Introduction

Music education researchers recognized the effects of listening to popular music as a means to make social connections (Airy & Parr, 2001; DeNora, 2000; Sloboda, 1985). Participating in a musical performance in any capacity, whether performing, listening, or providing any material support for the music, can be described as *musicking* (Small, 2011). While adolescents in North America might engage in many types of musicking throughout the day, millennials (Howe & Strauss, 2000) experience music discovery and consumption in ways that differ from past generations due to the commercial influence of online social networking. Whether in or out of school, social media helps adolescents establish relationships in highly participatory cultural exchanges (Jenkins, 2009; Livingstone, 2008). Additionally, social media provides adolescents with an interactive platform allowing autonomous input and feedback (Buckingham, 2008; Ma, Yuen, Park, Lau, & Deng, 2015). The ubiquity of digitally distributed music makes understanding how adolescents consume digital music essential for music educators (Burnard, 2008; DeNora, 2000; DeNora & Adorno, 2003; North, Hargreaves, & Jon, 2004; Sloboda, 2005).

Today, the majority of music consumed by millennials in the United States is recorded music played back in a digitized format (Katz, 2009; Magaudda, 2011; Tobias, 2014). More than 90% of United States adolescents use computers and .mp3 players, and 91% of teenagers go online at least daily (Lenhart, 2015). Handheld wireless devices, such as tablets, laptops, and smartphones, are adolescents' preferred devices for digital media consumption (Lenhart, 2015). These devices, combined with Internet accessibility, provide an untethered, programmable "global digital jukebox" (Katz, 2009, p. 36).

Technological mediation (see Figure 1) is a phenomenon that occurs when a person uses a digital device to understand a concept or to present an idea, thus creating a relationship between the user's perceptions and consequent reactions (Tripathi, 2005). The subjective nature of technological mediation, countered with immediacy of delivery, creates a unique musical response in each listener (Brushwood-Rose, 2003). To bind this sensation to an epistemological foundation, the millennials' perception of digital music engagement can be understood as a lived experience (Bogdan & Biklen, 2007; Dewey, 1959). For millennials, technological mediation blurs the lines between in school and out of school learning (Mesch, 2009). This digitally mediated experience, or the sense of "nearly-now" (Whitby, 2010), is a complex, personal phenomenon encompassing written text, symbols, and musical sounds, mediated with technical devices and wireless transmissions.

The purpose of this study was to understand the relationship between students, music teachers, and digital devices, especially concerning users' perception of the musical object. Three broad areas of musical and social engagement included students' perception of digital music reception, self-production, and transmission. A constructivist–interpretivist viewpoint framed the theoretical perspective of the study. Considering the complexities of digital culture (Ihde, 2003; McCarthy & Wright, 2004; Tripathi, 2005), the study focused on behaviors and practices of the participants as they discovered, produced, and shared music using digital devices in their out of school lives.

An existing body of research indicated that adolescents' out of school musical influences helped form their self-identity (Davis, 2005; Green, 2005, 2011; Ruthmann, 2007). According to Bogdan and Biklen (2007), observing human behavior in a naturalistic environment captured shared patterns that develop among a group of people. Previous scholarship from researchers

such as Frith (2007), Small (2011), and Lamont et al. (2003) suggested that engaging in musical activities holds high importance for adolescents. More recent studies (Espeland, 2010; Green, 2008; Tobias, 2014; Yu, Lai, Tsai, & Chang, 2010) indicated contradictory states of understanding between music teachers and their students regarding formal and informal music learning. Additionally, some researchers suggested that commercialized digital media consumption influences classroom music instruction (Bahanovich & Collopy, 2009; Finney & Burnard, 2007; Patchin & Hinduja, 2010). Although music researchers recognized the effects of mass music consumption in everyday life as a social practice (DeNora, 2000; Magaudda, 2011; Sloboda, 1985), music consumption practices continue to evolve due to technological innovations.

Methodology

A multiple case study structure, anchored to a social constructivism framework, gave insight into the changing nature of participants' perceptions and values (Creswell, 2009).

Participants

The participants were four high school students and their music teacher. Over the course of 6 months, data were collected from interviews and observations. Detailed accounts collected from the small sample illustrated the behaviors and perceptions of the participants, building a thick description. Student participants were between the ages of 15 and 17 and used wireless digital devices. The criterion for the teacher was that she used digital technology resources in her lessons. The site selection was a large public high school. The Music Appreciation class was chosen because the curriculum represented a general education music course most often taught in public high schools. Focusing on participants' accounts with digital media as a lived experience (Dewey, 1959) the collected data were bracketed to specific events to provide theoretical context

(Bogdan & Biklen, 2007). Observing and collecting data associated with the unique phenomena was bound to timeframes and locations (Stake, 1995).

