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Examining the Effect of Group Assignment on Upper Elementary Students' Experiences in a Technology-Mediated Collaborative Compositional Activity

Samuel C. Holmes

ACCEPTANCE

This dissertation, EXAMINING THE EFFECT OF GROUP ASSIGNMENT ON UPPER ELEMENTARY STUDENTS' EXPERIENCES IN A TECHNOLOGY-MEDIATED COLLABORATIVE COMPOSITIONAL ACTIVITY, by SAMUEL CHRISTOPHER HOLMES, was prepared under the direction of the candidate's Dissertation Advisory Committee. It is accepted by the committee members in partial fulfillment of the requirements for the degree, Doctor of Philosophy, in the College of Education & Human Development, Georgia State University.

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EXAMINING THE EFFECT OF GROUP ASSIGNMENT ON UPPER ELEMENTARY STUDENTS' EXPERIENCES IN A TECHNOLOGY-MEDIATED COLLABORATIVE COMPOSITIONAL ACTIVITY

by

SAMUEL CHRISTOPHER HOLMES

Under the Direction of Patrick K. Freer

ABSTRACT

Collaboration in elementary music instruction has been incorporated frequently in creative activities. With the increase of technology integration, researchers have investigated its use as a mediation tool in creative activities. The nature of how children are grouped remains in contention. There is a need for comparing students' perceptions in group work based on their group selection. The purpose of this mixed methods study was to examine the effect of group assignment on upper elementary students' experiences in a technology-mediated collaborative compositional activity. Research questions included: (a) How do upper elementary students perceive collaboration in a group-based, technology-mediated music composition activity? (b) Is there a significant difference in students' perceptions of collaboration based on their group assignment, as measured by the Collaborative Composition Through Technology Assessment (CCTTA)? (c) Based on group assignment, are there differences in the nature of students'

interactions in collaboration? and (d) How does group assignment influence the quality of students' compositional products? Data consisted of a researcher-adapted questionnaire consisting of Likert type items and open-ended questions pertaining to perceptions of working collaboratively, video observations, interviews, and a final product score. Fourth grade students (N = 40) from two, intact classes were formed into student-selected (SSG) and researcher-selected (RSG) groups. Groups participated in a 60-minute, open-ended compositional activity using GarageBand as the mediation tool. While participants viewed collaboration and technology positively, quantitative results yielded no significant differences between groups in students' perceptions. Similarly, there was no significant difference between groups in the quality of compositional products. Participants in SSG preferred working collaboratively over their RSG counterparts, which was a statistically significant finding. Qualitative findings revealed that both group sets employed a democratic approach to decision making. Both group sets reported having disagreements between members. Findings indicated that the SSG overcame differences through a shared understanding of their existing knowledge while the RSG reported frustrations in unequal role assignments, hindering the integration of individual ideas. The importance of exploratory processes in the activity indicated that the SSG employed purposeful planning of the final product, while the RSG used more random exploration.

INDEX WORDS: Collaboration, technology, group assignment, perceptions, composition, creativity, GarageBand, elementary

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1 INTRODUCTION

> The study of mental life has made evident the fundamental worth of native tendencies to explore, to manipulate tools and materials, to construct, to give expression to joyous emotion, etc. When exercises which are prompted by these instincts are a part of the regular school program, the whole pupil is engaged, the artificial gap between life in school and out is reduced, motives are afforded for attention to a large variety of materials and processes distinctly educative in effect, and cooperative associations which give information in a social setting are provided.
>
> (Dewey, 1916/1944, p. 195)

In the aforementioned statement, Dewey draws attention to the value of active endeavors in schools. These activities, or "exercises," contained "instincts" related to exploration, mediated resources, and positive attitudes. Later in his writing, Dewey (1916/1944) defined these "exercises" as active play and active work. Dewey's interpretation of active work, attributed from Plato, referenced activities in the arts as having an essential place in the school curriculum. More specifically, these "exercises" were situated in cooperative settings, emphasizing the need for students to work collaboratively.

