning processes that characterize who they are from non-musical and musical perspectives.

What Characterizes a Learner as Informal?

For my second research question, I asked: In what ways do secondary students who use music technology informally outside of school, and who and take part in non-b/c/o music instruction in school reveal alignment, or misalignment, between the two environments? Informal learners become dissatisfied with older ways of thinking or being (Marsick & Watkins, 2001). They approach learning goals with a more relaxed, playful attitude (Jenkins, 2011) than did previous generations of learners. Additionally, exploration and discovery are key to empowering informal learners, who find themselves in charge of their future (Marsick & Watkins, 2001). A variety of studies, both non-musical and musical, contain data that fit the descriptors outlined by these authors, and help describe characteristics of informal learners.

Characteristics located within a Non-musical Setting

When given the opportunity to complete academic goals outside of a routine school environment, learners exhibit empowerment and collaboration, such as students enrolled in a STEM [Science, Technology, Engineering, and Mathematics] course (Denson et al., 2015). The question arose to whether or not informal learning environments, specifically MESA (Math, Engineering, and Science Achievement), affected young adult student development. There were a number of attributes that essentially characterized informal learners who participated in the activities offered by MESA, such as their involvement in college preparatory test training, competitions, and career readiness trips. During these and other activities, Denson et al. (2015) observed participants assisting their fellow students as mentor-types. Students felt confident when moving toward their goals, as well as accomplished when reaching their goals. Additionally, the opportunity to work with others in a variety of ways helped develop a sense of camaraderie among the students.

I located a similar study involving secondary students enrolled in an engineering summer camp (Denson et al., 2015). The goal was understanding students' experiences while attending this camp and understanding what these students consider valuable in an informal learning environment. Students were divided into focus groups and interviewed about the challenges encountered and values attained by participating in the summer camp. Denson et al. (2015) noted, "[T]he most emergent theme that student participants presented regarding the benefits of this summer camp included the value of *teamwork* [emphasis in original]" (p. 43). Emphasis on teamwork paralleled a prior study (Denson et al., 2015) where such teamwork came in form of mentorship, though these researchers witnessed a bit more informal language. A student articulated their appreciation for learning with others, stating, "I think being in contact with other kids who have kind of like the same mind set as me. That's pretty cool" (Denson et al., 2015, p. 43). Versus mentorship, we witness a student who searched for others with the same mind set, not necessarily looking for one to help them, but one who has a similar frame of reference.

Informal learners demonstrate dissatisfaction with current ways of thinking by choosing to work on their own in another environment (Marsick & Watkins, 2001). The key to finding studies for this particular description was locating information about participants who a) worked independently, and b) exhibited dissatisfaction with their current learning environment. I located a study in which young adults exhibited these three attributes while they surfed the net at an Internet cafe (Cilesiz, 2009). Young adults were considered a relevant population for this study since they were "more likely to have the capacity to reflect on and provide full and sensitive descriptions of their lived experiences" (Cilesiz, 2009, p. 241). Participants explored what interested them most, particularly in terms of future professions. These approaches led to a path of "identity building" (Cilesiz, 2009, p. 252). In contrast to their opinions about the Internet café, participants mentioned their dissatisfaction with formal schooling due to its authoritative nature. Each of them felt that by using computers at an Internet café for educational purposes, they prepared themselves for college acceptance, employment, and sustainable job capability. They taught and learned from friends and customers in a spontaneous manner and were thus "socialized and assimilated into the practice of educational uses of computers" (Cilesiz, 2009, p. 259).

Informal learners who used the Internet to connect with each other socially demonstrated discontent with ways of being (Marsick & Watkins, 2001), as well as a relaxed attitude toward learning (Jenkins, 2011). In the next study, a group of 12- to 18-year-olds commented on their Internet usage, stating that learned about it strictly outside of school (Sánchez-Navarro & Aranda, 2012). The Internet was a laidback learning environment, one that "clearly separated from formal and daily educational contexts" (Sánchez-Navarro & Aranda, 2012, p. 70). While working online, participants indicated a strong preference for socializing, the majority of which was conducted via instant messaging. Monotonous conversation was the main subject of contention for using any form of Internet communication. Their resolutions included avoiding telephone contact, creating automatic messages, and preferring conversations with useful contexts over mundane.

Within the context of Internet usage, Cilesiz (2009) and Sánchez-Navarro and Aranda (2012) revealed similar themes between them. Both studies' participants revealed aspects of dissatisfaction with current ways of thinking. Differences between these themes lay in the manner in which participants discussed their diversion from use of the Internet in school. Some noted that Internet usage outside of school helped them reach practical and relevant goals instead of school. Others socialized online but made sure to divert from conversations that were of little to no use. I gathered that despite the similar theme, these two studies stood apart in terms of formal versus informal. When combined, however, we have an all-inclusive picture of Internet use in terms of what it is used for.

Characteristics located within a Musical Setting

What characterizes a learner as informal when involved in a music learning environment? The Internet provided the opportunity to learn an instrument in an exploratory fashion for young musicians. (Marsick & Watkins, 2001). One study I reviewed was a case study of a guitarist who used the Internet to obtain basic musical skills (Ruismäki et al., 2012). Curiously, the young musician's actions became less haphazard when looking for online tutorials. In contrast, when searching for online music instructors, the young musician expressed discontent, citing the inability to match a teacher with their skill set. They argued, "'Here's how to make millions: teach a search engine to recognize the skill level of the customer'" (Ruismäki et al., 2012, p. 385). If and when an online teacher matched their skill set, meeting standards for a specific teaching methodology that nurtured and promoted growth was key to this young musician.

Informal learners in musical settings discussed how music is learned in preparation for public performances outside the classroom. For example, Scottish musicians who frequently performed in music gatherings in pubs told informative stories about how they learned music (Cope, 2002). These musicians discussed the significance of watching others play, which motivated them and influenced their ability. All gatherings were subject to a set of unwritten rules, and "the basic principle of this etiquette was one of inclusion" (Cope, 2002, p. 100). Tolerance was key to letting others join the group during a performance. For example, incoming performers were not judged based on their ability. They were given the opportunity to perform because they enjoyed playing. In comparison to learning new music at home, participants preferred a performance session because it "provided both a source of new music and a strong incentive to learn it" (Cope, 2002, p. 100). Socially, participants focused more on the dynamic, more spontaneous, nature of the performance sessions, as opposed to the formal concert stage. They discussed learning how to adjust their performance based on how they feel while the music is bring performed, and this was considered aesthetically paramount to the formal goal of acquiring technique.

Informal learners in music have explored and discovered new ways to create music electronically and build confidence while doing so (Marsick & Watkins, 2001), in this case, a selection of electronic musicians (Thompson, 2012). These musicians answered a questionnaire about their overall musical background, as well as some information about "the first performance attended and the first record purchased, to the first time a new music-making technique was learnt and how the technique was learnt" (Thompson, 2012, p. 47). They would copy their choice of tracks repeatedly in order to gain confidence in the copying process. They felt that "copying those tracks gave [them] the grounding [they] needed to make [their] own tracks" (Thompson, 2012, p. 48). Independent practice sessions were of great importance, too, since for them individuality was key for gaining confidence during sequential hour-long rehearsal sessions, trying new DJ techniques, or learning new software. These musicians would also set small challenges for themselves, exchange techniques and knowledge amongst each other, learn from more experienced individuals, and research online video tutorials (Thompson, 2012, pp. 50–51).

Young musicians, such as those in a general music class (Davis 2013), exhibited informal learning characteristics while participating in a popular music activity, such as relaxed, playful mannerisms (Jenkins, 2011) and empowerment through discovery (Marsick & Watkins, 2001). For these young musicians, the main goal was covering a pre-selected song, focusing on the melody with the aid of note names (Davis, 2013, p. 35). They constructed the basic beat and associated melody by tapping their toes, moving their heads, and humming. These young musicians fiddled on instruments, which meant they used them to "enter into the aural process," as well as "create brief diversions from the covering work…to explore their own melodic ideas" (Davis, 2013, p. 35). While singing, the students "performed with conviction and passion from the onset, communicating a felt expressive understanding of the song" (Davis, 2013, p. 36). As the project developed, these young musicians exhibited an increasingly collective approach to learning and demonstrated an ability to select and regulate different ways to learn the music. Because they worked with popular music, their familiarity "escalated emotional connection to the music" (Davis, 2013, p. 42). This fostered their empowerment because they realized their abilities and "*a way of being in the world* [emphasis in original]" (Davis, 2013, p. 42). The latter part of this quote stands out for its broad connotations, but it may very well suggest that these young musicians found a particular niche in arranging or improvising music.

My review of literature also uncovered studies about the characteristics of informal learners who participate in garage bands, specifically their relaxed approaches to learning (Jenkins, 2011) and inspired work through exploration and discovery (Marsick & Watkins, 2001). An emerging garage band consisting of female and male secondary-level students constructed personal teaching methods in a variety of ways (Jaffurs, 2004). They chose "where they rehearsed, the style of music they wanted to play, the instruments they wanted to play, and the length of rehearsals" (Jaffurs, 2004, p. 197). Additionally, they were motivated to learn without the assistance of anyone representing someone in charge. Participants "collaborated and worked toward a common goal that they had a vested interest in" (Jaffurs, 2004, p. 198) in a collaborative fashion, as evidenced by their willingness to ask each other for help and advice while evaluating mistakes and finding ways to improve upon their performance. The absence of a leadership role, whether in the band or a director, was a significant factor in this band's attitude toward music-making. The next study, on the other hand, takes a more in-depth look at the formal learning that one would find in school in a garage band's rehearsal sessions.

Participants in Baker's (2012) study exhibited a "goal-driven and carefully planned approach to learning through practice" that did not agree with preconceived notions about what informal learning practices were. Much of what was observed confirmed that band members gathered together because it was fun (Jenkins, 2011). However, "these young musicians were prepared to put in a great deal of hard work to achieve their individual and band goals" (Baker, 2012, p. 67). Their approaches to learning reflected their formal training in high school acquired from junior choir and summer music school classes. Members of the band were not completely satisfied with how things were taught (Marsick & Watkins, 2001) during their current college music experience because "when left to their own devices, these musicians often willingly adopted formal, goal-directed music learning practices" instilled by their instructors during primary and secondary school (Baker, 2012, p. 71). In other words, the author observed a hybrid of informal and formal learning during these practice sessions:

> [Participants'] focus on aurality rather than notation certainly reflected my expectations for informal learning. Yet, their practice of splitting tasks into

> manageable steps and their incorporation of didactic teaching styles really seemed to confound some of my distinctions between formal and informal learning. (Baker, 2012, p. 73)

The dilemma of strictly categorizing the observed learning processes as informal or formal was a determining factor for the author's conclusions. Participants "constructed a complex, multi-layered approach to learning" (Baker, 2012, p. 74). Subsequently, the participants' approaches to learning was characteristic of all types of musicians, no matter where the learning took place.

Overall, studies of informal learners in non-music contexts (Cilesiz, 2009; Sánchez-Navarro & Aranda, 2012; Denson et al., 2015; Denson et al., 2015a) and informal learners in musical settings (Cope, 2002; Jaffurs, 2004; Ruismäki, Baker, 2012; Juvonen, & Lehtonen, 2012; Thompson, 2012; Davis, 2013) exhibit shared characteristics of informal learners amongst participants. Many of those observed participants developed or demonstrated a dissatisfaction with older ways of thinking or being, either by disassociating themselves from the authoritative school environment (Cilesiz, 2009), avoiding a routine conversation (Ruismäki et al., 2012), or favoring spontaneity during performance over technique acquisition (Cope, 2002). Additionally, informal environments allowed researchers (Thompson, 2012; Denson et al., 2015; Denson et al., 2015) to observe easygoing and empowered students. Likewise, researchers who studied garage band musicians (Jaffurs, 2004; Baker, 2012) observed a relaxed approach to learning. However, one study (Baker, 2012) produced an interesting predicament for researchers who assume that informal musicians learn in specific ways. Some garage band members hearken to goal-directed methods, a characteristic typically associated with formal learning. This could suggest that these musicians demonstrate a complex, hybrid approach to learning that cannot easily be defined as informal or formal.

Informal Music Learners' Attitudes About Technology

Informal learners use technology as a tool both at home (Furlong & Davies, 2012) and to work with others across a range of distances (Kratus, 2007). Informal music learners rely heavily on the Internet (Kratus, 2007; Tobias, 2012) for their endeavors outside formal learning settings. There continues to be an increasing availability of music technology tools in conjunction with the popular music culture, such as recording and mixing software and playback devices (Tobias, 2012). Additionally, informal music learners collaborate in their diverse efforts to make music with technology without the knowledge of experts (Lebler, 2012). The following section highlights literature that includes informal learners' attitudes about using music technology outside of school while exhibiting these particular theories.

Musicians expressed their viewpoints about participating in online communities. I located study, based upon a survey of 233 of musicians ages ranging from 12 to 49, with the intent of finding out their viewpoints about why they took part in an online music community based in Finland, called mikseri.net (Salavuo, 2006). These online music communities "showcase the need people have to distribute their music, as well as listen to music produced by their peers" (Salavuo, 2006, p. 257). Reasons why participants joined online music communities included musical, social, access to knowledge, and fame. Participants felt eager to hear other original compositions and favored the opportunity to download subsequent music when it became available. From a social point of view, many participants decided that meeting people with whom they interacted with on an online music community was more meaningful than meeting them in person (Salavuo, 2006). They preferred acquiring new information from others who had expertise in music software/hardware. Some were able to perform gigs because someone heard their music, while a few retained a recording contract. In general, respondents' attitudes toward fame reflected interest "in their peers' appreciation [rather] than getting national or worldwide recognition through record deals" (Salavuo, 2006, p. 266).

Other forums, such as www.banjohangout.org, offered a similar learning environment. Compared to Salavuo (2006), however, this forum was for a much more specific music population. Similarly, it had "many diverse features including a media and forum archive, chat room, links to related sites, online store, member blogs and home-pages, and reviews all posted and voluntarily maintained by site members" (Waldron, 2012, p. 92). For banjo players, www.banjohangout.org was "their only regular connection to a banjo community of practice, be it on- or offline" (Waldron, 2012, p. 99). They appreciated a public space that "facilitated both music learning at home and participatory music making with others" (Waldron, 2012, p. 101). Their appreciation reflected similar attitudes of participants in online music communities (Salavuo, 2006) where participating in music was held in high esteem. Additionally, these banjo players were of the opinion that their online community made it easier to help each other learn about music. They cited "positive reciprocity in online community as one of the most significant factors contributing to successful music learning" (Waldron, 2012, p. 101), which was similar to those who in the past who favored a learning environment online rather than in person (Salavuo, 2006).

Next, I located a study about a much younger group, who maintained their aspirations at home independent of others. Children's musical experiences outside of school are significant for the purpose of adapting music education practices, such as using karaoke (Young, 2012). Young (2012) conducted interviews with pairs of children and conducted home visits where karaoke performances took place. Participants' attitudes exhibited a preference toward a combined assortment of equipment, such as television, home theater system, gaming equipment, and an iPod, in order for karaoke activities to transpire—a "hybridizing of equipment…characteristic of new digital musical activities" (p. 120). Other participants preferred a simple karaoke machine. However, similar to opinions of others, it was necessary to expand the technology via using a personal CD collection and "inventively connecting it up through an iPod system to the main family audio system" (Young, 2012, p. 120). Participants' preferred self-directed learning. For example, they used "scaffolding offered by the video game visuals and back tracks and could monitor their singing using the graphic pitch representations and feedback in the form of scores" (Young, 2012, p. 122). It is this particular aspect of informal learning that contrasted prior studies (Salavuo, 2006; Waldron, 2012), wherein older populations continually mentioned their positivity about working and learning with each other. Similar to past research, however, it was clear that these children's attitudes toward karaoke technology revealed the desire to make music without the knowledge of experts (Lebler, 2012), much like older populations who wanted to learn more about music technology (Salavuo, 2006).

I turned back to a study about high school students who made music using digital technology, as well as the ways in which it guided their formal music instruction (Nielsen, 2016). One area of interest was students' practices "as they discovered, produced, and shared music using digital devices in their out of school lives" in a Music Appreciation course (Nielsen, 2016, p. 16). Nielsen's (2016) observations contrast prior studies in this section in terms of collaboration versus independent work. For example, one student described their attachment to their smartphone due its immediacy, particularly when listening to music. Another student sought listening experiences of the latest music, and Spotify and SoundCloud made that possible. Another used their school-issued MacBook for listening to music and using GarageBand at home. They also used YouTube to share personal musical performances and acquiring proficiency on GarageBand, teaching themselves the basics of putting beats together with their voice. All of these examples demonstrate these high school students' actions independent of each other as well as from others, not within some sort of participation in an online forum (Salavuo, 2006; Waldron, 2012). Instead, their attitudes about digital music acted as a type of framework for their interactions outside of school, and similar convictions made themselves known in the classroom.

Research conducted on informal music-making environments disclosed a variety of attitudes from participants who created electronic music. Patterns of language located in the chipmusic.org forum informed music educators about the ways musicians talked about and created original music using older gaming devices (O'Leary, 2018). Using software that detected language patterns was a different method for collecting data than prior studies (Salavuo, 2006; Waldron, 2012). Such a methodology helped O'Leary (2018) locate themes. One theme was "performance-related practices", where members "shared and discussed upcoming chiptune events…and provided suggestions for performing for audiences" (O'Leary, 2018, pp. 112–113). Members believed that modified Dot Matrix gaming devices, such as the Gameboy, should be treated like musical instruments instead of objects for the sake of performance. With specific modifications, such as improving audio quality, using the Gameboy as a musical instrument brought to mind similar manipulations, such as DJs spinning records, when performing music. Performance practices, some members stated, should focus on "having fun regardless of the audience's reaction, treating the performance as an opportunity to introduce others to chiptunes" (O'Leary, 2018, p. 122). Members' attitudes demonstrate how serious they considered their chiptune devices within the context of performance, while simultaneously referencing the significance of having fun while performing on this particular technology.

In summary, Salavuo (2006) and Waldron (2012) revealed that the Internet was of value to informal learners in music settings, whether participating in online communities or referring to video tutorials. The significance of the Internet as a learning aid (Kratus, 2007; Tobias, 2012) in these studies is similar to that located in studies of informal learners in non-musical settings (Korpan et al., 1997; Clough et al., 2007; Young, 2012). Participants in some studies valued technology because it accommodated their desired musical goal when using various conglomerations of home theater and mobile equipment

(Young, 2012). Informal learners preferred a variety of technology in conjunction with popular music culture (Tobias, 2012), including karaoke (Young, 2012), and recording software (Waldron, 2012). Participants also valued collaboration in their efforts to make music (Lebler, 2012), either on online forums (Salavuo, 2006; Waldron, 2012) or in a home setting (Young, 2012). Nielsen (2016) searched for the ways adolescents created and learned about music with digital technology outside of school, noting that their skills were self-taught and applied to activities in a music appreciation course. Finally, O'Leary (2018) explored the world of chiptunes through an online forum and discovered that members valued older gaming devices as instruments. They viewed performances as opportunities to have fun, and more importantly, to introduce their listeners to chiptune music.

Together, these studies offer the reader a progression of informal learners' attitudes, from outside musical settings to musical settings of various types. One particular musical setting, for example, is the online community. We can see an evolution from those who emphasize a wide variety of music technology interests (Salavuo, 2006) to very specific topics, such as chiptunes (O'Leary, 2018). Of interest, too, are the ways that attitudes and beliefs find their way into formal settings (Nielsen, 2016). It is from referencing this phenomenon that I turn to studies that address collaborative learning environments, where informal and formal learning meet in the classroom.

Collaboration within Formal Learning Environments

For my third research, I asked: In what ways do a music teacher and his students' attitudes about music technology reveal, or not reveal, a collaborative learning environment? Espelund (2010) composed a continuum representing two dimensions of a collaborative learning environment, namely the setting in which learning takes place, the degrees of student and teacher control, and instructional sequencing. Espelund (2010) theorized that the ideal educational practices emphasize a conglomerate of student control, non-sequential, and institutional qualities. When considering classroom technology, Espelund (2010) posited that the lines between formal and informal settings were indistinct. An appropriate teaching environment that accommodates this blurriness is semi-institutional and semi-controlled in nature.

Control

When working on general school-based projects, high school students articulated their perceptions about the kind and extent of control exhibited by their teachers' behaviors (den Brock et al., 2004). Upon completing a questionnaire, students differentiated between strict teacher control, emphasizing "teachers providing students with strategies to perform their learning activities, shared-teacher control, emphasizing sharing of responsibility between students and between student and teacher, and relaxed control, focusing on students' decision making during the performance of learning activities" (den Brock et al., 2004, p. 438). Questionnaire items chosen by students, which emphasized strict teacher control, included test strategies, homework strategies, and planning strategies. Items that stressed shared control were the teacher motivating students to help each other, allowing students to collaborate in small groups, showing appreciation regarding student resourcefulness, and encouraging discussion amongst peers regarding work. Items that students selected, which reflected relaxed control by the teacher, included a choice of pace for assignments, the ways to work on assignments, and planning work independently.

Select biology and agriculture students, who were provided wireless tablet personal computers, perceived that these tablets were useful to them in the classroom and opened the door to interactivity with their instructor (Shuler et al., 2010) A large portion of the students agreed or strongly agreed that tablets added interest, "suggesting that the cooperative learning opportunities provided by the tablet personal computers generated additional student motivation" (Shuler et al., 2010, p. 14). Other students indicated that using tablets aided in their interaction with both peers and professor. The researchers concurred, "The results of our study demonstrate that the judicious use of tablet personal computers can enhance cooperative learning in a diverse student population" (Shuler et al., 2010, p. 16). Looking back to den Brock et al. (2004) and their insights about control aspects in the classroom, if using tablets emphasizes student collaboration, it may be an example of relaxed control in the classroom.

Both studies in this section exemplified the theory that an ideal educational practice contained a mix of student control, non-sequential, and institutional qualities (Espelund, 2010). den Brok et al. (2004) discovered that students perceived a variety of levels of control from their teachers. The loosening of institutional ideologies, such as working within a specified timeframe and using a specific approach to work, was sometimes granted by teachers based on the perceptions of their students. For instance, the pace in which the student could work was relaxed, and the ways in which students could work was theirs to discover. When considering technology use, Espelund (2010) noted that the lines between formal and informal learning were not clear, and that the ideal scenario that generates clarity is an environment that both semi-institutional and semi-controlled. Comparatively, Shuler, Hutchins, and LaShell (2010) observed students working in an institutional environment (college classrooms), but learning also took place via the Internet, allowing for a more informal feel in an otherwise formal setting. Much like den Brok et al. (2004), Shuler et al. (2010) observed a variety of teacher control situations, but they extracted their data from interview questions, not preset questions from which a selection could be made.