Data Collection

Each participant was considered as a case. Because hybridity and multidimensionality characterize the perception of the digital environment (Warschauer & Matuchniak, 2010), the interconnected nature of multiple case studies suited the examination of the participants' unique behaviors. By comparing and contrasting cases, an interpretive understanding of inter-subjective meanings between the participants was developed. The textual data consisted of interviews and observations collected from participants regarding their attitudes and perceptions of digital music media discovery, production, and sharing. There were three 45-minute interviews with each student participant, and three out of school observations of the group.

Using HYPERresearch, a case file was created for each participant to compare and contrast the data. Notes, charts, digital media, links, and published resources comprised the bulk of materials used. The collection process involved deep reading and reflection, careful note taking and documentation, and impartial analysis.

By organizing the data in conceptually clustered matrices (Miles, Huberman, & Saldaña, 2014), it was possible to analyze and evaluate the significance of the participants' statements. The central themes indicated remarkable statements and patterns in an effort to capture the daily student and teacher interactions in Music Appreciation class (see Table 1).

Trustworthiness

During the research process, member checks, peer reviews, external audits, and reporting of bias helped to validate trustworthiness and reliability. Miles, Huberman, and Saldaña (2014) recommended looking at similar and contrasting cases to support the trustworthiness of the

findings and to build confidence in the results. Lincoln and Guba (1985) suggested identifiable credibility, transferability, dependability, and confirmable results as the four criteria for judging the quality of interpretive research. Themes were limited to the students' out of school music making, in terms of digital music media consumption and production, and their teacher's understanding of student media consumption as it reflected on music class. The findings generated from this study were limited to the select group of participants and cannot be generalized (Glesne, 2006).

Discussion

The model describing dynamics of digital media in school music contexts (see Figure 2) was created by clustering textual data of student interactions into three broad categories: Digital music reception, self-production, and transmission. The purpose of clustering is to understand the actions and processes in order to conceptualize a problem (Miles et al., 2014). Coupled with personalized music interactions, participants engaged in digital music as a social practice (DeNora, 2000; Green, 2008; Sloboda, 1985). Practical challenges for teacher and students included maintaining focus on specific learning tasks in class. The teacher endeavored to harness the capabilities of Internet access to channel students' learning tasks.

Digital Music Discovery

Digital music reception encompasses a group of values and behaviors incorporating responses to digital media as a decentralized self (Jameson, 2003). Throughout the day, participants perceived their online social exchanges as taking place in a simulated space (Finney & Burnard, 2007) where they could interact. The students' behavior correlates with recent findings describing how students navigate between physical and digitally mediated learning spaces (Greengard, 2012). Not only did digital music function as a backdrop for students' out of

school social interactions, it permeated students' musical worldview as they sought to learn in Music Appreciation class.

Digital Music Production

Participants who exhibited the most technical fluency in digital music production demonstrated skill in manipulating audio and video files by posting recorded music on several social media platforms. Through experimentation, participants taught themselves digital skills in an informal and experimental setting. The participants expressed a sense of immediacy surrounding the online sharing of student-created musical content. Participants produced, posted, and shared almost instantaneously, and the feedback would appear in an almost immediate response. Perhaps one of the most intriguing findings involved the students' reliance on smartphones. For the participants, smartphone ownership seemed directly linked to social status and seemed more important than having access to laptop computers. Whether smartphones served as an agent of change in academic learning remained unclear.

Participants perceived social media platforms as simulated environments to transmit ideas about popular culture. Instead of feeling isolated, the participants knew they could message their friends online. Additionally, the students could adjust their device settings so that the conversation seemed private. Participants seemed comfortable with cultivating close friendships online.

Digital Music Sharing

For the participants, communication via text messaging held as much significance as spoken conversation. Whether viewing a smartphone screen, laptop monitor, or interactive whiteboard, the participants often focused on a screen while listening to music. Mayer's (2002) cognitive theory of multimedia, incorporating the thought processes of selection, organization,

and integration, seemed evident in the participants' behaviors. For participants, visual images integrated seamlessly into the consumption of digital music. Even if the visual image did not correspond with the aural prompt, the participants often focused on the screen. Therefore, the physical act of visual media consumption occurred during learning tasks at school, then after school, in casual digital media exchanges. Instead, music, as an aural expression, embeds in the daily experience of multimedia consumption (Ma et al., 2015).

With the ability to discover and share music across the physical boundaries of school and social life, it seemed difficult to pinpoint exactly when students acquired self-learned music skills. Out of school, participants enjoyed almost unlimited Internet access and personal choice in media consumption. Likewise, it seemed difficult to discern when participants went online in an academic capacity, or to seek entertainment. Participants spoke of finding personal balance in digital and traditional music activities, especially when choosing music for out of school activities.

Results suggest correlations between the commercialized aspect of digital media discovery, production, and sharing and its effects on classroom music contexts. Because the participants had Internet access, they were exposed to advertisements during the school day. It was difficult to determine if the music teacher addressed mass media consumerism in music class. Given that students could access and purchase digitized entertainment artifacts during school, consumption of music for personal entertainment could occur in the classroom. These findings illustrate the complexity of digitally mediated relationships in a school environment.