Music educators have acknowledged the importance of collaboration with the adoption of the National Standards for Arts Education in 1994 (MENC, 1996). While the term "collaboration" was never explicitly stated, the phrase "alone and with others" referenced the importance of students working together in formal music instruction. In 2014, the National Standards were redeveloped into the Core Music Standards (NAfME, n.d.). The Core Music Standards specifically identified the term collaboration as "in collaboration with others" and "collaboratively-developed criteria."

Collaborative efforts are designed to create a student-centered learning environment (Kassner, 2002). The use of collaborative activities can enhance not only the social interactions of children but musical achievement (Kaplan & Stauffer, 1994). This student-centered approach to learning is in direct opposition to the traditional method of music instruction, where the teacher authoritatively controls decision-making in the creation and implementation of activities (Allsup, 2003; Luce, 2001). According to Wiggins (1999), instruction in teacher-led activities only considers the interpretation of the authoritative figure and assumes that "students bring little or no musical knowledge into the classroom" (p. 30). In the elementary music setting, this traditional method is realized through whole group instruction, where the primary focus of students' attention is on the teacher.

Collaboration in elementary instruction has been incorporated frequently in creative activities (Coulson & Burke, 2013). Ninety-four percent of surveyed music educators rated creativity as an essential component in elementary music instruction (Fairfield, 2010), understood through compositional and improvisational activities. The importance of creativity was recognized in the 1994 National Standards, identifying improvisation and composition as respective guidelines in formal music instructional planning. The addition of three Artistic Processes (Creating, Performing, and Responding) in the current Core Music Standards further emphasized the relevance of creative activities in student-centered instruction (Shuler, 2011). According to Shuler (2011), "our national music standards highlight the importance of creativity by suggesting that students engage in improvisation, composition, and interpretation of music. As a result, more teachers are including creative activities in their classrooms" (p. 12).

More recently, the proliferation of technology integration has changed the way that creative activities are approached (Webster, 2016). Students in today's classrooms bring

knowledge of technology from experiences that occur outside of school settings (Burnard, 2007). Prensky (2001) classifies the current student population as "digital natives," as they have "spent their entire lives surrounded by and using computers, videogames, digital music players, video cams, cell phones, and all the other toys and tools of the digital age" (p. 1). Upon recognizing how students strongly relate to technology on a personal level, general music practitioners are transforming their classrooms with technology integration (Dobson & Littleton, 2016; Savage, 2007; Tobias, 2013). Recognized on a national level, a separate strand for technology was a part of the Core Music Standards, emphasizing the need for generating original ideas, both individually and collaboratively. Incorporating collaborative activities through technology further emphasized a pedagogical shift to student-centered learning (Cremata & Powell, 2017).

While the incorporation of collaborative practices has been recognized as a student-centered approach to creating music, the nature of how children are grouped remains non-standardized in structure. When assigning children to collaborative groups, teachers commonly select students based on either musical ability or friendship (MacDonald, Miell & Morgan, 2000). The importance of group selection is based on "the degree of engagement with each [group member's] ideas and perspectives which the children are able to establish and maintain" (Miell & MacDonald, 2000, p. 349). Through mutual engagement, students can achieve a greater understanding of their interactions with each other (Faulkner, 2003).

Personal Motivations

The motivation for this study stems from my personal experiences as an elementary music educator. Instruction in my earlier years was steeped in authoritative teacher control, as my planned lessons were highly structured, leaving minimal time for exploratory activities. While I recognized the importance of creative activities in instruction, I rarely incorporated

compositional and improvisational activities in my teaching. My principal suggested implementing creative activities using student collaboration groups. While the transition from being an authoritative figure to facilitator was slow, I began to see benefits of collaborative work in classroom instruction. These benefits included peer-led negotiation, an incorporation of students' personal musical ideas, and unique products.

The use of technology was quickly integrated in my classroom. At one of my more recent school assignments, I was fortunate enough to have my own set of classroom iPads for instructional use. Music applications and programs were readily used, with the majority of them designated for creative, exploratory purposes, most often in collaborative settings.