Constructivist Ideals Used in the Classroom

Constructivist ideals support the framework for the third research question. In a constructivist philosophy, knowledge is subjective, and people create their own meaning of experience (Heuwinkel, 1996). Constructivism challenges teachers' beliefs about attaining knowledge, necessitating an abandonment of prior assumptions about what is known and how one comes about knowing (Shively, 1995). A variety of theories feed constructivist thought. Students' abilities provide the material and starting points for the teachers, and students' trained minds benefit most, in future thinking, by learning from past mistakes during the learning process (Dewey, 1910). In Piagetian theory, when children experience times in which their perceptions do not correspond with new information, the teacher can guide them in the right direction rather than forcing the issue

(Webster, 2011). Additionally, students who encounter problems without guidance (Vygotsky, 1978) may require the teacher to take on the mentor role and the student a participant role (Webster, 1998). Something to consider, however, is that a strictly constructivist approach may not fit every teaching and learning scenario (Perkins, 1999). What may be needed is the teacher's intuition regarding what works best, e.g., flexibility in the application of constructivist ideals—not one specific methodology.

I begin the following section with a presentation of literature about non-music classrooms where teachers implement technology. I follow this section with studies conducted within the music classroom in which a music teacher employs technology.

Constructivist Applications in Non-music Classrooms

Online graduate students achieved learning goals when taught using constructive principles of teaching. A selection of students participated in a three-week project consisting of (a) studying a Colonial-era tunebook website, which included an article written by the author, (b) reading, with the option to make choices, from a selection of chapters from a variety of music education historians, (c) researching one of nine focus group of tunebooks, and (d) delivering a face-to-face presentation to the class (Keast, 2004). The activity was designed with the constructivist philosophy in mind because it involved "actively building their knowledge instead of receiving knowledge through lecture or a series of assigned readings" (Keast, 2004, p. 78). Student success was based upon the overall score of each presentation based on meeting or exceeding criteria.

Analysis of students' tracking logs, which included webpages visited, number of logins, and amount of time spent on each webpage, revealed that students conducted their research using a variety of unanticipated approaches. For example, some students used Google or ERIC before analyzing their chosen tunebook focus group. They may have researched materials "without having much of an idea about what they were researching for" (p. 121). Some students used the website at the commencement of the activity but did not log back until just before the presentation was due. Others "completed the reading as a last step in the research process instead of the intended order of starting with the readings" (Keast, 2004, p. 125). These approaches were not meant to be taken in a negative light; rather, they reflected the results of employing a constructivist approach to a their curriculum. This ultimately helped teachers—in this case the researcher—determine the materials and starting points for online learning based on students' capabilities (Dewey, 1910).

I read about ways to enhance student learning, particularly with technology, in a manner that demonstrated constructivist ideals. I located a study containing two case studies about two postgraduate student groups who were enrolled in a course featuring online and in-class sessions (Ng'ambi and Lombe, 2012). Both courses featured the use of podcasts, with one requiring the use of them and the other deeming them optional. Upon analyzing the data, Ng'ambi and Lombe (2012) determined that podcasts can be used "to widen students' learning space into informal settings…what is referred to as 'time shifting'" (p. 187). Examples of these transitions included "odd bits of time, such as the commute to and from campus" (Ng'ambi & Lombe, 2012, p. 187). From a constructivist standpoint, the authors determined podcasts relieved some of the setbacks of face-to-face learning, such as "deep engagement in question-based consultations"

(Ng'ambi & Lombe, 2012, p. 190). Of note, too, was that despite the ability of mobile phones to download and view podcasts, students preferred listening to them on laptops or personal computers.

Constructivist Applications in Music Classrooms

While students used Information and Communication Technology (ICT) in the classroom, they created their own meaning of experience when composing music (Heuwinkel ,1996; Ward 2009). A teacher, who was also the researcher, examined how middle and secondary school students who use ICT composed their music freely, allowing an equal-for-all creative process (Ward, 2009). Based on prior teaching experience, Ward (2009) considered three compositional issues: (a) non-tonal sounds not considered the starting point for a composition, (b) lack of composition strategies involving 20th century music, and (c) the lack of use of ICT to manipulate sound. Participants worked on music composition assignments with the aid of ICT. In between semesters, Ward (2009) evaluated data to inform the next stage, which was clarifying the creative processes that were taking place the following semester as a new set of participants used technology. Students "were able to take control of their own learning, show initiative and develop their own ways of thinking" (Ward, 2009, p. 159), much like other students in past who conducted research using databases of their own choice without their instructor's explicit direction (Keast, 2004). Finally, students' work reflected constructivist approaches, beginning with the fact that "pupils created their own values and meaning for the music they composed and, in many cases, valued these pieces over other, more tonal styles" (Ward, 2009, p. 160). Those working in groups demonstrated that shared knowledge pushed them past the information that was given to them. Looking back again to Keast (2004), this was finding particular to groups, as prior research emphasized the individual.

Next, I read literature about whether or not a constructivist approach to teaching music was effective in advancing creativity in young children (Göktürk, 2010). Looking back to Ward's (2009) study, I recognized similar constructivist teaching methods in the elementary music classroom mentioned here. The primary school music curriculum in Turkey was developed using constructivism as a foundation. Both primary-level music educators and university music education professors participated in two surveys. Göktürk (2010) gauged the professors' ideas concerning students' and music teachers' "creative development in the constructivist approach in the 2007 primary music curriculum", as well as any suggestions on how to improve curricula with regards to students' creativity (Göktürk, 2010, p. 3076). The second survey appraised music teachers' experience implementing a constructivist approach, their development of students' creativity, and their suggestions to improve upon curricula with creativity at the fore. Upon completing their survey, professors indicated that a constructivist approach to teaching music improved students' creativity and musical capacity because "the accomplishment of goals in the curriculum help[ed] to create a better learning environment and vice versa" (Göktürk, 2010, p. 3078). Some teachers highlighted positive aspects about a constructivist approach to developing creativity, including student-centered learning and more active students. Other teachers found the approach difficult. Factors included "too much course work that causes lack of time for students to focus on musical activities" and “lack of time for music classes (only one hour a week)” (Göktürk, 2010, p. 3077). Some teachers noted that with this approach, students could “transfer the musical knowledge to other subjects and life better”, while others felt that “the lack of musical background of students generates lack of interest in the music classroom” (Göktürk, 2010, p. 3077). Based on the results, the author acknowledged that many issues arose regarding the employment of new approaches, such as the constructivist approach. They suggested that teachers “be adequately trained to understand the nuances of the curriculum” (Göktürk, 2010, p. 3079).

Researchers were interested in how music educators utilize a variety of constructivist approaches to teaching, each with a pragmatic attribute (Perkins, 1999). I read about how a constructivist theory became personalized in a particular classroom (Cleaver & Ballantyne, 2014). Three teachers, each with their own differences with respect to both their experience and education contexts, participated in the study. Following her pragmatic intuition, One teacher in particular, Selene (pseudonym), utilized a model for teaching an augmented chord that worked for each student, not one that catered to students with innate music theory skills. Selene also recognized the differences between those students who were part of a teacher-centered to constructivist approach over the course of five years of teaching, and those entering the high school program, in terms of their ability to handle experimental-type projects. Despite teaching in a more constructivist manner, her intervention was the only way to help newer students who feel worth. She “expressed the need to flexibly re-position herself between radical constructivism and objectivism, as her understanding is that the requirements for the earlier years are different for those of senior students" (Cleaver & Ballantyne, 2014, p. 232).

Constructivist Applications in Virtual Music Environments

Learning music online means that students more than likely have "rich resources and no time and space restrictions, and it can better highlight the subject status of students in autonomous learning" (Tian, 2020, p. 3). Autonomy comes at a price, however, because, as recent research has shown, some students stray from "the learning direction" due to the freedom the Internet offers (Tian, 2020, p. 4). In order to support the autonomous aspect of online learning, students should take advantage of the many teaching videos and listening examples, as well as the opportunity for uploading examples of their work (Tian, 2020). Interestingly, this study leaves suggestions for teachers wide open. Constructivist measures would certainly be taken if a teacher took it upon themselves to suggest these very things Tian (2020) asserted. The next study essentially answers that question.

In their research, music educators suggested methods for delivering music ensemble education virtually during the COVID-19 pandemic. These methods were constructivist in nature, revealing ways to teach music required sudden changes from normalcy. For teachers of ensembles, "a digital musical product that uses multiple recordings edited together to form a musical ensemble" (Cayari, 2021, p. 39). The curriculum included student-directed approaches with an emphasis on feedback. "Informal learning techniques," Cayari (2021) mentioned, "shift the teacher's responsibility to troubleshooting, inspiring, questioning, and holding students accountable" (p. 40). These obligations necessitated those students utilize what they already know in order to make decisions along the way with their teacher's guidance, with room for practical diversions as needed (Perkins, 1999). One aspect of virtual learning which required students' technological prowess was a student's ability to choose what technology to use for their projects. A teacher's role was using the phrases "how to…" and "best software for…" to help students makes their decisions (Cayari, 2021, p. 42). In the long run, practical considerations would have to be made should students run into challenges, necessitating the need for additional teacher intervention (Cleaver & Ballantyne, 2014). With pragmatism in mind, teachers would find a way, much like the same obstacles that occurred traditional conducting classes (Cayari, 2021).

In summary, Keast (2004) and Göktürk (2010) discussed teachers who used a constructivist approach to learning as the foundation for their curricula, challenging beliefs about how knowledge is acquired (Shively, 1995). Keast (2004) discovered that when students were left to their own devices during an online project, they would often follow an unconventional path to accomplishing a goal. Göktürk (2010) provided readers with an equitable outlook, based on the input of music educators, regarding the pros and cons of a constructivist approach to developing students' creativity. Göktürk's (2010) point of view indicated that teachers needed to become more familiar with constructivism through training. Ng'ambi and Lombe (2012) researched a learning management system that provided students with podcasts to study, either required or voluntary. They concluded that both ways established constructivist ideals to the extent that they expanded their learning environments to include informal spaces. Other studies exhibited constructivist approaches to teaching music, either through student observation (Ward, 2009), teacher rationalization (Cleaver & Ballantyne, 2014), and the development of virtual ensembles during a pandemic (Cayari, 2021). According to Ward (2009), students who used ICT during their lesson took control of their learning and evolved their creative approaches, causing them to create their own meaning of experience (Heuwinkel, 1996). During group work, the sharing of knowledge, which became the capabilities that provided the material (Dewey, 1910). Some teachers discussed their constructivist approaches with the inclusion of pragmatic points of view (Cleaver & Ballantyne, 2014). Intervention was necessary for students who were new to a music program as opposed to other students who gradually became accustomed to constructivist teaching methods. Recent exploration into online music learning revealed the need for students music educators offered new routes for teaching music due to historical events (Cayari, 2021), and recommended that those who attempt to run a virtual ensemble be mindful of the need to troubleshoot when various technology-based challenges arise.

Chapter Conclusion

While the studies presented within this chapter are not exhaustive, it is reasonable to say that a study that contributes additional insight into the topics discussed above for a variety of reasons. Although indicative of the importance of technology in general, literature about informal learners' characteristics, particularly within the context of a musical environment, does not entirely reflect today's ever-growing and ever-changing technological spectrum. Based on some of the findings, informal learners' attitudes exist within a small range of technological contexts, particularly the Internet. In contrast, a growing body of literature exists regarding teachers' attitudes toward technology. It is clear that this particular subtopic is of interest to music education scholars and would thus benefit from further contribution by this present study. Furthermore, the element of collaboration between formal learning environments and informal learning approaches is at the heart of this study where the use of technology is concerned. Very few studies have explicitly discussed this. Fortunately, constructivist settings accommodate a collaborative learning environment because of the focus on student-centered learning and inherent abilities, as well as the support by participating teachers' classroom and virtual classroom environments.

CHAPTER 3 – METHODOLOGY

In this chapter, I discuss why I utilized an ethnographic research design. I rationalize an ethnographic research method based on specific terminology used within each inquiry, and the subsequent consideration given to the music classroom environment as a culture. Second, I describe my rationale for acquiring and analyzing data using a hybrid approach. Third, I briefly discuss site selection based on purposeful sampling. I outline my data collection methods through discussion of triangulation and coding procedures and detail the ways in which I reproduce reliable and trustworthy data. Finally, I briefly discuss the delimitations of my study.

Research Design

Ethnographic Research

From a broad point of view, my study utilized qualitative inquiry, which "allows the researcher to investigate contextual questions beyond the reach of methodological approaches in which particular variables are isolated" (Krueger, 1987, p. 69). I required a classroom environment with a teacher who potentially integrated musical activities indicative both of school and the personal world of students (Allsup, 2003). An ethnographic approach was best suited for this particular investigation because it helped "identify and understand patterns of conduct that guide participants' day-to-day practice, as well as to explore the institutional structures that shape that practice" (Krueger, 1987, p. 70). Furthermore, Veblen (1996) pointed out, "[a]n ethnographic orientation seems especially relevant to educational research since it attempts to consider both observed characteristics and personal interpretations—a view of social interaction occurring within a natural setting" (p. 39), in this case a public school AP Music Theory classroom. Each research question was structured with this in mind.

Data collection methods required an ethnographic approach, particularly one that projected the personal world (Allsup, 2003) of students and their teacher's individual perspectives in a formal learning environment and associated music technology. During the time I spent on the high school campus, I interviewed Mr. Bloomfield, an AP Music Theory teacher, once, and each of his students once. Interviews lasted for the entire class period, or 55 minutes. Each observation was conducted for up to the same amount of time. Once the last day of data collection was determined, I spent the last 30 minutes of one class period collecting student artifacts. These items comprised AP Music Theory students' projects, which were either completed or in progress. The nature of these artifacts came in the form of music compositions made with Noteflight. Upon transcription of each teacher interview, student interview, and classroom observation, I coded the data using deductive and inductive techniques for a rich, detailed analyses according to my three research questions (Vogt et al., 2014).

Attitudes of the Music Teacher

My first research question reads: When instructing a broad population of secondary students enrolled in a non-b/c/o music course who also engages with music technology outside of school, what are the teacher's attitudes about music technology implementation? In order to better understand, and subsequently convey to the reader, the teacher's attitudes about students' music technology capabilities, I established a data collection method for inciting and maintaining conversation between the teacher and myself that allowed for attitudes to manifest. I describe this specific protocol later in my "Data Collection Method" section. According to Madden (2010), "all conversation from the most general everyday chatting to formalized interviewing is highly instrumental in character" (p. 66). I anticipated that the teacher's and students' storytelling would stray from the initial topic, but it was this uncertainty that made way for a variety of their personal beliefs to come to the fore. Madden (2010) argued that planned storytelling gradually "wandered off the track and the interaction became less of a recording session and more of general conversation" (p. 66). This was not an issue for Madden (2010) and therefore for me as well; rather, more was learned about the research topic when the conversation became either less formal rather than robotic response.

Interactions between the Teacher and Students

My second research question stated: In what ways do students who use music technology informally outside of school, and who and take part in non-b/c/o music instruction in school reveal alignment, or misalignment, between the two environments? Emerson (2009) argued, "Paying close attention to interactions forces the fieldworker to scrutinize process in social life, encouraging the researcher to treat social happenings as active 'doings'" (p. 536). This research question focused on what students expressed about the times when their informal music learning experiences with music technology interacted with the formal music classroom environment in a variety of ways. In order to interpret those particular expressions as accurately as possible, I listened to, and subsequently recorded, details and nuances within students' expressions during our interviews in order to provide the reader with an appropriate picture of "active doings"

(Emerson, 2009) within the music classroom. Ethnographic interviewing, discussed later in this chapter, is, in part, “talking to people about what they are doing with others” (Emerson, 2009, pp. 536–537). Students discussed their interactions with the formal music classroom based on their experience with music technology outside of school. In addition to deciphering what connections students made with their music classroom, I implemented a “strategy to foster increased sensitivity to and insights into interactional processes [involving] documenting the kinds of ordinary troubles that [arose] in the settings and worlds under study” (Emerson, 2009, p. 537). These “troubles” comprised students’ interactions that were “resolved locally and situationally” (Emerson, 2009, p. 537)—in this case, interactions between students and their teachers that represented a possible evolution from conflict to collaboration during music technology tasks with their teacher.

Indicators

My third research question was as follows: In what ways do a music teacher and his students’ attitudes about music technology reveal, or do not reveal, a collaborative learning environment? This question stressed a specific type of cooperation between students and their teacher in the classroom; specifically, the relationships between the teacher’s beliefs about their students’ music technology practices outside school and students’ perceptions about what goes on in the classroom—a place where both formal and informal practices could potentially interact or meet. I turned to similar logic as the ethnographic inquiry for the first research question because I expected the unexpected. According to Emerson (2009), “fieldworkers should mine the subtleties and complexities of the interactions they observe" (p. 545). Interactions included potential "mundane troubles", which, when given due scrutiny, improve "the empirical and the analytic depth of ethnographic work" and credibility of the study (Emerson, 2009, p. 545). Additionally, "close attention to interaction deepens appreciation of variation and unpredictability, highlighting agency and contingencies rather than statically deterministic outcomes" (Emerson, 2009, p. 536). Interactions that were pertinent to my third research inquiry consisted of either the unforeseen resolved or unresolved conflicts between both groups illustrated by their attitudes. These were observed in the classroom through their dialogue with each other or with themselves, as well as those expounded during interviews. The elements of cooperation, or lack thereof, manifested best when maintaining this particular ethnographic approach.

Classroom as a Culture

When I first took a glance of my research site—a high school classroom that students attended during the last period of the day—I put away all expectations in mind about what I thought I would encounter. My mindset was that of a willing blank slate, and to that point, an ethnographer. Fetterman (2010) wrote, "However defined, the concept of culture helps the ethnographer search for a logical, cohesive pattern in the myriad, often ritualistic behaviors and ideas that characterize a group" ("Culture," para. 2). Each research inquiry was a pursuit of attitudes fleshed out from teachers' and students' dialogue about their uses of music technology. Therefore, the ethnographic perspective was desirable when assessing the classroom as a type of culture.

Upon entering a secondary classroom, "attitudes or habits that natives espouse virtually without thinking [were] distinct and clear to the stranger", i.e., myself as researcher (Fetterman, 2010; "Culture", para. 2). Key to taking advantage of this clarity was researching with a variety of perspectives. According to the Fetterman (2010), studying a classroom culture comprised behavioral and cognitive perspectives. The strictly behavioral researcher views culture as a sum of all patterns related to customs and behaviors, while a cognitive researcher is interested in how social groups "define reality, what subcategories of their existence are, and what their symbols mean" (Fetterman, 2010, "Culture," para. 1). A cognitive perspective helped guide my research questions because of the anticipated subjective nature of teachers' and students' attitudes located within their dialogue—how does each group view each other and themselves, and how do these viewpoints determine a collaborative learning environment based on the "meeting of the minds"? Looking at culture from a behavioral viewpoint added a concrete dimension to the data. Specifically, what were the obvious trends within the classroom under scrutiny?

Glesne (2011) described culture as "the organizing principle for doing ethnography," particularly with a focus on "shared meanings within a group" or "what one needs to know to behave appropriately in some context" (p. 19). Only through long-term involvement in the field and data collection via interviewing and participant observation, the author noted, could a "thick description" (Geertz, 1973, as cited by Glesne, 2011) of a particular cultural group be attained. Rubin and Rubin (2005) referred to a constructivist concept, namely the cultural arena, where "people come to share some meanings" (p. 28) within a particular environment:

> Interpretive constructionists work to figure out what the shared meanings are in some particular group, recognizing that though each person interprets the event he or she encounters in a somewhat distinct manner, he or she is likely, at the same time, to bring to bear the understandings held by peers, family, friends, coreligionists, or members of other groups which he or she belongs. (Rubin & Rubin, 2005, p. 29)

Based on this explanation, I conducted my research with an interpretive constructionist perspective in order to arrive at answers that exhibited partnered, or shared, meanings about learning music with digital music technology.

Population and Sample Selection

Setting and Population

Data were collected at a medium-sized urban school district located in the southern United States. Student enrollment included roughly 91% economically disadvantaged and 21% English language learners. The general population included high school students enrolled in a non-band/choir/orchestra course. The district offered these courses to any high school students interested in taking them as an elective, though not every year. The study sample ($N = 10$) included one teacher and nine students (5 female, 4 male) taking Advanced Placement (AP) Music Theory offered in one of the two high school campuses. The district assigned Mr. Bloomfield to the course during this particular academic year, as it was offered once every two years. Students participated under Mr. Bloomfield's supervision during the last period of each school day, from 3:15 PM to 4:00 PM, Monday to Friday.

Enrollment in AP Music Theory meant that each student understood that they would eventually take the AP Music Theory exam. The overarching goal for the course was for students to learn "concepts and skills emphasized within introductory college music theory courses…helping students become sophisticated and thoughtful music listeners, performers, and composers" (College Board, 2019, p. 11). Verification of student participation was fundamentally a result of an enrollment process that followed their school district's scheduling protocol and teacher availability. Student-participants elected to invest their time in the "cultural and historical contexts that nurture or provoke such a gathering" (Glesne, 2011, p. 15).

I assigned the pseudonym Mr. Bloomfield to my teacher-participant. He was the only teacher assigned by his supervisor to teach AP Music Theory in the high school in which my research took place. The high school was one of two within a medium sized city school district located in the southern United States. Mr. Bloomfield was new to this district; consequently, he was subject to announced and unannounced observations by his direct supervisors per district and state protocol. This meant that, unlike veteran teachers, he was subject to administrative visits during AP Music Theory. I had to anticipate this when I conducted interviews and observations.

The technology budget for Mr. Bloomfield's campus, as he related to me before the study commenced, was limited. He did not mention a specific amount of money that was available to purchase or request. Restraints for his AP Theory course, however, were based upon the fact that he had to sign out specific devices from his campus technology coordinator. These devices comprised Windows laptops and Apple iPads.