Conclusion

Because digital music discovery, production, and sharing seemed to possess a nonlinear quality (Juslin & Västfjäll, 2008), participants interpreted content using multiple modalities. In

this manner, learning from digital media required less deciphering of written words and more focus on images and sounds. Digital devices interlaced the students' lived musical experience throughout the day. The benefits of online access throughout a student's day included increased autonomy to build a musical identity and lead a musical existence. The challenges included ambiguities in the school environment regarding personal digital device usages for personal consumption and learning tasks.

Today, teacher effectiveness requires depth and detail specific to high school students' informal musicking. High schools make sizable investments in their technology implementation, so it is important to consider the impact of music education on educational technology as a whole. In the field of education, the investment in human and capital resources is one worth protecting and nurturing, because the quality of resources affects the outcome of students' learning.

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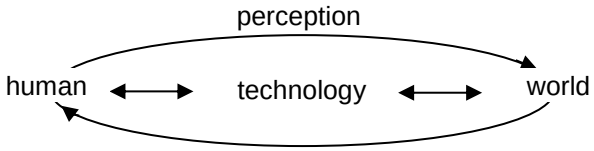
Table 1. Participants' Motivations and Attitudes about Music Class

Participant	Motivations / Feelings About	Attitude	Central / Recurring Theme
Evelyn	"Basically I didn't take an art... so I wanted to venture out into something that's not just academic-wise"	"I feel like we get there eventually in Music Appreciation… don't we eventually get to the 2000's?"	"I feel like, in this group mainly, we just sit there and talk about, like any kind of music you want"
T.J.	"My friend talked about [Music Appreciation]—it just sounded interesting, so I just ended up taking it"	"I guess [Music Appreciation] kind of made me more…musically curious"	"I really don't like learning about old dead white guys"
Jaime	"Well, I dropped AP chemistry, so I looked at the electives that were available"	"We're going over notes names, and it was so hard for me not to yell out the answer. I had to put my headphones in and ignore the rest of the class"	"We all sit together in Music Appreciation"
Alexio	"Since I'm the intern in the class, I know. It was for the students to listen to the tempo, to see how fast the song is, to understand"	"If I was just in Music Appreciation, I would like to learn about the most recent artists, like we're going to learn about a whole different genre of music"	"[Mrs. Price] will see, like, sometimes we might not be interested in learning about certain things about Bach, so, like, she'll make it fun, we'll engage in activities and make it more enjoyable for us"
Elinor	"One of my objectives is to help [students] figure out how to find the answers to things. We take notes in class, we use technology. They know where to find the answers, and then they know how to apply it"	"I feel like a lot of times they don't get an opportunity to do something at the level of their interests, so maybe it would be nice to do it in music"	"I think it's important to meet students at the level of their interests"

Table 2. Participants' Motivations and Desires to Learn Music

Participant	Motivations / Feelings About	Attitude	Central / Recurring Theme
Evelyn	"I would like to learn how to read [music notation], just so I can say 'oh, I can read the music.' I mean, not that I can play it, but I can read it"	"Hopefully with reading music, I'll grow and want to learn how to play something. Something that's interesting maybe piano, maybe guitar"	"I want to learn to read music… I don't think I have the talent to play it"
T.J.	"If you're around music every day, so if you could just play a typical instrument, I always thought that was cool. I guess the more you pick up one, and you can probably apply like what you've learned from a certain instrument to another"	"Like, you might learn a bunch of string instruments. You might learn guitar, and you would learn another string instrument and another string instrument"	"Just learning like, a very general instrument, can kind of lead you into others - that would be cool. Learning music production would be cool, too"
Jaime	"I am here a lot, though. I do practice a lot in school. I have my band class every other day, and I try to come in after school when I'm not busy"	"I've never taken private lessons but if I need to work on something for an audition I'll stay after school with Mrs. Price and she'll help me out"	"So, I do practice a lot"
Alexio	"Music definitely gave me a reason to, like, want something for myself, I'll give you that"	"I would like to actually learn how to play more music"	"Like, to know how to play, you kind of have the desire to show it off. You wouldn't want to put your time into learning music if you you're not going to end up using it"
Elinor	"I think that's what I'm kind of trying to do…is pull more of the technology into the Music Appreciation class"	"If the students who are really into it and want to try…You know, you want to do well in school so you're going to do whatever. And then it's the opposite in those classes. You know, I have students who… They won't turn anything in."	"We just had our midterms last week, and the grades are widely distributed. I would venture to say that… some of the students who are generally not paying attention did poorly…They did not take the time to even look for it, to answer the questions on the test. Which is very frustrating."

Figure 1. Technological Mediation



Adapted from *Culture of Embodiment and Technology Reflection*, (p. 10), by A. K. Tripathi, (2005), *Ethics and aesthetics of technologies, EDITORIAL, AI & Soc 25:5–9 DOI 10.1007/s00146-010-0265-7, Springer-Verlag London Limited 2010.* Adapted with permission.

Figure 2. Dynamics of Digital Media in School Music Contexts