While my students positively perceived these open-ended creative tasks, I often struggled with how to group them. Students frequently requested to work with their friends. My inclination was to assign student groupings by either musical ability or by patterns of behavior. Soon, I wondered if there were differences in how the selection of groups affected their overall attitudes of collaborative activities. Did group assignment affect the nature of their interactions? Did it compromise the quality of the final products?

Rationale for the Study

Compared to individualistic learning, working in collaborative groups can increase student achievement in generalist classrooms (Isik & Tarem, 2009; Peklaj & Vodopivec, 1999). In performance-based music classrooms, collaborative efforts can also benefit musical achievement (Cangro, 2004; Compton, 2015). In the elementary music setting, collaboration can improve students' social interactions (Beegle, 2010; Burnard & Younker, 2008; MacDonald & Miell, 2000)

The use of collaboration in elementary music classrooms has been studied through the creative activities of improvisation (Coulson & Burke, 2013) and composition (Burnard & Younker, 2008; Wiggins, 1994; Wiggins, 2000). Practitioners on this topic have encouraged the use of collaboration in elementary music classrooms to promote active and effective learning in creative music activities (Friedman, 1989; Kassner, 2002).

With an increase of technology integration in the music classroom, researchers have investigated its use as a mediation tool in creative activities, focusing on communication, creative processes, and exploration and development (Charissi & Rinta, 2014; Dillon, 2003; Gall & Breeze, 2008; Sawyer, 2008).

Researchers have identified students' attitudes of creative collaborative work in elementary general music settings (Faulkner, 2003; Kaschub, 1999) and secondary music classroom settings (Hopkins, 2015; Hopkins, 2019). More specifically, the nature in which creative activities were mediated was also investigated. These mediation forms comprised classroom instruments (Faulker, 2003; Kaschub, 1999), instruments in large-group ensembles (Hopkins, 2015; Hopkins, 2019), and technology (Cape, 2014; Cremata & Powell, 2017).

In understanding the nature of group selection, previous researchers have focused primarily on the effect of friendship (MacDonald, Miell, & Mitchell, 2002; MacDonald, Miell, & Morgan, 2000) and compositional product quality (Burland & Davidson, 2001). While researchers have uncovered the importance of how students are grouped in collaborative creative activities, there remains a need for comparing students' perceptions in group work based on their group selection.

Theoretical Framework

This study took the form of a mixed methods research design. This study was grounded in pragmatism. Pragmatism is a philosophical perspective that is most associated with mixed methods research (Teddlie & Tashakkori, 2009). The pragmatists' position embodies a pluralistic approach to problem solving, open to the use of any means and methods necessary to answer a particular problem. (Creswell, 2009). Ontologically, pragmatists tend to believe in multiple realities. Epistemologically, pragmatists tend to be universalist, suggesting that basic "truths" exist. Importantly, however, all "truths" are influenced within a particular context (DeCuir-Gunby & Schutz, 2017).

Educational influences in pragmatic thought are derived from the works of John Dewey (Dewey, 1916/1944; 1938/2015) and George Herbert Mead (1934/2015; 1938). For pragmatists, knowledge is based on things that are experienced through action (Garrison & Neiman, 2003). In educational settings, action can come in the form of problem solving, projects, and group work. This study will apply the progressive, pragmatic approaches of Dewey and Mead.

Theory of Experience

Dewey believed that all learning is situated in the context of its environment. Dewey (1916/1944) acknowledged his theory of knowledge as pragmatic. A prominent feature in Dewey's theory of experience is the activity itself, as it seeks to modify its surrounding environment. To achieve knowledge, one must be adaptable to the environment, as well as one's aims in a specific context.