Teaching Experience

Secondary non-performance courses were few and far in between in the vicinity to my location during the course of the study. I considered the balance between retaining a research site to be able to conduct the study and whether this site could provide satisfactory data for my research inquiries. Over the course of my career, I developed an informed understanding of what a non-performance-based music education curriculum when I taught Music Theory, Music Appreciation, and General Music class during my high school teaching tenure. At first, I included technology for myself which I funded out of pocket. I began with items that helped me deliver lessons, such as a simple projector. Over time, I considered what would benefit my students because they watched me use technology. Luck played a role when, out of the blue, the district provided Apple iMacs for my classroom. My attitude toward students' informal use of music technology developed from not having much interest to when they insisted on telling me what they did at home, whether it was producing a rap album using GarageBand, recording themselves playing an instrument or singing. Once they had their hands on the iMacs, my students were able to show me what they knew. This influenced my philosophy of music education to a point where I believed that non-b/c/o courses were places that could potentially offer students the means to implement their informal knowledge of music technology in school. I believed the teacher was the gateway for this to happen and it was up to them to determine how or when that would happen.

Study Sample

An ethnographic case study using "observations over time in a natural setting within a bounded system" was the clear designation for this study's research design (Angers & Machtmes, 2005, p. 777). Following the principles of doing traditional ethnography, I immersed myself in the "day-to-day lives of the people, and/or one-on-one interviews with members of the group" (Creswell, 1998, as cited in Angers & Machtmes, 2005, p. 777). I identified a case with boundaries—an AP Music Theory classroom—and sought to provide "an in-depth understanding" of this particular case (Creswell & Poth, 2016, p. 100). Because I researched this group over time "through in-depth data collection", the appropriate designation for the study fell in line with the case study (Angers & Machtmes, 2005, p. 777).

Purposeful Sampling

Upon researching discrepancies associated with qualitative sampling terminology, Coyne (1997) concluded, "All sampling in qualitative research is purposeful sampling. Thus, the sample is always intentionally selected according to the needs of the study" (p. 629). Coyne (1997) offered the following example:

> A researcher…may decide to purposefully select a sample of ten parents whose child has experienced a life-threatening episode requiring hospitalization in a critical care unit. The sample is not varied according to the emerging theory, rather it is selected for the information rich data that it can yield on the phenomenon of parents having a critically ill child in hospital. This type of sampling may be referred to purposeful sampling. (p. 629)

Prior research (Reese & Rimington, 2000; Dorfman, 2008) supports the fact that, within some states' music programs, a high percentage of music technology integration occurs within a general music setting. The experiences of secondary music students in non-b/c/o courses—such as Music Theory, Music History, Music Appreciation, Music Technology, or any similarly titled course—are different from band, choir, or orchestra when considering the shift from performance-based to "other"-based. A secondary general music classroom environment has potential for a variety of technologies to be used at any given time, as opposed to a class whose education tools were geared toward performance—musical instruments, for example. Finally, information-rich data gathered from this particular setting allowed for interactions between students and their teachers who use technology collaboratively, as opposed to comparatively more performance-based interactions during band, choir, or orchestra rehearsals when performance preparation is the more of the main goal than anything else.

Data Collection Methods

I used three types of data collection for my study: a) interviews, b) observations, and c) artifact collection. I describe the interview process by qualifying main and follow-up questions with methods of inquiry using ethnographic language and structure. Second, I articulate the methods I use to record interviews and transcribe the dialogue with an ethnographic eye. Third, I discuss the process that I used to observe the AP Music Theory classroom. I conclude this section with a description of the artifact collection process.

Interview Sessions

My approaches to interviewing began with knowing that there is no single, definitive method of inquiry to settle upon once the interview begins. My interviews were guided by three approaches: “Opening the Locks,” “Tree and Branch,” and “River and Channel” (Rubin & Rubin, 2005, pp. 144–146). Broadly speaking, “some interviews actually do fit precisely within these types, but more often an interview is a combination of several” (Rubin & Rubin, 2005, p. 144). “Opening the Locks” relies on the naïveté of the interviewer and the implicit knowledge of the interviewee. Ensuing interview questions reflected a consideration of what was most important to the interviewee, thus giving a more informed direction to the interview process over time. When using a “Tree and Branch” method, each question was structured so that it is “logically related and in [the] wording ensure that the transitions…make sense to the interviewees” (Rubin & Rubin, 2005, p. 145). Finally, when implementing the “River and Channel” method, the goal was to incite depth of inquiry with the understanding that I was “willing to focus on [an] issue to the exclusion of other themes” (Rubin & Rubin, 2005, p. 146). During its execution, the “River and Channel” method required ignoring some of the main questions in favor of proceeding further with one specific inquiry.

Reasons for Interviews

The initiative behind my approach to interviewing teachers and students was emphasizing ethnographic attributes. Spradley (1979) stressed “explicit purpose, ethnographic explanations, and ethnographic questions” (p. 59). Explicit purpose reminds the interviewee of the interview’s direction while supporting “easygoing talk” (Spradley, 1979). I offered ethnographic explanations and reminders to the interviewee such as reasons for my study, why I was recording information, encouragement to use language representative of their cultural scene, and information about the types of interview questions that will be posed (Spradley, 1979).

Additionally, ethnographic questions are often identified by their descriptive, structural, and contrast qualities. My descriptive questioning helped my collection of the interviewee's language, while my structural questions allowed me to discover how interviewees consolidated their knowledge (Spradley, 1979, p. 60). Finally, my contrast questions helped me "discover the dimensions of meaning" from answers; specifically, what is meant by the interviewee's terminology (Spradley, 1979, p. 60).

Number of Interviews

I conducted seven student interviews and one teacher interview. When deciding upon the number of interviews and observations, I took into consideration participants who granted me permission to interview them, the point when all data were collected, and the timing needed in order to achieve maximum data capacity. For qualitative studies in particular, data should be rich in terms of its quality and thick in terms of its quantity (Fusch & Lawrence, 2015, p. 1409). Subsequently, whether as much information as possible has been acquired is a matter of recognizing data saturation, or the point at which there were no new data or new themes (Fusch & Lawrence, 2015).

I considered the importance of determining codes early and their significance in achieving saturation. Guest et al. (2006) wrote, "If codes developed in the early stages turned out to be the most important, doing additional interviews would tend to seriously diminish returns on time…invested in additional interviews" (p. 72). Granted, I set my mind to two interviews for each participant based on whether or not each participant did not finish within the timeframe. I considered, however, how that might jeopardize Early coding indicated what Guest et al. (2006) called "the importance of a code as the proportion of individual interviews to which the code is applied" (p. 72). During my study, the exact amount of interview sessions per participant was deemed highly influenced by the moment when all participants were able to play their role at one given time. All interview sessions exhausted all questions, and all participants were asked the same questions. While at least two interview sessions per participant was the goal, only one session per participant occurred because of unavoidable and practical issues associated with those in a formal schooling environment—student attendance, teacher attendance, my attendance, principal approval, professional obligations, and rescheduling all played a role.

Length of Interview Sessions

The length of each interview varied when considering interviewer performance. Performance is based on the relationship between speed of the interview and the quality of responses (Loosveldt & Beullens, 2013). Empirical evidence also indicates a relationship between participants' cognitive capacity and interview speed (Losseveldt & Beullens, 2013). When participants ask for clarification or when the participant is much older in age, interview speed decreases, and while higher education level is less clear as a determining factor, interview speed decreases (Losseveldt & Beullens, 2013). My initial interview protocol was somewhat longer for Mr. Bloomfield than for his students, and each participant was given follow-up questions. Each answer varied in response time and length. Interview sessions ranged from 10 to 47 minutes long.

Interview Questions

Mr. Bloomfield's interview and students' interviews were scheduled 24 hours before administration. Rescheduling student interviews occurred when the student participant was absent or if the teacher participant changed their lesson plans and required all students present during the lesson. The following interview questions were guided by an ethnographic interview conducted by Spradley (1979) in conjunction with approaches outlined by Rubin and Rubin (2005).

Research Question 1

My first set of questions for Research Question 1 (Appendix C, Research Question 1: Teacher Interview Questions, Core Questions Part 1) focused on Mr. Bloomfield's attitudes about implementing music technology and his students' music technology knowledge. Questions were designed to elicit those answers that essentially reflect how willing he was to observe and learn from their students' innate music technology comprehension. At the outset, I wanted to get a sense of how he structured his curriculum based on what he used most and least, and consequently, what he chose to use or not to use. I pursued domains, or "*how* [emphasis in original] informants have organized their knowledge" (Spradley, 1979, p. 60). I asked Mr. Bloomfield if they exhausted the list of music technology implements in order to ascertain as much information as possible about their music technology-specific curricular domains. I was looking for his insight about what his students considered important regarding their music technology use outside of school.

Next, I progressed to the core of my first research inquiry—Mr. Bloomfield's reasons for why their students used music technology, and his beliefs about their students' music technology knowledge. Corresponding questions (Appendix C, Research Question 1: Teacher Interview Questions, Core Questions Part 2) of appropriate descriptive questions (Spradley, 1979). The main goal for asking these descriptive questions was to "collect an ongoing sample of the informant's language" (Spradley, 1979, p. 60). Answers exposed the music technology trends of their students outside of school within the parameters of their interactions with students, subsequently revealing a variety of terminology specific to teachers' attitudes. Initial questions followed a "Tree and Branch" method (Rubin & Rubin, 2005), wherein inquiries followed a logical transition from general descriptions to attitudes about why they believe their students use what they use. I also asked questions that revealed the discoveries Mr. Bloomfield made about his students' music technology use outside of school other than what they perceive by themselves.

The next set of questions (Appendix C, Research Question 1: Teacher Interview Questions, Follow-up Questions) were structural in nature, each designed to reveal information about how Mr. Bloomfield categorized his knowledge of students' music technology use (Spradley, 1979). These questions were flexible in terms of the language he used. In other words, in order to follow an ethnographic course of inquiry, Mr. Bloomfield's vocabulary was substituted within these questions when appropriate. There were countless ways that Mr. Bloomfield organized his thoughts about his students' music technology, either according to knowledge or application. By no means were these questions exhaustive because some panned out to further inquiries. The main goal at the time was to uncover some domains (Spradley, 1979) that would be organized according to the Mr. Bloomfield's cultural knowledge of his students' music technology usage outside of formal education practice. Furthermore, consistent with the "River and Channel" method (Rubin & Rubin, 2005), each inquiry favored what he knew based on his beliefs as to why they thought their students used, preferred, and knew about music technology at a variety of levels.

Research Question 2

For my second research inquiry, I looked primarily for characteristics of students that denote their self-directed learning of music technology, as well as palpable characteristics of informal learning processes (Appendix C, Research Question 2: Student Interview Questions, Core Questions). Subsequent statements and questions triggered a "grand tour" series of answers that allow the interviewee time to think about their answer or answers (Spradley, 1979, p. 62). I explained each of these to the student interviewee that it was clear as to why I was asking them, and I made sure to establish my cultural ignorance (Spradley, 1979, pp. 60–61). Finally, both questions exhibited the "opening the locks" approach (Rubin & Rubin, 2005), wherein the knowledge of the interviewee is given sole priority.

The next set of questions were follow-ups (Appendix C, Research Question 2: Student Interview Questions, Follow-up Questions). These were particularly important because they were designed to prompt students' discussions about specific relationships between the two music technology environments they function within—formal and informal. The initial question within this set was designed to arrange components (Spradley, 1979, p. 60) of the interviewee's music technology environments for comparison's sake. Spradley (1979) suggested posing the additional question about whether or not the interviewee can think of anything further to add after reiterating the intention behind each set of inquiries. Once the student interviewee indicated that they have come up with as many uses within both environments as they can recollect, I inquired about similarities and differences between both environments for music technology use.

The remaining follow-up questions provide the reader with a "grand tour" (Spradley, 1979, p. 62) of the many similarities and dissimilarities between them with no specific avenue to pursue. Next, I used a "River and Channel" method of inquiry (Rubin & Rubin, 2005) so that I could explore the depth beyond the basic list of relationships. For instance, I wanted to seek what students expressed about relationships between students' personal music technology use in and outside of school. In order to instigate responses that demonstrate an expression of attitude, philosophy, or belief, I asked students what they perceived to be the driving forces behind the use of music technology, and whether or not these reasons corresponded or conflicted with personal intentions outside of formal education. Answers to these questions provided an opportunity for the me to use native terminology, thus supporting the incorporation of the language into subsequent follow-up questions (Spradley, 1979).

Research Question 3

For my third inquiry, I searched for cooperating aspects about music technology located within both the students' and Mr. Bloomfield's attitudes; in particular, the ways in which students used their knowledge such that a semi-controlled learning environment (Espelund, 2010) materialized within the formal music classroom. These questions were for student and teacher participants.

Guided by categories of project control discovered by den Brok, Bergen, Stahl, and Brekelmans (2004), I began with descriptive questions to students (Appendix C, Research Question 3: Student Interview Questions), which were designed for collecting descriptions of each formal project in order to associate it with language (Spradley, 1979) associated with certain degrees of control by the student or their teacher. The second set of questions reflected the "Tree and Branch" method (Rubin & Rubin, 2005), following a logical succession of questioning from project description to project structure. Essentially, I was looking for how each student perceived that their projects were guided by a particular element of control, or not.

I designed questions for Mr. Bloomfield (Appendix C, Research Question 3: Teacher Interview Questions) to elucidate vocabulary (Spradley, 1979) associated with degrees of student control from his perspective, followed by additional questions, using the "Tree and Branch" approach (Rubin & Rubin, 2005), that revealed his understanding about the elements of music technology trends his students confided in within him.

Recording Interviews

Recording tactics engaged interviewees at various levels; specifically, using a recording device (Glesne, 2011). Each of these presented a series of pros and cons to consider. The notebook—defined here as computer-typed notes—was less obtrusive and intimidating to the interviewee and offered an opportunity for me to finish writing/typing quicker (Glesne, 2011). That being said, the connection between myself and the interviewee was less personal. Glesne (2011) argued, “You will feel less in control of the interview when, as you handwrite notes, your attention is focused on the struggle to keep up with the respondent’s talk…and you can only intermittently maintain eye contact and attend to all of the verbal and non-verbal cues that have beating on your procedure” (p. 115). Solely writing or typing notes was not as favorable despite the luxury of completing transcriptions at a quicker rate. I elected to type my notes while simultaneously audio recording them during my classroom observations. I audio recorded interview questions without typing down notes in order to make the best use of both my time, as the interviewer, and the interviewee’s time either as a student pulled out of their class, or Mr. Bloomfield taking the time to speak with me after school. Audio recording offered me the chance to observe important non-verbal characteristics and gain a personal interviewing experience. Digital recording devices included an iPhone and laptop computer, using Voice Recorder (TapMedia Ltd.) and Easy Audio Notes (Super Software) applications, respectively.

Transcribing Interviews

Glesne (2011) argued, “Whatever means can be afforded to minimize the agony of transcribing tapes—for analog transcribing, estimate five-plus hours per ninety-minute tape done by an experienced transcriber—should be seized” (p. 117). Digital records afforded speech recognition software, specifically, a “simultaneous translation in which [I] use earphones to listen to the recording of an interview, pause it, and then speak the same words into [my] computer” (Gibbs, 2007; Mears, 2009 as cited in Glesne, 2011, p. 116). Ethnographic interview responses also necessitated transcription literalness when necessary. When considering cultural patterns, I removed “um’s”, most pauses, and overlaps in conversation; however, these vernacular patterns were included in transcriptions associated with narrative (Gubrium & Holstein, 2009 as cited in Glesne, 2011) where appropriate.

Whenever possible, I began dictating iPhone or laptop interview recordings to the laptop using the enhanced dictation function for Microsoft Word once an interview was completed. I began transcribing interviews once they were completed in order to learn what they would offer me (Glesne, 2011). Whenever specific passages—and there were many—could not be understood as accurately as I would have liked upon the first review, I reviewed such passages as soon as possible. By the end of the entire transcription phase, I determined that the vast majority of interviews were transcribed without the aid of dictation, as much of the narrative sped by and required further review to ensure accurate portrayals of the cultural patterns and ethnographic nuances exhibited by the narrative (Glesne, 2011).

Classroom Observations

Khoo et al. (2012) wrote, “The use of ethnographic methods is often pragmatically tailored to address research questions in the context of particular organizational circumstances, resources, and constraints” (p. 83). I observed a high school classroom wherein I was not entirely prepared for the myriad of extenuating circumstances, the type of technology available to students, and the lessons that may occur. Consequently, I studied “the *setting* [emphasis in original] and describe[d] it in words…using all [the] senses” (Glesne, 2011, p. 69). The primary tool for recording observations, according to the Glesne (2011), was the notebook. Instead, I used a laptop as the primary collection instrument because I wanted to gain a thicker description quickly. The notebook served as a secondary resource in case the laptop malfunctioned. Additionally, Glesne (2011) suggested looking for terminology that was “unique to the setting”, which helped with “wording interview questions and creating “*insider* [emphasis in original] or participant-generated analytic categories in the final write-up” (p. 73). My interview protocol highlighted the integration of culture-specific terminology within questions once I observed and recorded words that emphasized my research inquiries. Any such vocabulary was significant to the culture-specific directions my interview questions took and led to the securing of relationships between data collection methods.

Length of observation time depended on my role in the classroom, as well as my knowing when the best times were to observe according to the district’s, teacher’s, and students’ participatory needs. My role was observer-as-participant because, more often than not, I was overt to those I either observed or interviewed (Baker, 2006, p. 175). My preference was conducting an observation within one class period each due to the windows of opportunity delineated by my work schedule and participant availability. I kept in mind that I would turn these "condensed versions" into "expanded versions" (Spradley, 1980, as cited in Baker, 2006, p. 183) within 48 to 72 hours of completing each observation phase.

Collecting Artifacts

Glesne (2011) wrote, "Artifacts are the material objects that, for your work, represent the culture of the people and setting you are studying" (p. 88). Glesne (2011) suggested that researchers "[c]ollaborate with teachers so that assignments simultaneously meet the needs of students, teachers, and researcher. For instance…you may be able to persuade English teachers to ask their students to write self-portraits and then let you read them" (Glesne, 2011, p. 88). Conversely, sometimes it is difficult to collaborate with participating educators in this regard because of the teacher's desire to maintain consistent flow within their curriculum, putting the desired goals for their students at the fore rather than manipulating their assignment protocol for the sake of a research project.

Keeping this concern in mind, I suggested to Mr. Bloomfield what types of formal music technology artifacts I hoped to collect before data collection occurred—music composition, recording, or production projects, for example. I collected them using a flash drive at various stages of completion in order to examine, or read, about the ongoing culture of learning. Five student participants offered one artifact each for this study. All artifacts were original compositions created using the music composition software called Noteflight. Each composition was initiated and completed during the time period in which Classroom Observation 2 took place. In order for analysis to be conducted, students exported project file as either a PDF file or PNG image.

Triangulation

Not only is triangulation a "practice relying on multiple methods," but also "the incorporation of multiple kinds of data sources (i.e., not just teachers, but students and parents as well), multiple investigators, and multiple theoretical perspectives" (Glesne, 2011, p. 47). According to Fetterman (2010), triangulation is at the core of ethnographic research; specifically, "testing one source of information against another to strip away alternative explanations" ("Triangulation", para. 1).

Three methods of data collection—interviews, observations, and the collection of artifacts—fulfilled these particular requirements of triangulation because they addressed multi-participant and multi-perspective components. I viewed data collection from a similar interpretivist perspective as Glesne (2011), who argued, "You are not seeking to elucidate 'truth' of a setting or situation since you believe in no underlying reality, but rather you are trying to understand the multiple perspectives available" (p. 47). The more routes of inquiry, the more likely a realistic picture of the environment being studied was painted.

Analyzing Data

Here, I present my discussion of the hybrid approach; wherein deductive and inductive strategies were employed. Next, I discuss the coding process used to analyze data. Finally, I present a concise overview of how I developed *a priori* and open codes developed from prevailing themes within each research question.

A Hybrid Thematic Analysis

Relevant themes linked to a component within each research question guided each interview question, as well as the lenses through which I viewed observations and artifacts. Therefore, a thematic analysis was the most appropriate means for designating applicable words, phrases, actions, and other phenomena that emerge from the data (Fereday & Muir-Cochrane, 2006). In order to demonstrate analytical rigor during thematic analysis, I employed a hybrid of deductive and inductive approaches because these jointly acknowledged my research questions by "permitting the tenets" of ethnographic phenomena to be fundamental to deductive thematic analysis while "allowing for themes to emerge direct from the data" using inductive thematic analysis (Fereday & Muir-Cochrane, 2006, p. 83).

Coding

The general process of coding data allowed for "the interpretation of large segments of text and portions of information in new ways" (Belotto, 2018, p. 2624). I decided upon two ways for sifting through the vast dialogue and descriptions within my observations, interviews, and artifacts. These were organizing similar themes and finding ways to clarify meaning from within words, passages, and action. A thematic analysis attended to these priorities because it combined "analysis of the frequency of codes with analysis of their meaning *in context* [emphasis in original], thus adding the advantages of the subtlety and complexity of a truly qualitative analysis" (Joffe & Yardley, 2004, p.

57).

I turned to qualitative data analysis software in order accommodate my organizational needs. NVivo 12 helped with making “vivid what [I] have experienced” (Eisner, 1998, p. 95). According to Richards (1999), “NVivo provides a range of tools for handling rich data records and information about them for browsing and enriching text, coding it visual or at categories, annotating and gaining accessed data records accurately and swiftly” (p. 4). The organizational tools I used were:

- Creating a document from copying and pasting each previously typed classroom observation and interview transcription.
- Creating nodes, or codes, with associated literature for each research question entered as subtext.
- Creating coding stripes, or color-based margins that helped me determine the coding frequency within each document.

The process quickly evolved into a routine based on these components. This is not to say I was robotic with my analysis. Rather, I used NVivo 12 in such a way that the technical processes for organizing data—clicking on a menu, selecting node, entering each node’s identifiable information—was not detrimental to the analysis itself.

I sought codes, whether one word or as long as a complete sentence, that transformed “particular qualitative features into generic statements” (Eisner, 1998, p. 38) akin to my research inquiries. When establishing nodes using NVivo 12, I took two approaches. If words or passages in any of the three groups of data reflected an exact or close-to-exact replication of a specific passage, term, or action within components of my research questions, the code manifested as such. This was known as "structured coding" (Belotto, 2018, p. 2624). Data that was more complex, random, multilayered, or based on a tangent, was coded using a "descriptive method" wherein I created a "label that conveyed the essence" of what I experienced at the time the data was collected (Belotto, 2018, p. 2625).

Whether structured or descriptive, coding was a process that acknowledged the heart of all three research questions, namely expressions and attitudes. The method for aligning codes to the core of my study was Values Coding (Saldaña, 2009). This application reflected "a participant's values, attitudes, and beliefs, representing his or her perspectives or worldview" (Saldaña, 2009, p. 89). While there was the possibility that expressions and attitudes were not always straightforward or in line with their actions, applying Values Coding transcripts "corroborate[d] the coding and enhance[d] trustworthiness of the findings" (LeCompte & Preissle, 1993, as cited in Saldaña, 2009, p. 90).

Coding techniques

Before collecting data, I determined an extensive set of *a priori* codes, each reflecting a basic component of one particular research question backed by prior scholarship. I initially favored coding solely according to premeditated categories "established prior to the analysis based on some theory" (Stemler, 2000, p. 2), or *a priori*. Upon further reading, I became aware that combining these deductive techniques, known as *a priori* coding, and inductive techniques, such as emergent coding, "allowed for a richer analysis and more detailed findings in relation to the research question" (Vogt et al., 2014, p. 432). Once I analyzed data exhaustively according to my *a priori* set, there remained terminology and passages that had the potential to enhance the overall picture of the environment and develop my analysis in response to it (Stalp & Grant, 2001, p. 213). I turned to an emergent, open coding process in order to make sense of the data.

A critical component for open coding analysis was "recognizing inductive concepts" (Blair, 2015, p. 17). In order for me to refine my inductive insight, I reviewed the remaining singular words or lines of text through the lens of "ethnographic qualitative analysis [where] there is typically an ongoing dialectical relationship between evidence and explanation" (Agar, as cited in Stalp & Grant, 2001, p. 213). The inductive approach for assigning a code to passages or words from a set of classroom observation transcripts, for example, meant capturing qualities of interest, using the evidence to make probable conclusions relevant to any one of my research question frameworks. Subsequent processes of axial and selective coding required "logical, systematical relation and intersection of data" and "insight of discovery", respectively (Blair, 2015, p. 18). The process from axial to selective coding was sudden, the author notes, but my "grounded…insider knowledge" of the secondary music teaching profession made this process conceivable (Blair, 2015, p. 18).

Organizing Codes

For my *a priori* set, each code received a color based on their respective link to a component of a research question framework: a) Research Question 1 = green; b) Research Question 2 = blue; and c) Research Question 3 = purple. Next, each *a priori* code phrase or word received an additional typed designation, either [RQ1], [RQ2], or

[RQ3]. This helped me find general themes based on research questions within Microsoft Excel codebooks generated with NVivo 12. Lastly, open codes received a yellow color assignment with the designation [oRQ]. These received no typed designations to research questions until I conducted further axial and selective analyses.

Establishing *a priori* Codes. When developing my *a priori* codes, I tailored my procedures according to thematic analysis. I based terminology—one word, a phrase, or a complete sentence—on themes that clearly manifested within the framework. For Research Question #1, I assigned the prefix "[RQ1]" to them in NVivo 12. For example, I allocated "[RQ1] Intentionality – a priori" to words or phrases that were linked to the tenets of this theory (Folkestad, 2006). I also referred to components of intentionality, such as students completing a task by relying on each other's knowledge and not the knowledge of experts (Lebler, 2012). I assigned the phrase "[RQ1] Students learn from each other – a priori" to words or statements that reflected this particular theme.

I designated the prefix "[RQ2]" to codes representing themes within Research Question #2 in NVivo 12. For instance, I assigned "[RQ2] Introverted traits - teacher - a priori" to dialogue or actions exhibiting more introverted than extroverted traits within that particular dimension of communication with students (Campbell, 2010). I also assigned "[RQ2] Passive reception of knowledge - a priori" for when the teacher lectures to their students in a banking manner, wherein the students receive information in static form (Freire, 2005).

Finally, I assigned the prefix "[RQ3]" to codes that exhibited themes within the Research Question #3 framework. For example, I ascribed the code "[RQ3] Personal, often haphazard without structured guidance - a priori" to phrases or words that reflect a principle of formal education that emphasized a partnership-nurturing music classroom (Green, 2008, as cited in Espelund, 2010). I assigned "[RQ3] Teacher's unchallenged beliefs – a priori" to moments where the teacher clearly discusses or acts upon their personal beliefs about teaching (Freire, 2005).

Establishing Open Codes

A theme that emerged from data was that technology was already part of the class' routine. Adding the letter "o" before the prefix, I assigned the open code "[oRQ1] Technology already part of the routine in class" to related statements or actions. With one primary reason for use being making music, I associated this phrase with a theme associated with Research Question #1, namely intentionality to make music (Folkestad, 2006). During classroom observations, one emergent theme was technology specifically used for the sole purpose of communication in class. I assigned the open code "[oRQ2] Technology used in class for the purposes of communication" to the appropriate data. With communication open between the teacher and students in the classroom, the code appropriately represents when the teacher nurtures and promotes open communication with students (Campbell, 2010), a theme associated with Research Question #2. Finally, I assigned the code "[oRQ3] Free to choose composition format", to specific artifacts that exhibited a component of a partnership-nurturing classroom associated with Research Question #3, specifically student control (Espelund, 2010).

Trustworthiness and Reliability

Member checks

Member checks occur when the researcher shares "interview transcripts, analytical thoughts, and/or drafts of the final report with research participants to make sure you are representing them and their ideas accurately" (Glesne, 2011, p. 49). I became interested in the ways in which each member check provided the reader with information that forwards ideas and concepts without worrying about interpretive *perfection*. Talburt (2004) argued:

> If research is to do more than represent "real" identities and experience, readers are to do more than gain information about and understand these identities and experiences, and new thought is to be cultivated, the sorts of complications I argue for through new uses of member checks, triangulation, and a fluid transferability are a needed first step. (p. 96)

The author mentions "new uses" of member checks—this does not necessarily constitute radical change from prior practice. Talburt (2004) wrote, "Our texts and our talk about research…must enact and acknowledge…inevitable imperfections and implications" (p. 97). In other words, it was inevitable that member checks could not guarantee a complete representation of what was meant by what was said or seen; instead, ideas and concepts subjected to trustworthiness procedures were subject to human interpretation, which essentially exposing a range of "realness."

Peer Review

I was fortunate to rely on a cohort of colleagues within the field of music education, each providing constructive criticism for all stages of my study. These included past and present music teachers with whom I work or have worked, as well as my doctoral supervisor and professors whom I have collaborated with during my course sequence and residency. I viewed my professional peers as "objective other[s]" (Tucket, 2005, p. 39) who avoided subjective assessment of my topic selection and provided guidance within the specific parameters of qualitative research methodology, e.g., interviewing, observing, coding, and member checking.

Decisions and Ensuing Delimitations

According to Simon and Goes (2013), delimitations "result from specific choices made by the researcher. Among these are the choice of objectives and questions, variables of interest, theoretical perspectives that were adopted…the theoretical framework, and the choice of participants" ("Delimitations"). With this study, I aimed to find out what a music educator considered critical for students "to gain and sustain agency as contemporary musicians" (Tobias, 2013, p. 228) with the aid of music technology, thereby seeking ways that their affirmations did or did not blend with those of students. A variety of music classes were available for study in order to fulfil this purpose. I had already developed a professional attitude about courses to study based on teaching experience. Furthermore, I knew that the chances of locating a research site that served the purpose of my study were few based on my location of professional practice. These two issues heavily influenced delimitations.

Interviewing Participants

Factors came into play when deciding upon the number of interviews and observations, including participants who granted permission for me to interview them, determining when all data has been collected, and determining the timing needed in order to achieve maximum data capacity. For qualitative studies in particular, data should be rich in terms of its quality and thick in terms of its quantity (Fusch & Lawrence, 2015, p. 1409). Subsequently, whether as much information as possible has been acquired is a matter of recognizing data saturation, or the point at which there is no new data or new themes (Fusch & Lawrence, 2015). I acknowledged that personal requirements and objective methodological requirements contributed to the determination of data saturation. I operated between “multiple worlds while engaging in research” (Fusch & Lawrence, 2015, p. 1411), including the general culture of those I researched and a specific culture consisting of my personal interpretations and research experience. I conducted research according to the methodological requirements and theoretical underpinnings that helped me obtain data for each research question.

Fusch and Lawrence (2015) argued that, in general, interviewing is an ideal way to achieve data saturation. During my study, the exact amount of interview sessions per participant was deemed highly influenced by the moment when all participants were able to play their role at one given time, multiple times. Because all interview sessions exhausted all questions, and all participants were asked the same questions, data saturation was achieved (Fusch & Lawrence, 2015). While at least two interview sessions per participant was the goal, only one session per participant occurred because of a variety of unavoidable and practical issues associated with those in a formal schooling environment—student attendance, teacher attendance, my attendance, principal approval, professional obligations, and rescheduling all played a role.

Research in the social sciences revealed that “(r)espondent characteristics, interview performance and the type of questions can have an impact on interview speed, and consequently on the interview length” (Looseveldt & Beullens, 2013, p. 1429). Empirical evidence supports the relationship between participants’ cognitive capacity and interview speed, with cognitive capacity defined by the age, education level, and the act of asking for clarification (Losseveldt & Beullens, 2013, pp. 1423–1429). According to the authors, when participants ask for clarification or when the participant is much older in age, interview speed decreases, and while higher education level is less clear as a determining factor, interview speed decreases as well. My initial interview protocol was somewhat longer for the teacher than for the students, and both the teacher and student interview protocols contained follow-up questions. Each answer had the potential to vary in response time due to circumstances based on age and education level. There was also a chance that questions could be answered at a rate as high as five to six per minute (Losseveldt & Beullens, 2013, pp. 1429). Indeed, both possibilities occurred, resulting in a wide variety of interview sessions in terms of length, ranging from 10 to 47 minutes long.

Observing Participants

Length of observation time depended on my role in the classroom, as well as my knowing when the best times were to observe according to the district’s, teacher’s, and student's participatory needs. My role was observer-as-participant because, more often than not, I was overt to those I either observed or interviewed (Baker, 2006, p. 175). My preference was conducting an observation within one class period each due to the windows of opportunity delineated by my work schedule and participant availability. I kept in mind that I would turn these "condensed versions" into "expanded versions" (Spradley, 1980, as cited in Baker, 2006, p. 183) within 48 to 72 hours of completing each observation phase.

Ethical Concerns

During collection of data, I managed each recording, transcript, and artifact appropriately in order to make certain no ethical concerns occurred. Mr. Bloomfield gave his written consent, and all students provided their written assent. Next, all data were kept confidential through a process of storing files in a double-password-protected laptop with locked file-status. This information could not be accessed by anyone but myself. Lastly, the research posed no risk to the participants, as their daily classroom routine remained the same.

Under expedited review, Boston University IRB approved my research protocol. IRB determined that my research did not involve greater than minimal risk, that assent would be attained from each student-participant, and that the permission of one parent would be sufficient. They specified that written assent would be obtained from high school students. IRB approved all data collections methods—student assent form, parent consent form, teacher consent form, and interview protocol for both the teacher and students. Finally, as the Principal Investigator I was responsible for making sure that my study was conducted in accordance with federal regulations, state laws, and institutional policies.

Summary of Methodology

My research methods followed an ethnographic approach, a search for "patterns of conduct that guide participants' day-to-day practice" and the ways in which the formal environment shapes these patterns (Krueger, 1987, p. 70). I organized my data collection methods according to a) Mr. Bloomfield's attitudes about technology implementation, b) students' discussions about the AP Music Theory classroom while referencing their music technology knowledge and experiences outside school, and c) interactions between Mr. Bloomfield and his students that represented interactions between informal and formal learning environments. Participant selection was based on availability of a high school program that offered a non-b/c/o course. Student participants were enrolled in an AP Music Theory course, and Mr. Bloomfield met with them during the last period of each school day. I collected data using interviews, classroom observations, and artifact collection. Collectively, these methods achieved triangulation during analyses. Using *a priori* and emergent coding techniques, I extracted relevant themes from the teacher interview transcript, seven student interview transcripts, and five artifacts. Each participant had a chance to look over their transcripts, and my colleagues—including my dissertation supervisor—scrutinized the data, codes, and themes as they evolved. Upon determining the themes according to their respective research questions, a comprehensive picture of the setting could be drawn, as discussed in the following chapter.

CHAPTER 4 – FINDINGS

The following chapter is framed according to my research questions, with each section embodying the actions and interview responses of Mr. Bloomfield, his students, the classroom, and the technology each participant employed in and out of school. The design of my investigation was in case study form and the amount of qualitative data was ample enough to provide my readers with a dynamic picture of an AP Music Theory classroom in which technology was or was not employed by the participants involved, formally and informally.

Mr. Bloomfield's Attitudes about Implementing Music Technology

This section is based on the first research question: When instructing a broad population of secondary students enrolled in a non-b/c/o music course who also engage in music technology outside of school, what are the teacher's attitudes about music technology implementation? The focal point of this question was Mr. Bloomfield and the reasons why and how he thought his students used music technology. To begin, I illustrate my initial observations of Mr. Bloomfield within three phases of a typical class period, as well the projects in which he implemented technology. Next, I outline a series of Mr. Bloomfield's attitudes about music technology implementation.

Mr. Bloomfield

Mr. Bloomfield was brand new to the district but not to teaching music. The Director of Fine Arts, principal, assistant principals, and students kept him busy each and every day of the week, planning not only AP Music Theory but choir as well. He anticipated unannounced observations from his supervisors and prepared for teaching AP

Music Theory in a classroom designed for theater. His good-natured humor, positive attitude toward teaching, and realistic outlook comprised his typically energetic approach to teaching.

Upon arriving, Mr. Bloomfield appeared worn out, but his quick preparation said otherwise. Mr. Bloomfield's routine featured hectic preparations for his lesson. Sometimes he arrived late with a cart of school laptops, and other days he arrived on time flipping his personal laptop open on the closest table. From a spot in the center of the room, Mr. Bloomfield greeted a few students and held brief private conversations with one or two at a time. During these conversations he sometimes forgot what day it was. "It's not Tuesday," he responded to an inquiring student during a class, "Oh, it's Tuesday!" [CO#1para1]. Once the bell rang, the teacher typically stopped the students' private conversations and suddenly announced the day's activity loudly and with vigor. "Alright, y'all," he interjected, "Five minutes on the clock…we're starting Unit 2…five minutes on the clock, ready? Do the first one, E natural minor!" [CO#3para1].

During the lesson portion of class, Mr. Bloomfield maintained his high-energy persona, with pacing characterized by rapid-fire dialogue and occasional moments where he corrected himself before moving on. His communication with students consisted of directives, musical cues, and collegial dialogue. "That's awesome," he expressed to a student experimenting with composition software, "I have no idea how many measures you can add" [CO#2para1]. He used metaphor to help students learn something musically ambiguous, for example, writing out a "shell" [CO#3para1], or a framework for deciphering a key signature based on its sharps or flats. Other musical concepts were communicated specifically according to the terminology, such as seven and fully diminished chords. When explaining how to change a fully diminished chord to a half-diminished chord during one of his lessons he altered one of the pitches inaccurately and corrected it a few moments later.

Within ten to fifteen minutes of the daily announcements and dismissal bell, Mr. Bloomfield reserved class time for a variety of reasons. These included a quick check up on music theory fundamentals, unstructured work time, or waiting for the announcements. Mr. Bloomfield's pace evolved from intense and abrupt to relaxed and carefree at this particular time. I witnessed one moment when he attempted a quick check-up of music theory knowledge without altering the quick pace from before. Otherwise, Mr. Bloomfield let his students continue a project on their own, or converse with each other about other matters, such as musical rehearsals. During these particular moments, there was a well-defined shift from a fast-paced formal lecture to a relaxed and period of downtime.

Descriptions of Projects

Mr. Bloomfield implemented technology for two specific projects that took up the bulk of a class period, as well as one short activity. The first project was an instrumental identification assessment in which he employed Kahoot. Mr. Bloomfield uploaded Kahoot to his MacBook Air and used a separate school laptop and wired speakers for accompanying listening examples. His computer connected to the classroom projector in order for students to view Kahoot's interface on a screen opposite the classroom door. So those students could interact with the assessment, Mr. Bloomfield instructed students to use either their smartphones or district laptops to enter a passcode and enter answers once they listened to the example.

For the second project, Mr. Bloomfield required his students to compose an original piece of music using Noteflight. He directed students to maintain the following requirements: a) stay within eight measures, b) use any key signature except C major, and c) structure the music according to a I-IV-V-I chord progression. Mr. Bloomfield provided students with school-based laptops so that they could access Noteflight and save their work. Part of the project was spent getting to know Noteflight's interface, with the rest of the period reserved for the composing. Mr. Bloomfield did not explicitly direct students to get to know the interface in a specific amount of time. The result was students began composing at different moments based on how long they wanted to spend time becoming familiar with it.

Next, Mr. Bloomfield had his students work on key signature identification exercise using musictheory.net. The exercise took approximately ten minutes to complete. Mr. Bloomfield provided his students with instructions, sent to their smartphones by means of the Remind application. Upon receipt of these instructions, students logged into musictheory.net and worked on the exercise. Mr. Bloomfield required students to take a screenshot of their score and send it back to him using Remind. This application was not an example of technology used to teach. It was used primarily for Mr. Bloomfield to send or receive messages pertaining to homework and quizzes, or for students to send their assignments back to him.

Why Students Use Music Technology

Mr. Bloomfield believed his students gravitated toward music technology that was easy to set up and not related to schoolwork. “Apple Music,” he said, “Really easy to set up. Spotify, really easy to set up. YouTube, really easy to navigate. Musictheory.net exercises, they’re going to avoid. They’re not going to do those things for fun, ‘cause it’s work” [TIpara34]. He noted that students favored “simple things” such as tuners and virtual keyboards on their phones, as well as “Karaoke tracks that they can sing along with to their favorite song” [TIpara28]. Mr. Bloomfield’s insight culminated with a reference to recreation. He stated, “If they are using something music technology-wise, it’s something solely for pleasure, or something for relaxing, or winding down” [TIpara36].

Mr. Bloomfield suspected students used music technology for a variety of other reasons based on what they shared with him in class or in passing. He mentioned, “I would say that they never seem very excited about the technology I make them use (laughs), and I’m not sure if that’s the technology aspect of it, or if it’s they just don’t want to do the work” [TIpara18]. Mr. Bloomfield went on, “I never really hear good things about the technology we’re asking them to do” [TIpara18]. “They’re looking for easy things” [TIpara36], he emphasized. On the flipside, he felt they were more eager when discussing what they used at home. They were music listening applications, such as iTunes, Spotify, and Pandora and “keyboards they use on their phone” [TIpara18]. This was the extent to which students shared what they did with music technology outside of school, at least up until this point in the school year. Mr. Bloomfield perceived why there was a lack of communication in this regard, stating, “They do not really talk to me much about music technology or ask me if I have advice on music technology, things like that” [TIpara18].

Achieving AP Music Theory Goals

Mr. Bloomfield’s attitudes about integration of technology reflected his desire to achieve specific goals guided by the AP Music Theory curriculum. These attitudes were directly influenced by what was available:

> We’re kind of at the whim of musictheory.net, or just kind of what another school posts for free, their own worksheets and things like that, which I have used sometimes, too. So, I feel like [students] don’t know a lot about what their options are, and even me as a teacher, I feel like I don’t know what the other options are, to be able to help them, or guide them to what could be beneficial for them and their learning. [TIpara30]

Mr. Bloomfield knew his students appreciated the creative element within their personal music technology use. However, regarding the current AP Music Theory material—I-IV-V chords, for example—he believed that he did not “have anything for them as that can be used effectively for creativity” [TIpara46]. Ironically, he assigned a project with music technology that promoted the very creativity he felt was not effective, having students write out an original composition using those very chords.

One reason Mr. Bloomfield assumed that he did not have the necessary music technology was because “the technology department [played] the run-around of who is able to get the technology or even just asking questions…I just can’t get ahold of them”

[TIpara4]. He perceived that some students did not have personal technology to work with, other than their smartphones, and he felt pressure to supply them with the best possible equipment in order to maintain some semblance of flow throughout the class. “A lot of them don’t have their laptops, or they don’t have their own iPads,” he stated, “I think that it would be too difficult to use [music technology] on your phone, or most of the time you would be messing up with that anyway” [TIpara2]. All students made every effort to use their phones for his projects; however, Mr. Bloomfield anticipated that future music theory projects would be “impossible to do without the iPads” [TIpara2]. He settled upon school laptops in order to start his students on the fundamentals of music theory using musictheory.net and Noteflight.

Mr. Bloomfield implemented musictheory.net for teaching fundamentals, such as key signatures, “dominant, pre-dominant…chord functions, chord progressions,” concepts that he felt were “more applicable to [students]” [TIpara6]. He added, “I want them to be doing a lot of dictation in an actual program, like Noteflight” [TIpara38]. At the time, key signature identification was the primary focus. Mr. Bloomfield considered his students’ preferences with their personal musical technology use in order to accomplish identification quickly in class. “I want that time to be getting shorter every time,” he stated, “Because really things like those fundamentals—key signatures—they need to be so fast” [TIpara50]. “They know this is important,” he added, “They are getting better, they’re definitely getting better” [TIpara50].

I mentioned Mr. Bloomfield’s implementation of Kahoot for a project during my time in the classroom. This was his effort to help students with their instrument identification. His prior experienced with the software guided his decision. “I have used Kahoot in the past,” he mentioned, “Not just for this class but also some classes that I taught at the university” [TIpara2]. “It does help in the music classroom,” he added, “Just listening examples, what is this instrument, things like that, that are easy” [TIpara2]. Mr. Bloomfield also emphasized how Kahoot appealed to his students’ visual learning, no matter if it digressed from the topic at hand. He explained, for example, “At least [they were] able to go up, point out the chin rest, like, okay, this a good hint, things like that” [TIpara78]. His personal laptop provided music in sync with a slideshow presentation of the instrument groups, accompanied by colorful backgrounds, pictures, and a multiple-choice answer format. He asked students to dictate their answers to Kahoot directly by means of their personal phones, thus supporting his quick pace.

Communicating with Students

Mr. Bloomfield was sensitive to his students’ smartphone usage in class and implemented their knowledge into his curriculum. Mr. Bloomfield reminded me that “the trend is…something that’s going to be more useful for them…or they’re going to use more” [TIpara33]. When giving his students chord quality exercises in musictheory.net, he used Remind. Mr. Bloomfield explained the process, “So I sent personalized, or customized, music theory exercises from musictheory.net through Remind…and I just copied that link, I sent it to them, gave them the directions, I tell them when to start and they go” [TIpara38]. “Phones out…alright, I sent you a Remind message” [CO#1para1], he announced during class. Once Mr. Bloomfield decided that students were at their final questions, he announced, “If you’re done with it, screenshot it and send it” [CO#1para1].

Students Working Together

Mr. Bloomfield revealed just a few opinions about implementing music technology for the times when students worked in small groups. He initially believed that students organized themselves according to “big personalities” or “small personalities” [TIpara60] while they used music technology. Indeed, the more outgoing and louder students sat in groups, while the introverts sat alone, typically on the floor or sitting at a separate table. Other than this observation, Mr. Bloomfield’s attitudes about implementing music technology in group work reflected his future outlook. He stated, “I haven’t thought much about using technology, or having them work as a team in general—something I feel like I should be thinking a little more about” [TIpara52].

For future lessons, Mr. Bloomfield anticipated that music technology, such as musictheory.net and Noteflight, would work best during times when students provided each other with feedback in a group setting. He stated:

> When I want them to be working in groups, I want to talk about why these chords may work with each other…in groups of two, maybe three…I think two’s probably better for that so they can actually get feedback from the other person…why this is not working, or why would this work, things like that. [TIpara40]

By the time the second class was completed, I observed him favoring a stationary approach in which he kept to himself. He did, however, allow students to form into groups without explicitly asking them to do so. The introduction to Noteflight featured a moment when students had to activate their account. He let them discuss how they could make a headshot for their respective accounts and decided to stay in one spot of the room as most of the students worked together in groups.

Lecturing with Music Technology

Mr. Bloomfield's attitudes reflected an affinity to a lecture-type approach when teaching AP Music Theory with music technology. He reasoned, "They're kind of a class that's like, especially eighth period, they're like, 'Tell us what we need to do,' and they do it, because I think everyone is dead at this point" [TIpara90]. He perceived those students were tired since it was the last period of the day. He negotiated between what he felt was necessary to teach them, such as "fundamentals and the rhythms and things like that" [TIpara88], and "things practical to their music" [TIpara90]. Mr. Bloomfield genuinely desired that students offer him some ideas along the lines of creativity while using music technology, however, "Because we've just begun to talk about fundamentals," he maintained, "I don't think there's a much wiggle-room for creativity" [TIpara46].

While lecturing, Mr. Bloomfield implemented technology based on his students' experiences and knowledge of software and hardware. His attitude about their knowledge revealed a genuine understanding about their experiences using it outside of school. He stated, "A lot of [students] I know tell me about the keyboards they use on their phone" [TIpara18]. When they were outside of school, Mr. Bloomfield perceived his students could "just plunk [music] out" by ear on their own with these applications [TIpara28]. and he let students intoned pitches on digital piano applications. Some pitches were accurate, while others were haphazard, not necessarily having to do with the specifics of the lesson. He asked his students, “What does the I chord want to lead to? Predominant. The predominant wants to lead to dominant, dominant wants to lead to the tonic” [CO#2para1]. He asked the class what note was at the top of the circle fifths. A student yelled “F!” with Mr. Bloomfield answering, “The answer is C” [CO#3para1]. Mr. Bloomfield wanted students “to be able to make decisions…to make decisions through music technology” [TIpara56], but it was difficult to tell if students were using personal digital piano applications to outline chords or playing around.

Confidence in Personal Music Technology

Mr. Bloomfield’s attitudes about music technology implementation demonstrated confidence in his personal music technology much like his students did. His cell phone was frequently employed for purposes of intoning a starting pitch, playing a scale, or performing chords on his digital piano application. Mr. Bloomfield was confident that his phone provided accurate pitches for his students, and that it was a reasonable substitute for a real piano. “When I can’t have a piano in here,” he asserted, “I just pull out my own and say okay what’s a G, and there it is…I’d rather be at least, like, oh if this is D Major, I want to actually sing D major instead of I’m not just making something up on the spot” [TIpara12]. His confidence in personal devices as teaching tools reflected his choice to stick with what he knew, thus directly impacting how students learned music theory. “When I try new things,” he stated, “It actually hinders the learning process because of my lack of knowledge of the technology I’m using” [TIpara10]. Mr. Bloomfield implemented specific music technology that avoided potential disruption to the flow of class rather than other types that could potentially disrupt the flow of class. There was no indication that he would branch out in the future.

Implementation in the Face of Frustration

When discussing the implementation of music technology, Mr. Bloomfield often referred to his and his students' frustration with it. For him, implementation required prior explanation from someone else. "Without having somebody sit down and explain [technology] to me, I tend to get frustrated," he pointed out [TIpara10]. He added, "[Students] can also see how often sometimes I get frustrated with technology, because I do. It hates me (laughs)" [TIpara80]. Mr. Bloomfield did not shy away from expressing his frustration as he implemented his personal technology into the lesson. In front of his students, I heard him mutter "technology really does hate me" as he set up his laptops or whispering "Oh crap" to himself when the sound did not work as expected [CO#1para1].

Mr. Bloomfield frequently referred to his students' frustrations with technology during lessons or projects, and their input shaped his attitudes about its implementation. "I think [students] most relate their frustration to technology because any time we use music technology…they're like 'which one is it,' and then somebody get lost…they're all frustrated together" [TIpara80]. Mr. Bloomfield witnessed a few students exhibiting "organic frustrations" [TIpara82] similar to his own, such as a negative attitude about the tools he was using or foregoing an attempt at troubleshooting. Consequently, he felt comfortable about choosing whether or not to implement technology at that time or in the future based on impending frustrations. "A student being upset by his computer, that's something that I know to look out for," he explained, "I don't want that happening to me, I can avoid those things" [TIpara82]. Regarding himself, he stated, "I think a lot of those things are the organic things that come up, because most of them can relate to what those frustrations are" [TIpara82].

Alignments and Misalignments

I framed the following section around the second research question: In what ways do students who use music technology informally and take part in non-b/c/o formal music instruction reveal alignments, or misalignments, between the two environments? The primary focus of this research question was the students—what they did and said that brought alignments and misalignments between school and outside-of-school technology uses to light. I begin with a brief introduction of the student cohort, placing my readers in the very spots wherein I sat—the classroom during observations and Mr. Bloomfield's office for interviews. Next, I present my findings for my second research inquiry organized according to alignments and misalignments shared between in and out of school.

The Student Cohort

Whether together in class or one-on-one during our interview sessions, students were enthusiastic throughout the course of the study. My presence was generally unnoticed by students while observing their classes because I did not get in the way of their conversations and movements. I was able to gain some insight into their musical experiences when they conversed with each other in class and with me. Students were instrumentalists and singers in and out of school. They often sang out loud at random times during lessons or announced it for all to hear. "My primary instrument is my voice," one student announced to the group during class [CO#2para1], for example.

Many of them exhibited bonds acquired from other music classes in school such as choir, and extracurricular activities such as the school musical. Those who were in choir often sat together at one table, and likewise the band students. Those who worked with each other during musicals often reminisced about prior rehearsals with Mr. Bloomfield or each other.

Individual students approached interviews candidly, having no knowledge of the questions they were about to be asked until their session commenced. Students answered questions quickly, occasionally taking some time to think, adding to their response at will, or asking for clarification. "What do you mean by music technology…like listen to music…or to make music?" one student asked me, for example [SI#1para2–6]. When I asked for clarification about some of the terminology they used, they were willing to elaborate. When I asked a student what they meant by "pressing" when describing the kind of schedule, they follow when using music technology, for example, they immediately replied, "If I feel like that's something we should be focusing on" [SI#7para10]. All told, students responded to questions, asked for clarification, and provided clarification with efficiency and poise.

Alignments

Daily Life

A student told me, "[Music] takes up a big time in my daily life" [SI#6para8]. Daily life was an overarching term aligning both environments, described according to activity, relevance, and casual attitude. From beginning to end, students' daily activities included music technology. "When I do competitions," one student related to me, “Sometimes I feel like that’s something I should be focusing on I’ll use whatever app or whatever soundtrack to practice that, like that night” [SI#7para10]. Students practiced on multiple instruments, such as guitar, ukulele, and piano, in and outside school. “I have off periods,” one student mentioned, “And sometimes I go play piano in [the practice rooms] and I use my sheet music app on my phone, so I look up stuff and play with things” [SI#2para8]. Others referenced the moments where they listen to music in class and at home. “Sometimes I listen to music at school if we have a chance in class when were just…working…by ourselves,” one student mentioned, “It’s definitely like school and out of school” [SI#1para20].

Students identified with music technology as a relevant mainstay across both settings. When asked why they believed technology was used in AP Music Theory, one student realized it was because of its relevance in their overall daily lives, stating, “There’s been a rise in music technology, because of just the overall incorporation of technology in our lives and how it really facilitates the things we do” [SI#6para28]. The use of music technology in class reminded students of reasons why they used it outside of school almost every day. One asserted, “It has a way to give a student a way to benefit themselves in order to take responsibilities into their own hands” [SI#4para30]. Another student affirmed, “I feel like music technology is used inside school because it’s a good skill to learn, and it’s a universal skill” [SI#5para34]. One other student felt the reasons were aligned to their prior knowledge of music, stating, “It really helps us get it in our brains. It’s easier than worksheets, sometimes, because worksheets you have to write it out” [SI#2para24].

Casual Attitudes

Students took a casual approach when using music technology in the AP Music Theory classroom, much like they would if they were home or hanging out outside of school. Just before or after the initial bell rang, students conducted individualized rituals, whether finding a spot away from everyone else, gravitating to their friends at one table, rushing or walking in as slowly as possible, talking as loudly as possible to one another or not at all, or calling a parent. At one point a student shouted, “Hey Google, call mom” into their phone, while at the same time setting up the same phone for musictheory.net [CO#4para1]. Roughly half the class ate a snack and drank water or soda when working on their projects and assignments. Crunching sounds, snack wrappers crinkling, loud gulps, and the opening and closing of bottles blended with the sounds of music technology regularly. I kept waiting for an official announcement by Mr. Bloomfield meant to curb these particular behaviors; however, students were accustomed to these particular aspects of the classroom setting without an overt concern from him. Consequently, these formal behaviors thrived while they used music technology in class.

Spontaneity

Another aspect that aligned both environments was students’ spur-of-the-moment use of music technology. “I’m really spontaneous when using music technology,” one student enthusiastically remarked about their usage outside of school [SI#6para8]. Students used their personal equipment on impulse as part of the learning process, particularly their smartphones. During the beginning of each class, students often listened to their personal music collection directly from phone’s speakers, much like they would outside of school. Spontaneous listening continued during the actual lesson. The reason for this, one student mentioned, was because "A lot of [students] are used to choir and stuff…it helps us to hear" [SI#1para78]. They also used their phones at sporadic moments for playing a digital piano, using a mobile browser that supported music applications, or using a camera for scanning the QR code. Some students supplemented their smartphones with other personal equipment, such as a laptop or tablet. They made a temporary home for these devices on their respective tables and used them whenever they felt like it. Their continued use of personal hardware in AP Music Theory aligned their technology use in and out of school.

Playful Personalization

In conjunction with spontaneity, students brought their lighthearted and individualized attitudes to the classroom. One student discussed "messing around" [SI#7para10] with music technology outside of school, and this attitude prevailed mainly during music composition lessons using Noteflight. Students generated customized headshots and accounts just like they would for a social media account outside of school. "Hey, are y'all going to use your personal accounts or your school accounts?" one student asked [CO#2para1]. "Uh, what should I make my username", another student added, while laughing [CO#2para1]. Just before creating their music, students focused their title or subtitles. These were rife with humorous, personal twists, such as "Mr. Bloomfield is Impressed" [AR#1], "A Happy Man's Piece" [AR#1], "everyone's favorite pop song!" [AR#3], "probably kylie jenner" [AR#3], and "Spirit of Mr. Bloomfield" [AR#5].

Arbitrary and Independent Usage

Students revealed an aspect aligning both environments by way of their attitudes toward the arbitrary implementation of technology in the curriculum. There was not always a definitive plan set in class, and students were particularly sensitive to this when talking with me. One shared:

> Some days Mr. Bloomfield will have us do structured chord writing, and have us do a composition based on that, and then some days Mr. Bloomfield will just have it be a free-write period, just to see what comes to us naturally…it's still kind of random, but I think as we get further into the curriculum for the year it will be more structured. [SI#7para14]

Outside of school, students related similar-type schedules when using music technology. "I think I may have a sort of daily schedule going on with me," they exclaimed, "But I'm not really sure, I'm a bit of a disorganized person, so it's kinda iffy as to whether I do or not" [SI#4para6]. While discussing using technology to take audio, another student mentioned, "I don't have a specific schedule, it's whenever I feel like playing an instrument" [SI#2para6].

Students' use of music technology outside of school was often conducted independently across both environments. "Every day I go to my little setup," one student stated [SI#1para8]. "I use apps on my phone…when I get bored, I look up chords and stuff," another student exclaimed [SI#2para2]. For some students, independent work continued in the AP Music Theory classroom. One student clarified, "Mr. Bloomfield just really lets us do our own thing…it was really self-driven" [SI#6para36]. Students talked to themselves, saying such things as “why are these all…mmm…there we go” [CO#1para1]. Students were assured of the fact that independent work was typical of their day. “There’ll be days where Mr. Bloomfield, let’s just, you know, free-write whatever we feel like writing in that day” [SI#7para26]. Independent use in school allowed students to “get to the final goal a lot faster and a lot more efficiently for sure” [SI#7para18]. Students sometimes decided to use applications at home for similar independent work. “I use technology from school, and I bring it home—musictheory.net”, one student mentioned, “It helps, it improves my knowledge of music” [SI#2para24].

Learning with Peers

Students learned from their peers while using music technology, aligning both environments. Students recalled a few moments outside of school. “The only time I remember recording, or at least attempting to, was with my friend trying to do sort of a cover of a song that we both enjoy,” one student mentioned [SI#4para4]. Another student recalled a time when they observed an uncle assist their father with music production. “My dad and brother, they’re trying to make a CD album for my dad,” the student mentioned, “So I watch them play with the mixer through my uncle because he has a studio” [SI#5para4]. In school, some students learned with each other as well. “I feel like any time we’re doing an assignment,” one student mentioned, “I personally never really understand it until I go do the assignment and work with my friends to really understand it” [SI#1para84]. For their composition project in class, one student took the opportunity to get together with their peers while using Noteflight. “I remember asking ‘ooh how do I do a chromatic scale in this key'?" they reminisced, "And we all worked together to do that" [SI#5para59].

Misalignments

Use of Technology

I located a selection of misalignments between both environments within students' explicit descriptions about the music technology they used. Those students who used technology more or less equally in class and at home did not identify the technology they used for the purposes of AP Music Theory projects. They called them "online things" [SI#2para10] instead of Noteflight, Kahoot, and musictheory.net. Outside of school, these same students used technology that did not match that which was prescribed in the curriculum, such as GarageBand, Acapella, Google and iCloud drives, tuner, and metronome applications, "files and some other websites [to] get music scores from" [SI#6para2], and "apps that have music tracks on them" [SI#7para3].

Other students used music technology in one environment more than the other or preferred not to bridge their personal equipment from home to school. Some students did not use music technology outside of school at all. "I don't use it much," one student recounted, "Or, I don't use it all except for this class" [SI#3para11]. In contrast, one student articulated, "I don't play and record and stuff at school as much, just because it is easier at home" [SI#2para20]. Other students, who either did not use or did not want to bring their personal technology to class, requested access to school district-managed laptops whenever a smartphone could not be used, such as their Noteflight project. One student said, "It's really important to me that we've had this sort of technology come in, it's been really helpful" [SI#7para24].

Connectivity

Students revealed another misalignment between both environments when discussing or reacting to their experiences using WiFi for their music technology in school. The district provided students with free WiFi throughout the building. While they did not overtly reveal their WiFi experiences outside of school, students were sensitive to how district WiFi affected the use of their personal and school-based music technology, expecting it to run according to what they were used to in terms of speed. The phrase "My phone is going too slow," [CO#1para1] and other similar-type complaints, were commonplace.

Students were also perceptive about the district's web filtering. One student commented:

> The WiFi doesn't really work here (laughs). It works, but it doesn't load fast, it blocks a bunch of stuff when we're trying to get on. Some website…I forgot…I think it was Remind or something, and the WiFi kept blocking us, and also this building that we're in, the service usually isn't the best, sometimes we struggle with getting our technology to actually load and function (laughs). [SI#2para48]

Beforehand, the plan was for students to use MuseScore, but they were prevented by the district's current firewall. They used Noteflight instead, having not been blocked when accessing it in school. Ultimately, the challenge for students was negotiating what to use for the sake of uninhibited workflow, whether to use WiFi or their cellular carrier. When using the former, the issue was the firewall. When using the latter, the issue was loading speed.

Time Constraints

Students discussed the amount of time they had to work on music technology projects, revealing another misalignment between the two environments. One student mentioned, “During school we have limited amount of times…can’t really do as much, and outside of school there’s more of a variety of stuff we can do” [SI#3para32]. During their free-writing project on Noteflight, students were able to use the maximum amount of time allotted in their schedule. On the other hand, one student observed, they “end up running past the end of class period” [SI#7para46]. “I like having a lot of time to work on music stuff,” the same student continued, “But, I think our class is 55 minutes, and I end up, you know, the bell rings at four and I end up working until 4:05, before 4:10, something like that” [SI#7para48].

The students appreciated additional time flexibility offered outside of school when using music technology because it allowed for a focus on creativity. “I also enjoy sort of doing outside of class time,” one student exclaimed, “Because that’s where everything can spark and that’s where everyone comes together and create something” [SI#4para64]. During class, however, a few students spent the majority of the period acclimating to technical aspects—the interface, commands, or account setup—and less time engaging their creative spark. The result was a dichotomy of student outcomes for the Noteflight project as the class period ended. Those who were able to maneuver around the software announced what they were able to add to their score— “guitar, winds, percussion,” one student stated while they worked [CO#2para1]. Those who considered Noteflight tedious turned to their smartphones for entertainment. “I’m so lost,” one student exclaimed at one point [CO#2para1]. If helped by their peers or teacher, these students had only enough time to create music that exhibited requirements based on theory without engaging in the inventive paths others took, such as looking for an instrument that could add a “boom” sound effect [CO#2para1].

A Collaborative Learning Environment

Research question three read: In what ways do music teachers’ and informal learners’ attitudes about music technology reveal, or not reveal, a collaborative learning environment? Framed around this question, I organized students’ attitudes about collaborative learning, followed by the same for Mr. Bloomfield.

Students’ Attitudes

Peer Groups

Students’ attitudes about music technology revealed that a collaborative learning environment shared their respective ideas and guidance with each other. “I’d say every time we have a composition,” one student exclaimed, “There’s always room for asking questions and bouncing ideas off of each other, for sure” [SI#7para40]. Sharing ideas occurred most often during the Noteflight project. A student said excitedly:

> Oh, do I want this to be, like, for simple terms, do I want it to be a happy sounding piece, or like a sad one, or, like, more like dramatic, theatrical, just sort of stuff like that. Like, one of my friends said ‘oh should we have this be something like a symphony, or something, you know, like a waltz, stuff like that. [SI#7para44]

In a similar fashion, another student revealed how Noteflight helped their friend realize a selection of musical styles, exclaiming, “One of my friends made a sort of spooky kind of melody, it was really enjoyable, and another one of my friends sort of made a jazz type creation” [SI#4para44].

Students’ attitudes revealed a collaborative learning environment when they discussed the use of music technology collectively as a class. The role of Kahoot, for example, was rooted in students’ effort to “memorize the sounds of [instruments]” as a team [SI#1para61]. Another student observed:

> We all, like, wrote notes together and shared things while we listened, and like, talked about certain things, and we used technology….and we could go, like, to each one and listen to solos and certain things and see how they looked, and we did that together. [SI#2para44]

Students typically answered the quiz questions all at once— not necessarily in sync—and gradually agreed upon what made the most sense as far as the answers were concerned. “Wow, I didn’t know it could go that low,” one student observed when they heard the double bass” from the speakers [CO#1para1]. A student responded, “But then basses are more, like, lower” [CO#1para1]. “These huge string basses,” another student responded, looking at the picture of the instrument on a Kahoot slide [CO#1para1].

Students Identifying with Content

Students’ attitudes about the use of Kahoot in class revealed a collaborative learning environment in which they were able to relate the learning content with their prior knowledge. Within the cohort, students who related to each other according to other music classes—band in particular—would help each other answer instrument-identification questions generated in Kahoot. One student clarified, “I probably say that within our class we have kids that came from band, and there’s kids from choir, and they usually, you know, tend to group together with what we’re more familiar with” [SI#7para40]. While the introduction to “Rhapsody in Blue” played with a picture of a clarinet accompanying the recording a student yelled, “Hey I know this one!” [CO#1para1] to one of their fellow band students. While the saxophone example played, another student expressed to Mr. Bloomfield, “I wish you would’ve played a jazz version, because I would be like, ‘oh I know what that is, boy!” [CO#1para1]. These band students identified with melodies and instruments that they were familiar with, and Kahoot was the means in which they made that connection.

Students Working with the Teacher

Students considered Noteflight the means by which they could pursue original music compositions while still implementing fundamental goals that Mr. Bloomfield established. There was a balance between the times when students used Noteflight on their own and the moments when they decided to reveal what they came up with to Mr. Bloomfield. It was universally accepted that Mr. Bloomfield “wanted to see we understood chords and how they fit and how we could make a melody on top” [SI#5para40]. A student reminded me, however, that their peers “talk[ed] to each other quite a bit about their pieces before [showing] anything to [their] teacher” when using Noteflight [SI#7para38]. The result was a collaborative learning environment characterized by students’ attitudes about using music technology with a variety of guidance from Mr. Bloomfield.

Students maintained that Noteflight was a means “to do anything” [SI#5para44]. Their descriptions of collaborative learning with Mr. Bloomfield took this into account while he guided them during their Noteflight project. A few students immediately wanted Mr. Bloomfield to know they were able to integrate the music theory fundamentals while they used the software. A student mentioned, “The closest thing that I can think about is…telling Mr. Bloomfield what I did, like the theory behind what I wrote on Noteflight” [SI#6para42]. I asked what they meant by theory, and the student clarified, “Just the structure of the song” [SI#6para44]. After working for a little while, some students needed a simple reminder about the chord progression they were supposed to use. Mr. Bloomfield responded, “A four (chord) leads to a five (chord)” [CO#2para1]. Another student sought Mr. Bloomfield’s input while dictating an original melody into Noteflight. “We wanted [the melody] to sound like this (singing),” a student explained, “For example, I had a melody in my head it was like (singing), and I was like Mr. Bloomfield how do I put this in the computer” [SI#5para44].

Students Maintaining Creative Aspirations

Students’ attitudes about music technology revealed a collaborative learning environment in which they could maintain individual creative aspirations while working within the framework of the AP Music Theory curriculum. Students anticipated moments in class when they would use music technology similar to how they used it outside of school “I thought of incorporating into my personal use,” one student explained, “And just like writing songs on my own and not just for music theory” [SI#6para52]. They also perceived that when they used music technology in class, there was typically room for creative liberties. A student reminded me, "Mr. Bloomfield really lets us do our own thing" [SI#6para34]. When they used Noteflight, students felt comfortable coming up with a variety of ways to exhibit the progression, or part of their progression, in their music (see Figure 1) [CO#4para1].

Figure 1

Part of a Progression

Some students noted that when they used Noteflight, they were able to compose an original melody within the context of whatever key they desired, as well as whatever score they deemed necessary, all within the boundaries of the original chord progression they were required to follow, I-IV-V-I [AR#3]. "We all have sorta an idea what we wanna make for our melody," one student explained, "we're kinda of, like, we'll use kind of accidentals, or we'll use different instruments" [SI#4para58] (see Figures 2 and 3).

Figure 2

Composing with a Progression. Example 1

Figure 3

Composing with a Progression. Example 2

Making Music Versus Studying Music

Students discussed a few differing aspects about how or why they used music technology in and out of school. When explaining how they used technology to make music, a student answered, “Obviously in theory a lot more steady and down to the basics. When I’m at home making music or recording music, it’s pretty different. I’m just playing guitar and not down to the basics if that makes sense” [SI#1para41]. With regard to what influences why they used music technology at home and in school, students perceived that technology helped them realize their general love of making music, as opposed to studying music. One student summarized:

> When I’m at home making music, I’m not making music to become, I mean, I guess I am, not to become, not to study it. I’m making music because I love to do

> it…I take the class because I love music, but I think it's pretty different between…studying music and making it. [SI#1para50]

These attitudes about music technology culminated into a singular perception that the classroom felt restricted to them. "I do feel a little more, probably say, more restricted in school because…there's guidelines and expectations" one student recollected, "I feel like at home I can do more of what I feel I need to work on for that day, or I feel that I need to create, listen to, you know" [SI#7para20]. Their attitude about music making outside of school reflected how less restricted they felt in that particular environment, allowing them personal preference for making music in their own terms and not necessarily according to what was taught in class.

Mr. Bloomfield's Attitudes

Sensitivity to Students' Needs

Mr. Bloomfield's attitudes about music technology revealed a collaborative learning environment in which students' needs were met, regardless of the ultimate goals for each lesson. Two themes that emerged during the interview were a) his intuition about what works best for his students during the class period, and b) his perceptions about how students adjusted to music technology implementation.

Mr. Bloomfield offered his thoughts about what worked best solely from a practical standpoint. He discussed the flexibility of exercise customizers embedded in musictheory.net, giving students "plenty of ways to be shortening times, or lengthening times, or lengthening assignments" [TIpara50]. He implemented musictheory.net in his lessons with these flexibilities in mind, having students complete exercises in "one minute, to do as many as you can; what I actually quizzed today, it was two minutes, I want twenty right, but do as many as you want after that" [TIpara50]. Correspondingly, he understood that when students used technology to identify pitches, each one worked at their own pace, and timing need not apply when the entire class period was available. Mr. Bloomfield stated, "Most of the time I don't give them timed options" [TIpara109]. Musictheory.net allowed students to work at their own pace, no customization or timer needed. "If you finish," Mr. Bloomfield continued, "The rest of the time is yours to do with what you please, or you can look around, whatever, through the rest of musictheory.net" [TIpara109].

Mr. Bloomfield mentioned that his students adjusted to music technology in school according to their prior knowledge, but not at all levels. From the perspective of effort, Mr. Bloomfield supposed the students were not lazy when they used music technology in class. "They're not," he reinforced, "They work really hard" [TIpara36]. Secondly, he believed that students' frustrations with technology were akin to those they encountered anywhere else, and they adapted accordingly in class. "Most of them can relate to what those frustrations are…I think they're good at relating on frustrations" [TIpara82] he mentioned with a laugh. Mr. Bloomfield also outlined a few aspects of his students' prior experience with music technology that contrasted in the classroom, particularly when it came to practicality. "I think a lot of the times they don't feel like it is applicable to them," Mr. Bloomfield mentioned, "Or they don't feel like it's practical and I don't blame them for that" [TIpara24]. He also revealed how students wanted to avoid the aggravations associated with school-based music technology. "They're not worth the hassle of using the technology, he stated, “I think a lot of them are really just like I’m just gonna plunk this out myself, or plunk this part out myself, or look up on YouTube, things like that” [TIpara28].

Acknowledging Student Control

Mr. Bloomfield’s attitudes about music technology revealed a collaborative learning environment where, despite the ultimate goal of achieving a high score the AP Music Theory exam, he wanted students to be in control of the ways they used music technology during his lessons and projects. During each of the classes I observed, Mr. Bloomfield allowed students to choose what music technology worked for them. He stated, “I want them to have choice, I want them to be able to make decisions…to let them make decisions through music technology” [TIpara56]. He emphasized further, “I want them to choose a piece based on their instrument or their voice-type, and do analysis kind of through that,” adding, “I want to give them freedom by writing their own parts” [TIpara56].

Mr. Bloomfield also discussed using music technology while teaching with varied pace. He acknowledged that before the study began, his pace was one of his choosing, or not according to what students could handle. “I felt like I was just flying through things,” Mr. Bloomfield mentioned, “I’ve started to take more time for things, I feel like everyone’s kind of slowly growing together, as opposed to me just leaving people in the dust, like half the class” [TIpara104]. During the study, achieving a particular goal with the help of music technology meant students took as much time as they needed. Mr. Bloomfield explained:

> Some [students] are a league ahead of the other ones, so there's a lot of times I like it when they're done early, because can be, like, focusing on the students who need help, or figure out why it's taking so long for them to figure out. [TIpara104]

This attitude remained consistent throughout the lessons I observed. Mr. Bloomfield supported students for two main reasons, one being the theory content and the other the technology itself, particularly moving about the interface.

Organizing the Class

Mr. Bloomfield's attitudes about students using music technology within a variety of social configurations disclosed aspects of a collaborative learning environment. The idea that students work in groups while using music technology in class, according to Mr. Bloomfield, was a "preliminary project standpoint" [TIpara44]. He did, however, let students organize themselves into whatever groups they wanted without formally instructing them to do so. When I asked him if he could describe a project in which he formally offered students the opportunity to work in small groups, Mr. Bloomfield bluntly and succinctly declared, "Nothing yet" [TIpara40]. Nevertheless, I watched students work in groups while they answered quiz questions using Kahoot and composed music in Noteflight. Mr. Bloomfield did not explicitly instruct his students to work in such away during these lessons, nor did he keep them from doing so.

The Teacher as Facilitator

Mr. Bloomfield's attitudes about music technology uncovered a collaborative learning environment in which he facilitated its use according to his students' preferences. He believed that his students preferred to use music technology that was generally “user-friendly” [TIpara34]. Before his interview, Mr. Bloomfield introduced Noteflight to his students in order for them to obtain “kinda the gist of how it works” [TIpara2], in a way preparing them for the day when would work on it hands-on. Mr. Bloomfield also asked his students to relate the reasons why studied music theory fundamentals before using Noteflight:

> So I have at least discussed with them, when we’re doing this first project of writing your own melody, putting parts under it, I asked why we’ve ever done every single thing we’ve done up until this point, the fundamentals and the rhythms and things like that. [TIpara88]

Mr. Bloomfield wanted to take the reasons why students believed they learned fundamentals and facilitate them in the context of their technology usage. He stated, “I always try to make things where I want to continue to make things practical to their music, but still being in fundamentals” [TIpara90].

When I observed his hands-on approach, Mr. Bloomfield began the lesson with the announcement, “The idea for today is to experiment with the software” [CO#2para1]. It was at this very moment some aspects of a collaborative learning environment were revealed, but these aspects favored those who could essentially keep up or could relate to their prior music technology experience. Mr. Bloomfield facilitated the startup process according to the terminology from the user interface. He intoned, “Create new score”, “Start from blank score sheets”, “Perfect, a piano comes up”, and “Click the little sharpies in the corner” [CO#2para1]. Throughout the process, Mr. Bloomfield moved at a rapid-fire pace, and some students struggled to find their way around Noteflight. Those who did not struggle may have had experience with a similar-type application or found the interface easy to navigate.

Chapter Summary

The findings addressed my research questions in a variety of ways. These findings painted a dynamic picture of an AP Music Theory classroom, fueled by Mr. Bloomfield's implementation of music technology, his students' perceptions about the music technology they had access both in and out of school, and some possible ingredients for a collaborative classroom. Having presented my findings, a discussion within the theoretical and narrative contexts presented within the first two chapters is needed to arrive at some conclusions that help me determine implications for further research. The following chapter is an examination of my findings and conclusion to my study.

CHAPTER 5 – DISCUSSION

The following chapter concludes my dissertation, beginning with an examination of my findings organized around my three research questions. This portion is essentially a meeting between the findings and the theories that drove my research questions forward. I move to a discussion of my findings according to the ways in which they support prior literature reviewed in Chapter 2. Next, I discuss novel paths of inquiry based on my findings and the implications for secondary music educators who implement music technology in a non-b/c/o classroom. Finally, I conclude the chapter with proposals for future research followed by a brief final summary of my study.

A Theoretical Discussion of Findings

For the following section I discuss my findings around each of my research questions and the theoretical framework that supported them. While considering each discussion, I utilized two questions for guidance: a) what about these findings did or did not hit home with the theoretical framework that supported each of my research questions; and b) what did I deduce from the data that was essentially a highlight for music educators to think about or respond to?

Research Question 1

When developing a discussion around my first research question, I considered Mr. Bloomfield's attitudes about integrating music technology and how these attitudes communicated his understanding of music technology as it pertained to himself and his students. Theoretical material will be integrated throughout in order to connect the discussion to the basis for this research question.

Observe and Learn

Mr. Bloomfield appreciated his students' general technology expertise. His personal assumptions informed the bulk of his attitudes about what they used outside of school more than what his students related to him, but not entirely. One attitude comprised both his assumptions and knowledge about why students preferred specific types of music technology. Mr. Bloomfield believed that his students looked for things that were easy to use, namely a diverse array of technologies used specifically for playing and listening to music. Of the ones he listed, he identified with smartphones most because his students spoke directly to him about how they used digital keyboard applications to "plunk out" melodies at home [TIpara28]. It appeared that Mr. Bloomfield appreciated how easy it was to use the same technology because he used his smartphone in the exact same manner as his students did. Furthermore, the only personal technology that he and his students shared for the same purpose was some type of digital keyboard application.

Mr. Bloomfield often discussed the lack of expediency of district- or school-based resources. With all the unknowns regarding technology availability, students relied on their smartphones. Mr. Bloomfield acknowledged that his students used their smartphones in lieu school-based equipment on a daily basis; however, he maintained that future projects would be unachievable without the aid of school iPads. Mr. Bloomfield was rather quick to consider his initial implementation of students' smartphones unsustainable. If he had analyzed his students' technology needs based on their expertise and the reality of what was currently available, perhaps he would have considered them sustainable.

Mr. Bloomfield noted that his students organized into groups (Green, 2008) according to their extroverted or introverted personalities. They typically arranged themselves into two rather talkative groups, while a few individuals sat away from them remaining quiet. Because the majority of his students sat together, there were ample opportunities for Mr. Bloomfield to stand back and observe groups using music technology (Green, 2008). He did so once while his students used Noteflight for the first time, albeit not without helping a few of them every so often. During our interview, which occurred beforehand, Mr. Bloomfield mentioned he had not thought much about having students work in groups. When he had his students experiment with Noteflight, he allowed group work involuntarily because the majority his students were already used to sitting in groups without permission and the activity suited them. Nevertheless, this countered his prior statement about group work. Furthermore, he mentioned that he wanted his students to provide feedback to other students. Students talked with each other about navigating the interface, commands, and the music they were creating anyway. Yet again, Mr. Bloomfield desired this feedback component within the classroom, but seemed rather oblivious of the fact that this was already occurring.

Communication

Mr. Bloomfield hoped that his students would talk more about their music technology practices outside of school, but the ways in which he communicated with them did not always make this possible. He often discussed how little his students reached out to him, but not about how little he communicated with them. His communication approaches could be described as introverted because he waited for them to share their experiences with him instead of initiating the discussion himself (Kemp, 1996, as cited in Campbell, 2010). During lessons, his lecture-type teaching style revealed his unwillingness to solicit or accept student feedback. He was comfortable lecturing to his students because they wanted him to tell them what they were supposed to do [TIpara90]. More open-ended questions would have been a better approach if looking for insight into their technology savvy, but students typically accepted what he asked them to do without inquiry. Consequently, he did not gain valuable insight into students' uses of music technology (Campbell, 2010), leaving him with a broad list of assumptions with which to inform his implementation of technology into the curriculum.

Creativity

Aside from including students' piano simulation applications in his lessons, Mr. Bloomfield maintained his hesitant attitude about investing time and effort into other technologies that represented his students' creative aspirations. He wanted to hear from his students about their creative uses of music technology yet insisted that trying new technologies hindered the learning process in the classroom, a notion that reminded me of Freire's (2005) discussion about a banking model of education, particularly if Mr. Bloomfield wanted his students to use technology with which he was most familiar. His statement was an interesting contradiction, however, because he already implemented his students' creative approaches when they used their digital keyboards in school the same as they did outside of school. Perhaps he decided to do so because they were easy to use and therefore not a hindrance to him in terms of teaching his students how to use them. If his students gained access to other creative music software and hardware for the classroom, what would Mr. Bloomfield do if offered the same? Having mentioned his tendency to shy away from new technologies, the possibility exists that some or all of these technologies would not be implemented. They would need to be tools that he was most comfortable with in the interim—the easy technologies—instead of ones he had not yet investigated in more depth.

According to Mr. Bloomfield, there was hardly any “wiggle-room for creativity” [TIpara46] when teaching music theory fundamentals. Other than for playing pitches, it appeared that he did not really see a connection between fundamental activities and his students’ creative uses of their smartphones outside of school. Mr. Bloomfield’s efforts were spent mostly on implementing the technologies he claimed to have known most, Kahoot in particular. He utilized two computers to conduct his instrument identification test while students entered answers using their smartphones. Mr. Bloomfield had an opportunity to manage a creative experience for his students—perhaps one that his students were familiar with—but the manner in which Kahoot was implemented was clumsy and tentative. Had he invested more time in learning resourceful ways to use Kahoot, particularly from his students’ point of view, his attitude may have shifted from no room to plenty of room for creativity in order for students to experience being together in music (Folkestad, 2006).

Research Question 2

While framing a discussion around my second research question, I reviewed the ways in which students used music technology, how these ways differed or aligned, and particular phenomena that stood out to me in the classroom.

Relaxed and Playful

Students demonstrated relaxed-type attitudes (Jenkins, 2011) during the moments in class when they felt like unstructured uses of technology were acceptable, similar to "free-time". They also exhibited playful attitudes (Jenkins, 2011) when they took time to customize a particular music technology project. Just as if they were at home, students listened freely to music on their personal devices in class, typically during the five to ten minutes before the lesson officially began. Their spontaneity revealed laidback attitudes toward the classroom routine, particularly because there were no directives about whether or not they could do so or not. Students acted casual toward listening to their music listening devices because it was a common practice in other music classes, such as choir. During their lessons, students accessed their smartphones whenever they wanted to and applied them to the tasks at hand at will or when directed. When using smartphones as digital pianos, however, there were moments when it was hard to tell if they were using them according to Mr. Bloomfield's directives or for other purposes, such as playing random pitches or tunes. The cacophony of sounds made it difficult sometimes to discern what the immediate purpose was.

Students recalled the ways they would use music technology outside of school. Their routines continued in the classroom when they worked on their Noteflight projects. Because the project was exploratory in nature—create a piece of music using any key signature except C major—the students looked to the extreme ends of the key signature spectrum, many flats, or many sharps. A few students fooled around with titles and subtitles, referencing pop culture and Mr. Bloomfield's name in a variety of humorous and dedicatory ways. Of the software implemented by Mr. Bloomfield, Noteflight received the most playful treatment (Jenkins, 2011) from the students. It offered ways for them to put their personal stamp on the project, as well as the means to be silly when preparing a template for composition. It was clear, however, that in order for them to engage in these behaviors, lack of monitoring needed to occur, perhaps just like home or some other space outside of school.

New Challenges

Students gained an understanding about how and why they would use music technology for AP Music Theory when it was made available to them. Their insight brought about new challenges for them, specifically comparing their knowledge of music technology outside of school with school (Marsick & Watkins, 2001). Some of the more telling comments students made had to do with Noteflight and the technology their peers had access to outside of school. One student declared, “It’s really important to me that we’ve had this sort of technology come in, it’s been really helpful” [SI#7para24]. All students used the school-based laptops for their introduction to Noteflight, but for those who did not use music technology at all, there was an additional development. Their prior experience with music creation software was far less than some of their peers; therefore, their interpretation included genuine curiosity, perhaps more so than their peers. These students may have also approached Noteflight with different attitudes, ranging from apprehension to excitement, depending on what they realized upon using the program in terms of what it.

Shared and Unshared Practices

One of the more significant findings in my study was discovering to what extent informal musical learning was strictly bound to somewhere outside of school (Folkestad, 2006). Musical learning was persistent and cyclical between both environments because, as one student observed, music took up a "big time" in their daily lives [SI#6para8] (Furlong & Davies, 2012). While in school, students looked for opportunities to continue or initiate listening or composition activities. Looking at their overall routine, students sometimes start at home with listening to music, then use sheet music applications for a practice session during a free period, and finally go home after school to practice music for a competition with an accompanying soundtrack application. While they typically find time outside of school to take on a variety of activities with music technology, many students found a way to do the same things in school during their off periods.

Students recognized the relevance of music technology in their lives and believed this was the reason why it was being introduced into their classes in general. Of interest was much of what students used outside of school received greater distinction than what was currently implemented in the AP Music Theory curriculum. Students simply labelled the technology for AP Music Theory "online things" [SI#2para10]. This was a distinctive characterization because many of the items they listed from outside of school were given a specific identification. They mentioned technologies for composing, discovering, and uploading music with their official names—GarageBand and Acapella, for example. It was clear that students were able to talk about their music technology outside of school with more precision, or at least with a greater emphasis on what each of them were called and their particular functions (Kratus, 2007).

Internet

Students were exceptionally perceptive about their school's Internet service and discussed their experiences with me openly. While on district WiFi, students did not communicate to each other in the classroom or with others outside school. Instead, many of them noted, Mr. Bloomfield reached out to them using the Remind application. When they worked on their compositions using Noteflight they shared their work with their peers by either moving their laptops next to someone's spot or waiting for someone to walk over. By and large the Internet was a virtual space for directives, not so much a platform for students to engage in communication about music or music technology (Tobias, 2014). In addition, students were especially sensitive to their school's Internet functionality. Sometimes personal smartphones ran too slowly when they used them on WiFi. Because of the district's firewall, much of the online software they attempted to use was blocked. Both factors shifted the level of flexibility that students were conceivably used to outside of school, whether it was worse or better. The phenomenon that intrigued me most was how many students talked about their school's WiFi in a humorous, dry, or ironic way, subtly revealing their expectation in class for better, more open service similar to what they were used to outside of school.

Independent and Dependent Learning

Students exuded independence from Mr. Bloomfield (Lebler, 2012). One student mentioned "[he]…lets us do our own thing" [SI#6para36], and he bore witness to the relaxed, slightly unmonitored atmosphere that I likewise observed on a daily basis.

Students were used to learning independently from older adults outside of school, using what one described as “my little setup” [SI#1para8] and their innate music technology savvy for looking up chords and other related material. A few students admired musictheory.net in class enough to bring it back home to learn additional theory concepts. Altogether, these characteristics revealed a relationship between school and out of school within the context of students’ learning and doing music on their own, strengthened in part by the generally relaxed and carefree classroom environment.

Students learned with and from each other while using music technology in both environments (Lebler, 2012). After thinking about it for a while, one student mentioned watching their relative using, or “playing with”, a mixer [SI#5para4]. Likewise thinking carefully, another student finally mentioned learning how to record a cover with a friend. Examples about school were mentioned quickly and with more depth. One student in particular struck me with her candor about the importance of learning from her peers. Without question the primary goal for any music technology project was for her to look to her friends for guidance before moving forward. Likewise, another student turned to her friends in class about a specific music theory component, the chromatic scale, based on the key she wanted to compose in. Both students were a bit more responsive and passionate than those who discussed the same outside of school. While reasons for their more responsive and passionate answers were unclear, it was still a significant and noticeable aspect of these specific interactions.

Innate Knowledge

Students used music technology outside of school, including a broad range of software and hardware, in a variety of contexts specific to their needs. The freedom to decide how they make music or experience music means that teachers meet students who encapsulate a wealth of general musical knowledge (Folkestad, 2006). I learned about their innate musical knowledge not just from direct questioning but from listening to students' dialogue with each other in class. Much of what I initially learned in this regard, however, did not have to do with music technology. I was able to take this information and connect it to what they shared during their interviews. For example, one student, who was typically lively and vibrant, announced their proclivity for singing out loud and then sang portions of Broadway melodies at random times throughout the class, loudly and proudly. I learned later that the same student used a soundtrack application to practice a song for a school-based competition outside of school.

While they possessed an innate knowledge about music software and hardware, a few students were unsure of what I meant by the generic term "music technology" in our discussions together. Going into the interviews initially, I wondered whether or not all students understood what I meant by this seemingly conventional element of the music education lexicon. At least two students requested clarification, and they were not shy about asking me what I meant by it. Upon repeating myself, they provided their individualized understandings about what "music technology" meant to them. Meanings comprised acts, such as making, listening to, or recording music, followed by the appropriate music application or software. In fact, the music application, or "apps", essentially defined their "music technology". Perhaps the term has grown stale in the eyes of younger people, or they simply do not think of the materials and processes within a single phrase. There may be too many elements to consider; therefore, it is reasonable to think that they simply look at music technology in terms of what it does or what it is called.

Research Question 3

When framing a discussion around my third research question and referencing supporting theories, I remark on aspects of collaboration that manifested when Mr. Bloomfield implemented music technology in the AP Music Theory classroom.

Semi-controlled Practices

Mr. Bloomfield voiced his proactive stance about students controlling the ways they used music technology for analyzing music in the future, using the phrases "have choice" and "make decisions" [TIpara56]. These applied to the future, however. In the meantime, he permitted students to use their personal smartphones for other topics, either identifying instruments (Kahoot) or matching pitch while taking dictation (digital piano application). Their personal technology was rooted to classroom use because they were not explicitly given an option to conduct or complete these activities outside of school. Perhaps Mr. Bloomfield will allow similar projects to be worked on outside of school, but his attitudes were specific about the context he was planning for—analysis. In the meantime, he maintained complete control over the setting in this regard while supporting his students' personal technology use, evoking a rather blurry picture of a semi-controlled approach to teaching (Espelund, 2010).

Mr. Bloomfield prescribed stages to his Noteflight project (Green, 2008). The sequence was: open Noteflight, get to know the interface, and create an eight-measure melody with supporting harmony. While all students adhered to the procedures, many students moved forward rapidly, spending much of the time creating music, while just a few spent more time navigating and exploring the interface or thinking about what they like to do. Mr. Bloomfield provided as much time as the period would allow, facilitating students' need to explore and learn at their own pace. Ultimately, all students' projects were incomplete just before the bell rang. I waited for Mr. Bloomfield to announce that students may continue working on their project at home, but his final directive was to save their project for next time. His directive revealed no shift of control to his students at this time (Espelund, 2010), particularly to those who may have wanted to continue their project at home. He could have facilitated a collaborative learning environment further had he allowed students to continue working outside school, at their own pace while continuing to use his process.

Discovery and Reflection

There were moments when students reflected upon their work (Heuwinkel, 1996), particularly when they used Noteflight. I considered the possibility, however, that even though students made discoveries and reflected upon them during their Noteflight project, they followed a teacher who did not take the assignment entirely too seriously. Mr. Bloomfield announced that for this "experimental project", students could "pick any key except C major" [CO#2para1] for their eight-measure melody and supporting harmony. From the very beginning this project had multiple, conflicting objectives for students to reflect upon. Students observed how poorly they were navigating the interface and how silly they could be with their key signature selection or pitch choices. Often their reflections led to sharing music with each other, particularly because it maxed out the range of notes or contained a silly title or subtitle. The experimental component outdid the music theory component, and this was due to Mr. Bloomfield letting them proceed as they saw fit without a great deal of guidance. I considered the fact that he may have been unprepared for this lesson, or at the very least, lacked significant experience with Noteflight because he let the students dictate the lesson. Because the students discovered a great deal of information about Noteflight, particularly as it pertained to their casual, creative, or humorous penchants, it may have been a good idea for Mr. Bloomfield to wait to add the theory requirements and make the lesson more about the technology.

Students' Instincts and Abilities

Mr. Bloomfield considered his students' instincts and abilities regarding technology for providing the material or starting point for his lessons (McDermott, 1981). Solely from an instinctual perspective, Mr. Bloomfield claimed that students related and adapted to the frustrations they encountered when using music technology in class. Erratic WiFi and availability of hardware and software prevailed. These issues guided Mr. Bloomfield's decisions about what to implement to some degree, but they were also unavoidable, particularly district WiFi. Mr. Bloomfield and his students contended with firewalls blocking MuseScore before I arrived, which was why Mr. Bloomfield selected an alternative, Noteflight. Such a scenario might have been similar to times when students sought music notation freeware outside of school on their own, except they may have more control over choosing an alternative should the first choice fail.

Mr. Bloomfield's assessment of his students' abilities using music technology played a role in initializing some of his lessons. Legitimizing this role was difficult, however, because his reasoning contradicted his actions. His personal opinion was that his students found school-based music technology impractical, irrelevant, and a hassle. At home, he assumed, they play a part out on their own or navigate YouTube for guidance instead. Mr. Bloomfield implemented music technologies regardless of this subjective insight about his students' abilities and attitudes. It has been argued that teachers may try connecting with their students' activities carried on of their "own initiative independent of the educator" (McDermott, 1981, p. 444). It is from this point of view that I determined Mr. Bloomfield maintained a collaborative learning environment simply because he implemented musictheory.net and Noteflight. In doing so, he appealed to a particular dimension of his students' strengths—smartphones and the Internet. I kept in mind, however, that his actions were inadvertent because he did not explicitly mention the reasons why he implemented these particular music technologies in the first place.

Stepping In

With the aid of technology, Mr. Bloomfield took just a few opportunities to step in and modify the ways his students understood musical content. While they operated their personal smartphones as answering devices for their Kahoot instrument identification quiz, I recalled the "initial ideas of the learners" (Appleton & Asoko, 1996, as cited in Webster, 2011, p. 42) who revealed prior experiences with instruments outside of school. When the speakers blared the clarinet glissando from the introduction to

Rhapsody in Blue, one student remembered hearing the piece before. Another student recalled the harp because they remembered their grandmother playing it. Mr. Bloomfield attended to other students' "inaccuracies or misconceptions" (Windschitl, 2002, as cited in Webster, 2011) with regard to what instruments sound or look like. He would do so as much as possible, although he gave some of his attention to his personal technology issues, such as no audio, or issues students experienced because of the school's Wifi. It was clear that students brought with them prior knowledge about instruments, Kahoot, and smartphones. If Mr. Bloomfield spent just a little more time preparing the lesson such that he did not have to root himself to one spot in the room, or struggle with not just one but two laptops, he would have been able to step in and help students who submitted incorrect answers with greater frequency.

From Expert to Mentor

Mr. Bloomfield-as-expert appeared mainly within the context of the AP Music Theory curriculum, whereas Mr. Bloomfield-as-mentor emerged within the context of music technology (Webster, 1998). At the beginning of the Noteflight project, Mr. Bloomfield asked students to create a piece of music according to a specific progression. A few students wanted Mr. Bloomfield to address both "the theory behind what [they] wrote" [SI#6para42] and "the structure of the song" [SI#6para44]. Others asked for a reminder about the chord progression, to which Mr. Bloomfield briefly replied, "A four (chord) leads to a five (chord)" [CO#2para1]. When teaching theory components, Mr. Bloomfield favored a more passive approach, and to that end an expert attitude. As the lesson progressed, however, his attention to students' needs became situated within their music technology activities. One student mentioned, “I had a melody in my head…and I was like Mr. Bloomfield how do I put this in the computer?” [SI#5para44]. What caught my eye was the way in which Mr. Bloomfield guided students who made such inquiries. He did so as if he was learning the program with them as opposed to suggesting what they could do.

From Passive Receiver to Active Participant

Often, the use of music technology in the classroom went hand in hand with the moments in which students organized themselves into groups. These were scenarios in which I saw students shift from passive receivers of information to active participants. As Mr. Bloomfield-as-expert shifted to Mr. Bloomfield-as-mentor, his students turned to each other in the spirit of “project-centered learning…working to solve problems” (Webster, 1998, p. 3). One student discussed “bouncing ideas off of each other” [SI#7para40], such as making music sound happy, sad, dramatic, or theatrical in Noteflight [para44]. Because Mr. Bloomfield’s mentorship was not imposing in nature, students naturally turned to each other for inspiration, ideas, and help, especially when they organized themselves into groups beforehand. Looking at the Noteflight project, peer groups featured more and more talking and laughing as time went by, and the learning environment began to feel more informal. Students became immersed in their peers’ compositions based on mood and genre, as well as the extremes they accomplished in terms of range and rhythm. While active participation was present, I sensed it was less focused on theory goals, possibly due to Mr. Bloomfield’s increasingly reflexive mentorship heading toward the close of the class period.

A Pragmatic Approach

Mr. Bloomfield took a limited pragmatic constructivist approach to teaching with the aid of music technology, similar to a "Swiss army knife with various blades for various needs", and each blade conforms to the "flexibility, active, social, and creative learning" aspects of this approach (Perkins, 1999, p. 11). Mr. Bloomfield mainly touted the flexibility of musictheory.net because he could determine a ratio of questions to the time limit. He allotted students the entire period, adding, "The rest of the time is yours to do with what you please" [TIpara109]. While inherent flexibility was beneficial for students who needed more time while other students were left on their own to "look around, whatever, through the rest of musictheory.net" [TIpara109]. This, coupled with the same carefree attitudes during the closing minutes of the Noteflight lesson, made it seem like Mr. Bloomfield did not take the class seriously.

Witnessing Mr. Bloomfield's approaches, I perceived a lack of a collaborative environment in terms of the reasons why students study or make music with the aid of technology. The remaining aspects of pragmatic constructivism—"active, social, and creative learning" (Perkins, 1999, p. 11)—were not necessarily missing in the classroom. Students just had a difficult time connecting the theory concepts they supposedly learned in class to their music studying or making music outside of school. For example, they acted upon their informal approaches from outside of school because they found opportunities to mess around with Noteflight. Students worked with each other, were creative with their compositions, and actively engaged. Collaboration existed only because Mr. Bloomfield implemented technology haphazardly and tentatively and students appreciated it for their own sake. Nevertheless, students maintained they felt restricted in class and could do creative work at home. They took the class because they loved music, but they were not finding the relevance of theory to what they knew best. For Mr. Bloomfield, additional time and thought were needed when implementing technology: what does it do, what is it good for, and can it be used to blend what his students know with theory concepts in the spirit of a collaborative learning environment.

Prior Research and Current Findings

Findings in this study reinforce and validate prior research, while others pose novel areas for examination. The following section is a discussion about ways in which findings connect to prior literature, structured around the research questions.

Research Question 1

Everyday Knowledge

Similar to music teachers discussed in prior research (McPhail, 2013), Mr. Bloomfield reflected upon the everyday knowledge that his students brought to school, namely about their music technology in terms of how to use it and why they prefer it. While his reflections were personal assumptions rather than direct observations taken from within his classroom, to some extent they influenced his providing an environment where students potentially “develop personal musical tastes and skills” (McPhail, 2013, p. 48). Students used their smartphones in the classroom as tools for entering an answer to a test, working in musictheory.net, and performing pitches on a keyboard simulator. Mr. Bloomfield integrated classical music examples in their Kahoot-based instrument identification quiz, for example. A few students recognized specific instruments according to their experience listening to them, and successfully submitted their answers using their smartphones.

Facilitation of the Class

The manner in which Mr. Bloomfield facilitated his classroom was similar to teachers who taught a class the emphasized practices influenced by popular music, albeit inadvertently. He decided to let them work on their own, staying “out of the way” (Cremata, 2017, p. 71). Accordingly, students took it upon themselves to organize into peer groups for the majority of the classes I observed. Mr. Bloomfield’s facilitation of Noteflight allowed students a greater amount of autonomy over their projects while working in these groups with many of their compositions exhibiting current trends (Cremata, 2017), such as titles with current artists and experimental-type music. On a rare occasion, Mr. Bloomfield took the opportunity to “resolve challenges and redirect opportunities for learning” (Cremata, 2017, p. 70) as it pertained to the theory behind their work.

Integration of Mobile Phones

I observed Mr. Bloomfield integrating his students’ smartphones into the AP Music Theory curriculum, specifically for key signature identification, chord progressions, and instrument identification. Wallerstedt and Hillman (2015) likewise observed students working on projects with their mobile phones, taking pictures of their instruments to mark fingerings and searching for popular music websites using Google. Mr. Bloomfield directed his students to use their smartphones within a similar interactivity context, wherein they sent their musictheory.net results via Remind, performed pitches on digital keyboards, and submitted test answers using Kahoot. Of additional interest was the way in which personal smartphones represented a universal tool for all students. Mr. Bloomfield faced difficulties implementing school-based technology he deemed appropriate for his class due to accessibility or lack of resources. By implementing smartphones into the curriculum, he initiated a "reframing of the technology that involves bringing in established practices from outside the music classroom" (Wallerstedt & Hillman, 2015, p. 81).

Research Question 2

Teamwork

Students in Mr. Bloomfield's class reminisced about elements of teamwork (Denson et al., 2015) when discussing music technology projects outside of school. Others emphasized the importance of teamwork (Denson et al., 2015) because it helped them solve music theory problems inside of school. For students, teamwork was a bridge between both informal and formal learning environments. This bridge paralleled the intentions of the researchers for both corroborating studies. For my study, some students reached out to others in their group to listen and scrutinize their work, as well as inquire about their musical ideas. Their gratefulness for group work reflected similar attitudes of other students who appreciated being around others with "the same mind set" (Denson et al., 2015, p. 43).

Using the School's WiFi

Much of what was learned about students and some of their WiFi experiences outside of school was from their attitudes about it when they used it in their classroom.

Similar to other young adults who worked in Internet Cafes outside of school (Cilesiz, 2009), a few students expressed their dissatisfaction with their formal environment based on the WiFi functioning below their expectations. The measures placed upon them by their school—downloading speed and firewall—were reminiscent of an authoritative environment (Cilesiz, 2009) in terms of what they accessed or how fast they answered test questions or assignments. Their discussions were rife with dry humor, particularly about the slowness of their district's Internet. This may have contributed to a different experience socializing and assimilating into "the practice of educational uses" (Cilesiz, 2009, p. 259) of technology in school as compared to outside of school.

Exploring Music Technology

Students in my study were substantially more open about the music technologies they explored outside of school as opposed to their AP Music Theory classroom. Their interests mirrored those of previously interviewed electronic musicians, who talked about their independent and group work settings and learning from someone who was more experienced (Thompson, 2012). Independent students learned about mixing while watching a relative using a music mixer. Another described their "little setup" [SI#1para8] to look up chords—an objective similar to that of those electronic musicians who "discussed setting explicit goals or working to a structured practice regime" (Thompson, 2012, p. 49). Electronic musicians have discussed the comparable importance of learning with others in order to share knowledge and techniques (Thompson, 2012). Similarly, one student appreciated the time when they recorded a cover with a friend.

Fusion of Informal and Formal Practices

Similar to Baker (2012) who observed garage band members, I found myself in the midst of "a complex, multi-layered approach to learning" (p. 74) in the AP Music Theory classroom. Students acknowledged that music took a "big time" [SI#6para8] in their daily lives, including the hours they spent learning music in the formal learning environment. A cyclical pattern of learning revealed moments when some of the students "willingly adopted formal, goal-directed music learning practices" (Baker, 2012, p. 71) learned in the classroom outside school walls. One mentioned they practiced theory related concepts on musictheory.net due to its mobility. Another student took the music from their school's musical and practiced it at home on using a soundtrack application. Both of these students were "left to their own devices" outside of school, in which they "willingly adopted formal, goal-directed music learning practices" (Baker, 2012, p. 71).

Research Question 3

Teacher Control

Students considered Mr. Bloomfield to be a teacher who "lets us do our own thing" [SI#6para36]. I corroborated this statement with his tendency to deliver short amounts of lecture-type instruction followed by much longer amounts of time wherein students worked on their own. I also considered the fact that there may have been a level of preparation he did not seem to have, demonstrated through the routine in which he initiated an assignment followed by the hesitation to help students beyond that point. den Brock et al. (2004) noted a similar level of teacher control—a "shared-teacher control"—where "sharing of responsibility between students and between student and teacher" was most prominent (p. 438). It is important to note, however, that this type of control was not on purpose but consequential. Mr. Bloomfield's control over context during projects—which was curriculum-driven—and the contrasting attitudes his students led me to believe that students found his easygoing approach memorable but not entirely educational. Two facets that stood out for this particular approach were allowing students to collaborate with one another and the choice of pace for assignments (den Brok et al., 2004). Again, however, these aspects were a result of Mr. Bloomfield's level of preparation.

While Mr. Bloomfield did not hold an online-only music theory session, one class in particular revealed students' autonomous learning similar to that of online learning platforms (Tian, 2020). In particular, students considered their own learning goals when they used NoteFlight once Mr. Bloomfield announced that they should explore the software. They exhibited "self-managed learning" (Tian, 2020) toward a goal of becoming familiar with the software. While Mr. Bloomfield cultivated an autonomous classroom environment based on his directive to explore, students still needed to compose a piece of music based on an application of theory skills. I noticed that some of the students took to the theory goal quite well, which meant that they navigated the software enough to begin that task. Others investigated Noteflight for quite some time. Within this subgroup, a few chose to spend the entire class navigating Noteflight while others struggled and missed out on the theory goal. I learned that while Mr. Bloomfield promoted autonomous learning, he essentially allowed for two goals instead of one: learn about Noteflight, and learn how to use Noteflight to compose a piece of music.

Flexible Parameters

While unintentional, Mr. Bloomfield supervised a music creation activity that revealed constructivist principles of teaching. When using Noteflight for the first time, his students were "actively building their knowledge instead of receiving knowledge through lecture or a series of assigned readings" (Keast, 2004, p. 78). Granted, Mr. Bloomfield lectured briefly beforehand about the main goals behind the project, comprising the general investigation of Noteflight and the creation of a piece music using a progression learned during a prior lesson. However, the minute he let them choose any key signature and move about the program on their own, students determined their starting points based on their capabilities (Dewey, 1910). Some students investigated the interface first, while others began working on their composition. Their sequence of steps did not reflect any "intended order" (Keast, 2004, p. 125).

Developing Original Music

While composing music on Noteflight, a few students "were able to take control of their own learning, show initiative and develop their own ways of thinking" (Ward, 2009, p. 159) while composing music based on a I-IV-V progression. Because students took a more experimental approach—essentially, they found a way to deviate from the music theory task at hand—they "created their own values and meaning for the music they composed and, in many cases, valued these pieces over other, more tonal styles" (Ward, 2009, p. 160). Meaning came in many forms, namely the title of their piece, the humorous complexity of rhythms or range, and association with Mr. Bloomfield himself through a dedicatory-type title. At times, these meanings superseded the goal of following an explicit progression, a clear directive announced at the beginning of class. Their confidence in their experimental work benefited from working with each other, revealing their "latent abilities" (Ward, 2009, p. 161) using Noteflight.

Implications

In this section, I discuss implications for my study for non-b/c/o teachers who implement technology, and the students enrolled in their class, to consider.

Communicating with Students

In light of my study's findings, I suggest that high school music teachers actively communicate often with their students about what music technologies they are using in order to acquire an informed, rather than assumed, knowledge base with which to implement technology in the classroom. It was apparent that Mr. Bloomfield implemented technologies he was aware of personally or those that worked at the time, given his school's allowances. As an observer, I learned that his students used a variety of music technologies, many of which promoted creativity. One attitude of Mr. Bloomfield's that stood out was that there was no "wiggle-room for creativity" [TIpara46]. I found this contradictory attitude insightful in light of the students' apparent interest in Noteflight as a music creation tool. I suggest that non-b/c/o teachers discover what their students use outside of school to promote or accelerate music creativity so that wiggle room is achieved and promoted, even while following strict curricular guidelines.

Non-b/c/o teachers should also actively communicate with their students about the ways in which they socialize when using music technology outside of school. Mr. Bloomfield mentioned that he did not give much thought about group work in his class, yet many students worked in groups when using Kahoot and Noteflight. I suggest that non b/c/o teachers consider the fact that even when a clear directive for students to work in groups has not occurred, they may feel compelled to do so because it is something they are used to doing outside of school. While facilitating music technology projects, I suggest that non-b/c/o teachers consider their students' organizational habits and ask about how they organize themselves while working with music technology outside of school.

Understanding Students' Technology Experiences

Based on my findings, it is logical to suggest that non-b/c/o teachers will more than likely work with students who have technology expertise to some degree. Because the availability of technology in school was hit-or-miss, Mr. Bloomfield turned to his students and their know-how on personal smartphones, essentially mending this inconsistency. There were a few successful applications of the smartphone to assessment, submitting work, and communication. Based on Mr. Bloomfield's investment in the smartphone as a music technology tool, it is recommended that non-b/c/o teachers consider the use of smartphones in their classrooms in similar ways to bridge the informal with the formal. Additionally, I suggest that teachers research all possible technology scenarios that their campus has to offer, including any limitations, and then discuss with their students about their expertise with similar personal technologies they use outside of school. Teachers may be able to paint a better picture of their music technology based not only on what they have or do not have at their disposal on campus, but what their students know or do not know.

Students were excited to talk about what types of music technologies they use outside of school. Even though they were working on projects using Noteflight, musictheory.net, and Kahoot, many students could not recollect what they were using in class. On the other hand, they could easily identify what they used outside of school, talking eagerly about their "little setup" [SI#1para8], for example. I suggest that non-b/c/o teachers who implement music technology consider what aspects of learning are significant to students outside of school, paying particular attention to independent work, learning with a friend, or learning with family members. These three qualities typified students' answers in terms of the context in which learning occurred. For these considerations to be impactful, I suggest teachers implement music technology that reminds students of their life outside of school within contexts of learning music.

From School to Home

A few students learned with music technology not strictly within one particular setting, but within and out of school. Without explicit directives from their teacher to do so, these students continued learning music theory at home on technology implemented by Mr. Bloomfield, particularly musictheory.net. Significant to this study is students' willingness to embrace "formal, goal-directed music learning practices" (Baker, 2012, p. 71) at home. I suggest that non-b/c/o teachers who implement music technology learn about what types of music technology from school their students continue to use at home, without provocation. This particular knowledge will help the teacher understand what types of music technologies they appreciate as learning tools, building bridges between their classroom and environments outside of school through technology.

Suggestions Concerning Shared Control

Based on my findings, students in a non-b/c/o classroom may make some connections with their informal learning outside of school should their teacher share control over music technology projects with them. These connections include collaborative elements and flexible pacing. While planning to implement technology, teachers should consider in what ways they can promote collaboration. I suggest that they allow students to look to their peers for guidance navigating a particular interface, as I observed students doing the same, enthusiastically and without directives from Mr. Bloomfield. I also suggest that teachers maintain projects with flexible pacing, at least as much as possible within a given class period. Students discussed how the nature of formal learning environments was restricted. One student emphatically mentioned that their home was a place where they could “do more of what I feel I need to work on for that day, or I feel that I need to create” [SI#7para20] as compared to the classroom. Teachers may want to consider such statements when assigning time allotments, finding ways to support an informal-type atmosphere that supports creativity and offers flexible times for completing assignments.

When introduced to Noteflight, some students deviated from their initial music theory-based directive and remained focused on their other task, which was exploring the software. Once Mr. Bloomfield allowed students to work on their own, it immediately became unclear as to what the primary objective of the lesson was. I determined that these loose parameters allowed students to focus more on what the music technology could do for them from a creative standpoint and less on what the music technology could do for the theory objective. I suggest that non-b/c/o teachers consider what route to take when introducing specific music technologies for the first time. Parameters are a matter of control, and it seems that students will more than likely gravitate to what they already know from their informal learning experiences and less on the formal objective.

Recommendations for Future Research

My first recommendation hearkens to a limitation regarding the small class size I studied. Given the type—an ethnographic case study—I suggest that researchers replicate this study in other types of non-b/c/o classrooms, particularly those have a higher enrollment. With a larger group of participants to interview and observe, the researcher may be able to develop a deeper understanding of how students "experience smooth transitions between their musical engagement and learning in and out of school" (Tobias, 2015, p. 23) within the context of teachers implementing technology. With more students to observe and interview, the researcher may also be able to draw a more dynamic picture of the teacher's and students' "uniqueness and patterns in their perspectives and behaviors" (Glesne, 2011, p. 19). It was through these qualities that I explained data outlined in Chapter 4, and with a broader range of participants in a single environment, future researchers may build upon or add to these findings.

My next recommendation is based upon a prior issue pertaining to teachers implementing smartphones into a music classroom. Based on past students' surprised reactions to their teacher's recommendation to use mobile phones, researchers indicated that "the use of the device as an educational technology in a school classroom may not be an agreed stable configuration" (Wallerstedt & Hillman, 2015, pp. 83–84). Based on my findings, I contend this prior assertion and recommend additional research of smartphone implementation in non-b/c/o classrooms, particularly the observations of the ways students' smartphones are established tools for learning music just as they are outside of school. Wallerstedt and Hillman (2015) noted that musical context plays a significant role in determining if a mobile phone is a relevant tool. In light of how resourceful students were with their smartphones—continuing their theory work at home and using them as digital keyboards in and out of class—I suggest that researchers include this particular educational technology in their observations in order to gain further insight into how informal and formal learning practices blend by means of the smartphone.

Another recommendation that bears further investigation is the role of the teacher while determining what technology to implement into a non-b/c/o classroom. Tobias (2015) concluded, "Music educators can structure their classrooms and curriculum in ways that foster students' ability to apply their musical experiences, interests, and understanding from outside of school" (p. 39). In his implementation of music technology, Mr. Bloomfield focused primarily on availability and his experience or knowledge of it. His students applied their experiences on technology to their lessons and projects, namely through their smartphones and prior work on projects outside of school. The classroom was accommodating, yet there remains a void in the data with regard to Mr. Bloomfield explicitly referring to *their* experience for implementation's sake. I recommend further research into the role of the teacher as a facilitator of students' knowledge of music technology, a role that is more deliberate and less assumptive.

Limitations

For my study's limitations, I considered "what documents, people, or places were unavailable" to me, as well as the peculiarities of my research site that "illuminate the phenomena of interest in some lights but not in others" (Glesne, 2011, pp. 213–214). Locally, non-b/c/o high school classes were few and far between. I was fortunate that a site was available, comprising enough students to make for a viable ~~case study~~. From an ethnographic perspective, proximity aided in my ability to spend as much time as possible when the class was in session. Nevertheless, I had little control over what type of non-b/c/o classroom I would study. For the sake of generalization, other non-b/c/o high school classrooms should be considered, such as beginning music theory, music appreciation, music history, or an actual music technology class. Had I studied an actual music technology class, wherein the purpose of the course was to learn about music technology instead of learning a specific non-b/c/o curriculum with the aid of music technology, the learning environment may have been more technology-focused

The classroom in which the research took place was not a dedicated music classroom space. Even the most basic materials for music theory—a whiteboard with a staff, for example—were unavailable. This type of environment may have influenced the ways in which music technology was implemented by Mr. Bloomfield or used independently by students because of what they were lacking. The room itself was a phenomenon from an ethnographic point of view, adding insight into the types of classrooms teachers use involuntarily to teach AP Music Theory. Nevertheless, the study concentrated on the dialogue and actions of Mr. Bloomfield and his students within this environment, not the classroom type.

The majority of student participants were quite familiar with one another. There were two possible reasons for their camaraderie: 1) similar familiarity in other classes, music or otherwise; 2) the particularly small size of the AP Music Theory roster. Both elements may have steered the ways in which they spoke about or for each other in terms of their music technology uses and expertise and Mr. Bloomfield. From an ethnographic perspective, the intimacy of their responses contributed to a deeper understanding of the way they perceived their teacher and each other through the lens of music technology. A larger class may have contributed breadth to the ethnographic data, as well as additional depth.

Conclusion

The purpose of this study was to find out what a music educator participant considered critical for their students "to gain and sustain agency as contemporary musicians" (Tobias, 2013, p. 228) with the aid of music technology, thereby seeking in what ways their viewpoints did or did not blend with those of students. Mr. Bloomfield characterized his students according to the simple, easy-to-use, recreational music technologies they used at home. He based his attitudes upon his personal assumptions rather than any direct communications he had with his students. His facilitation of a non-b/c/o classroom while implementing technology reflected some of the ways in which he described students' using music technology, especially the simpler and accessible qualities. He allowed smartphones to be an integral part of his implementation, with a particular emphasis in using them for communicating assignments to his students, playing a digital keyboard application, and submitting answers to a quiz. It was difficult for Mr. Bloomfield to access the technology he wanted from school-based resources, but it was also clear that his foresight about other options was limited to a day-to-day basis.

Students appreciated the opportunities to work in groups. Groups formed without intervention or initiation from Mr. Bloomfield, and students took advantage. For some students, working together was an imperative component to learning music, including moments when technology was implemented. Students arrived at their non-b/c/o classrooms with individualized experiences with WiFi outside of school. Students discussed WiFi experiences in their classroom with dry humor, elucidating their frustrations with the firewall and blocked music software. Students discussed their technology experiences outside of school with comparatively more enthusiasm and accuracy than those in the classroom. Students talked about moments when they continued working on a specific music project initiated in school at home. One specific technology revealed within this phenomenon was musictheory.net.

Students collaborated during projects aided by music technology, and during at least one of these projects they experienced flexible pace and time limits, at least up to the end of the class period. For the most part, the formal environment was semi-controlled—shared between Mr. Bloomfield and his students—when a music project was in play. From a constructivist point of view, students were able to build their knowledge instead of obtaining it through lecturing. This was made possible because Mr. Bloomfield did not keep students on task according to the music theory directive, allowing students to tap into their informal learning experiences while creating music. Consequently, some students created music with multiple meanings derived from their musical experiences outside school, in particular their playful titles, experimental rhythms and harmonies, and dedication to Mr. Bloomfield.

Mr. Bloomfield's affirmations about music technology blended with those of his students in a variety of ways, with these phenomena appearing contingent upon his teaching styles and attitudes toward technology implementation. Researchers should replicate the study in other non-b/c/o classrooms, drawing an all-around picture of how students bridge or blend formal and informal learning with music technology, with additional depth and breadth. Multiple ethnographies may offer teachers insight into patterns within teachers' attitudes about music technology implementation, as well as how they associate or disassociate with those of their students. One particular aspect of implementation that stood out for both participant-types was the smartphone. While not an outlier in prior research of high school music classrooms, it bears consideration for future research as a bridge between non-b/c/o classrooms and informal environments because students are willing to take mobile digital keyboards from home and use them in class or continue using musictheory.net at home. It is also suggested that within the parameters of the non-b/c/o classroom, researchers look further into the extent to which students' experiences play a role in the teacher's music technology implementation, especially when it is revealed that the teacher's assumptions play more of a significant role than their informed understanding by way of direct communication with their students.

APPENDIX A—SITE APPROVAL LETTER

Patrick-
We are currently not offering any non-performance-based music courses. In 2019-20, we will offer AP Music Theory at Waco High, but only 10 kids are enrolled.

External Research Application
Waco ISD

Please use this form to request access to Waco ISD campuses or information to complete external research in the Distr- *District. The District shall provide feedback to the submitting party as quickly as possible from the date of submission as either approved, disapproved, or returned for further information. This application must be accompanied by a project proposal or an executive summary (e.g. IRB Proposal) that details involvement by the campus and/or classroom impacted by the project.*

Research Contact: Timothy Hawkins
16:00:49
Email Address: t_hawkins@me.com
Contact Number: 716-410-7272

Date Submitted: 1/27/2019

Organization: Boston University
Organization Address: 885 Commonwealth Ave., Boston, MA 02215

General Project Information

Project Title: Mergers between Informal Learners and Secondary Music Educators who use Music Technology

Project Executive Summary: The purpose of my study is to find out if music teachers and their students share beliefs about what is important for high school students to develop into musicians, particularly with the aid of technology. My research questions are: a) what do students who use music technology outside of school, as well as participate in non-traditional formal music instruction while using
technology, express about the interaction of the two environments; b) what are the comparative attitudes between music teachers who serve the broad population of secondary students and their students' music technology experiences and approaches to learning; and c) in what ways do music teachers' and their students' attitudes about music technology reveal, or do not reveal, a mutual learning environment. The research design is ethnographic because I am interested in the routines that shape students' and teachers' classroom environment. Data will be collected via face-to-face interviews, classroom observations, and classroom project collection (artifacts).

Potential benefits to Waco ISD include teacher-subjects acquiring deeper thinking about how they implement music technology into their curricula, and student-subjects acquiring deeper thinking about how they use music technology in or out of school. This study may benefit the general school district community in terms of seeking potential best practices for teaching, wherein these practices include ways of teaching with music technology that overlap with students' informal practices using the same medium.

The identification of subjects is based upon the following qualities: a) the subject is either a secondary grade level student or teacher; b) there is use of technology in the secondary classroom; and c) the course is non-performance based, i.e., AP Music Theory, Music Appreciation, Music History, Music in our Lives, or any such course that is not band, choir, or orchestra. I will be the sole recruiter. Upon approval from applicable district personnel, I will distribute consent and assent letters personally to potential participants during class time, at which time I will begin the recruitment process.

We only have 10 kids in courses listed.

Within a time span of up to three total weeks or less, face-to-face interviews (high school students and high school teacher), music classroom observation (high school students and high school teachers), and artifact collection (high school students' projects) will be conducted. Data collection begins with classroom observations scripted on a laptop computer. Each observation session may last as long as a class period (approx. 40, depending on scheduling), with two observations per week within two weeks for a total of four observation sessions. The amount of time required for interview sessions is flexible, and the maximum amount of interviews is likewise flexible to accommodate scheduling. Interview sessions will occur in between observation sessions within the first two weeks. An ideal interview schedule includes one teacher session and two student sessions within the first week, three student sessions within the second week, and four student sessions within the third week—one teacher session and nine student sessions, for a grand total of ten interview sessions. One artifact collection session will occur during a pre-scheduled time within the third week when interviews are not being conducted.

Interviews will be recorded using a laptop and an iPhone at the same time to ensure consistency. Interview recording instruments include two apps: Voice Recorder (TapMedia Ltd.) for the iPhone and Easy Audio Notes (Super Software) for the laptop. Observations will be conducted using the same laptop, and a notebook will be used at any time the laptop is unavailable. Artifacts will be collected using a password-protected USB flash drive for when computers are used to complete music projects. Identifiable information will be collected only via the consent and assent forms. Upon receipt of signed forms, the following coding systems will be used to protect the confidentiality of data, while linking subjects to their responses: a) School Identification – district and school information will be known as "The District" or "The School"; b) Observations Sessions – those observed in the classroom, teacher and students, will be known as "The teacher", "The student", "students", or "The teacher and student(s)"; c) Teacher Interview Sessions – upon receipt of consent form, the teacher's name will be coded with "Teacher 1" and "Teacher 2", and both the consent form and key will be stored in a locked file cabinet; and d) Student Interview Sessions – upon receipt of assent forms, each student's name will be coded with "Student 1", "Student 2", etc., and both the assent forms and key will be stored in a locked file cabinet. Upon receipt of parents'/guardians' consent forms, each student's name will be coded with the same ID as distinguished on corresponding assent forms, and these consent forms will be stored in a locked file cabinet.

Upon recording, audio files named according to the teacher or student ID will be transferred via lighting cable from the iPhone to the laptop then immediately deleted from the iPhone to ensure security. Students' projects considered for artifact collection will be digitally renamed for anonymity and transferred to a laptop using a password-protected USB flash drive. Consent forms, assent forms, backup observation scripts, and backup interview scripts, will be
stored in a locked file cabinet. Each data collection device is password protected (iPhone—fingerprint and password; laptop—two passwords and locked audio file). Additionally, all transcripts, recordings, and artifacts will be stored in a password-protected external drive. No "Cloud"-based drives will be used.

Please note that the research start and end dates entered in this application reflect my interest in whether this study can be conducted in Spring 2019. If not, I am interested in Fall 2019. Please also note that the wide range of dates entered below do not reflect the total amount of time needed for my study, but the fact that data collection can take place at the times that are most convenient for the district and student/teacher instructional time.

No non-performance based music courses currently offered

only AP Music Theory offered at WHS in 19-20 Year 10 students

Project Purpose: Dissertation

Research Start Date: 2/1/2019 **Research End Date:** 6/1/2019

Does any aspect of your study pose a potential emotional or physical harm to participants? No

If Yes is selected above, please elaborate.

Which campuses are you requesting access to in this application? (Please select all that apply) University High, Waco High

Projected number of student participants in the study: Up to 48, and the number is flexible based on allotted instructional time and amount of students available.

Projected number of teacher participants in the study: 2

Projected Instructional Time required per student participant: Maximum 80 minutes, if available, per interview session, or up to two class periods. The amount of time needed is flexible based on allotted or acceptable instructional time given. During an observation session, no instructional time will be taken from student participants.

Project time required per teacher participant: Maximum 80 minutes, if available, per interview session, or up to two class periods. The amount of time needed is flexible based on allotted or acceptable instructional time given, or during conference periods if that is more convenient. During an observation session, no instructional time will be taken from teacher participants. During artifact collection, a maximum of one class period may be needed, or a conference period, whichever is most convenient.

Assurances to Waco ISD

By submitting this application, you agree to the following terms and conditions outlined below:
1. I understand that I am requesting assistance in a research and evaluation project and I am not requesting information pursuant to the Texas Open Records Act. If my request to conduct research and evaluation assistance is granted, I agree to abide by all policies, rules, and regulations of the district including securing written parental permission prior to implementation of my project, and maintaining the confidential nature of records, and the privacy rights of the individual and school.
2. I understand that the supervision of this project and responsibility of providing a copy of the final report to Waco ISD rests with me. I also understand that the privilege of conducting future studies in the Waco Independent School District is conditioned upon the fulfillment of such obligations.

3. I understand that any unauthorized disclosure of confidential information is illegal as provided in the federal Family Educational Rights and Privacy Act of 1974(FERPA), 20 U.S.C. 1232 eg.seq. and in the implementing federal regulations found in 34 CFR Part 99. FERPA is specifically incorporated into the Texas Public Information Act (formerly known as the Open Records Act). It is listed as an exception to records that are subject to disclosures to the public.
4. In addition, I understand that any data, data sets or output reports that I, or any authorized representative, may generate are confidential and the data are to be protected. I will not distribute to any unauthorized person any data or reports that I have access to or may generate using confidential data.
5. I hereby agree that failure to abide by the requirements of this client agreement may lead to the immediate revocation of any contract (or research project) that I may be performing for Waco ISD. I understand that any intentional, knowing, or negligent release of confidential student information to unauthorized persons may also subject me to a legal cause of action for violation of an individual's civil rights in addition to state or federal criminal penalties.

Signature | Applicant — Date

2/19/19

Signature | Approving Cabinet Member — Date

If she is ok with doing it in Fall 2019.

APPENDIX B—IRB APPROVAL LETTER

Boston University Charles River Campus Institutional Review Board

25 Buick Street
Room 157
Boston, Massachusetts 02215
T 617-358-6115
www.bu.edu/irb

BOSTON UNIVERSITY

Notification of IRB Approval: Amendment 1

May 16, 2019

Timothy S. Hawkins, Ph.D. student
Boston University College of Fine Arts
855 Commonwealth Avenue
Boston, MA 02215

Protocol Title:	Mergers between Informal Learners and Secondary Music Educators who use Music Technology
Protocol #:	5006E
Funding Agency:	Unfunded
IRB Review Type:	Expedited

Dear Mr. Hawkins:

On May 16, 2019, the IRB approved the amendment for the above-referenced protocol.

This approval includes the following:

- The study will take place at Waco ISD. Houston ISD has been removed. The IRB application has been updated.

Please note that the approval for this protocol will lapse on ***November 8, 2019.*** Please submit a Continuing Review Application, which is located on our website (http://www.bu.edu/irb/), eight weeks prior to the expiration of your study.

As the Principal Investigator, you are responsible for ensuring that studies are conducted in accordance with federal regulations, state laws, and institutional policies.

Please note:

- No subjects may be involved in study procedures prior to the IRB approval date or after the expiration date.
- All unanticipated problems or serious adverse events must be reported to the IRB immediately.
- All protocol modifications must be approved by the IRB prior to implementation unless they are necessary to eliminate immediate hazard to subjects.
- All protocol deviations must be reported to the IRB.
- All recruitment materials and methods must be approved by the IRB prior to use.

If you have any questions, please contact me at 617-358-6922.

Sincerely,

Mary McCabe
Senior IRB Analyst
Charles River Campus IRB

cc: Jay Dorfman, PhD

APPENDIX C – INTERVIEW QUESTIONS

Research Question 1: Teacher Interview Questions

Core Questions Part 1

- I am interested in your (the teacher's) attitudes about your students' use of music technology, including what they know and how they use it. To begin, however, I would like to know some general information about your personal applications of music technology in the classroom. You have had experience teaching with music technology in the past, either this year and/or years prior to this one. Would you mind relating some of your experience to me?
- To what degree would you say that you implement music technology within projects?
- Of the types of music technology that you employ, what do you to teach with and about most and least?
- You have described a variety of music technology applications that you implement in your classroom. These include (examples the interviewee revealed). Can you think of any more music technology that you have employed within your curricula during your teaching career?

Core Questions Part 2

- Could you describe the types of music technology your students use outside of school?
- Could you describe what matters most to your students in terms of practical application of music technology outside of school?

- Could you tell me what music technology applications your students talk to you about? For example, what do they relate to you on a consistent basis, and what applications do they touch upon infrequently?

Follow-up Questions

- What are some of the reasons that you believe your students decide to use, or not use, specific music technology?
- What do you feel your students know most about music technology in terms of what is available? What do you feel they are aware of least? What do you believe are contributing factors do their awareness or lack thereof?
- What music technology trends do you believe your students acclimate to? What trends do you feel they avoid? What are some reasons that you believe that their preferences pan out the way they do?
- What do you perceive are some of the contributing factors to their music technology knowledge outside of school?

Research Question 2: Student Interview Questions

Core Questions

- My understanding about the ways you use music technology outside of school may be different than yours. If I am looking at your daily music technology habits through your eyes, what would they be? Do you only create, record, or listen to music, or do you mix these activities?
- Do you follow a specific routine each day, or are you more inclined to use music technology without a daily schedule?

- I am interested in the differences and similarities between school and out of school. Before we discuss these differences and similarities, tell me about how you use music technology in school.
- Do these routines stay consistent each day, or does your teacher prefer to randomly use music technology as part of your projects?

Follow-up Questions

- Thank you for discussing your music technology routines, both outside and in school. These included (list of routines from both environments). Would you say that the list of activities you have discussed reveals all that you do, both in and outside of school, or are there more that you would like to add?
- Again, I would like to find out about the relationships, or any special connections, between both environments. Now that you have disclosed your routines, I would like to know about your observations of how your activities are, or are not, linked. In what ways do you perceive music technology is used similarly in school and outside of school?
- Are these routines the same in a variety of ways, such as listening, creating, or recording music? In what ways are they not alike?
- What do you believe influences how, or why, music technology is taught in school, and are any of these reasons similar to what motivates you to use music technology outside of school; in other words, why do you believe music technology is used in your class, and do these reasons remind you of why you use music technology outside of school?

Research Question 3

Student Interview Questions

- I am going to ask you questions specifically about how you perform music technology tasks in school. Before doing so, could you review some of the music technology-based projects that you have participated in?
- Next, I am going to ask you some questions about these projects; specifically, the ways in which you were instructed to complete these projects. For example, could you briefly describe a project where you were asked to work on your own to complete it?
- Could you briefly describe a project where you were given the opportunity to work with your peers in small groups as a way to help complete it?
- Could you briefly describe a project where you were given the opportunity to talk about your ideas with your teacher and/or your peers as a way to guide completion?
- Could you briefly describe a project where you were allowed to choose the length of time to complete it?
- What are some ways that you can remember working as a team with your peers during a small group project (insert specific project name) that used music technology?
- What are some ideas that you can remember talking about with your peers when attempting a particular music technology project (insert specific project name)?

- What lengths of time are you attracted to most to when given the opportunity to choose them during a music technology project (insert specific project name)?

Teacher Interview Questions

- I am going to ask you questions specifically about how you assign music technology tasks in school. Before doing so, could you review some of the music technology-based projects that you have asked your students to complete?
- Next, I am going to ask you some questions about your projects; specifically, the ways in which you instructed your students to complete them. For example, could you briefly describe a project where you asked students to work independently, with no assistance from either you or their peers?
- Could you briefly describe a project that offered the opportunity for your students to work in small groups?
- Could you briefly describe a project where you offered students the prospect of discussing their ideas with either yourself or their peers?
- Could you briefly describe a project where you offered a variety of time completions?
- What are some ways that you encouraged students to work as a team within the context of a small group project (insert specific project name) that required music technology?
- In what contexts did your students decide on their own to work as a team when projects required music technology?

- What are some consistent ideas regarding music technology implementation that you can remember talking about with your students when they were engaged in a particular music technology project (insert specific project name)?
- What are some ideas that you can remember students relating to each other most when they were engaged in a particular music technology project (insert specific project name)?
- Have you taken any ideas discussed with or observed from your students and discussed implementing them within future projects using music technology?
- What lengths of time do you perceive your students are most attracted to when you provide them with options during a music technology project (insert specific project name)?

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