Dewey (1938/2015) argues that experience must come from two interrelated principles: continuity and interaction. Dewey states that continuity "means that every experience both takes up something from those which have gone before and modifies in some way the quality of those

which come after" (Dewey, 1938/2015, p. 35). In other words, an individual's past experiences will have some influence on future experiences. The experiences with an environment can shape the perceptions of an individual within that environment. According to Dewey (1938/2015), this can affect the quality of how future experiences are shaped:

> As we have seen, there is some kind of continuity in any case since every experience affects for better or worse the attitudes which help decide the quality of further experiences. . . . Every experience influences in some degree the objective conditions under which further experiences are had (p. 37).

An individual's experiences take place within a particular context or environment, which Dewey calls a "situation." It is in the situation where the principle of interaction applies. Through interaction, an individual's present experience is realized from the relationship between the environment and the individual's past experiences. To Dewey, the concepts of situation and interaction are inseparable. Dewey states that "an experience is always what it is because of a transaction taking place between an individual and what, at the time, constitutes his environment" (Dewey,1938/2015, p. 43). Important to the situation is the object that mediates an activity. Mediation objects, according to Mead (1938), are interdependent on an individual's experience and the situated environment:

> It is in so far as the reality of the thing is affected either with the future or with the past that we are able to isolate elements which are referred to the experience of the individual. . . . Things are what they are in the relationship between the individual and his environment, and this relationship is that of conduct (p. 218).

The Individual Within His or Her Environment

One central focus of Mead's (1934/2015) work is on the individual. The individual, however, is situated in society, or the surrounding environment. Mead delineates the attitudes of the individual as the "self" and the "mind." Mead characterizes these distinctions as the "I and the Me." In Mead's words, "the 'I' is the response of the organism to the attitudes of the others; the 'me' is the organized set of attitudes others which one himself assumes" (Mead, 1934/2015, p. 175). In understanding the individual within society, the "I" is the immediate response of an individual to others. These immediate responses consist of impulses by the individual. The "me" is the collective attitudes of others. Here, the individual assumes the collective attitude.

The acts of an individual with his or her environment and the realization of the self and mind are dependent on communication (Mead 1934/2015). To Mead, communicating in a social process consists of language and gestures. Through language, "there are an infinite number of signs and symbols which may serve [its] purpose. . ." (p. 14). Verbalizations are commonly used in language functioning. Gestures, however, can be non-verbal. Mead describes gestures, saying that "we are reading the meaning of the conduct of other people when, perhaps, they are not aware of it. . . . Conversation in gesture may be carried on which cannot be translated into articulate speech (Mead 1934/2015, p. 14).

Theoretical Model

As an extension of pragmatism, the use of a holistic model can offer an understanding of several contributing elements of collaboration when analyzing students' perceptions. This study used Engestrom's Activity System Model as a means to identify differences in the grouping of students in collaborative creative activities. Engestrom's model is a visual representation of the interrelationships between the individual learner situated in a socially mediated activity (Burnard, 2007). The model visually embodies Activity Theory.

Activity theory (AT), sometimes referred to as Cultural Historic Activity Theory, is a process by which "individual learning is mediated by cultural artifacts and membership of groups" (Welch, 2007, p. 25). AT's primary focus is on the examination of the relationship between an individual within a particular environment (Barrett, 2005). In terms of peer collaboration, AT can provide an understanding of interrelated elements that take place through interactions (Burnard & Younker, 2008).

AT is based primarily from the work of Vygotsky (1978). Vygotsky created the concept of mediation, where an action ("object") by a "subject" is interceded by a particular mediating "artifact" (Welch, 2007). Artifacts include signs and tools which are transformed by the individual during a social activity. It is through the mediation of artifacts where the transmission of knowledge occurs (Vygotsky, 1978). In other words, "the individual could no longer be understood without his or her cultural means; and the society could no longer be understood without the agency of individuals who use and produce artifacts" (Engestrom, 2001, p. 134).

According to Engestrom (2001), Vygotsky's first generation of AT remained individually focused. Leontiev (1978) extended Vygotsky's idea of cultural mediation by positing that interactions were governed by "rules" and "division of labor," all through a sense of "community." Notably and most oft-cited, Engestrom (2015) provided a model of an activity system, a more detail-oriented representation of AT which provided a visual depiction for the system.

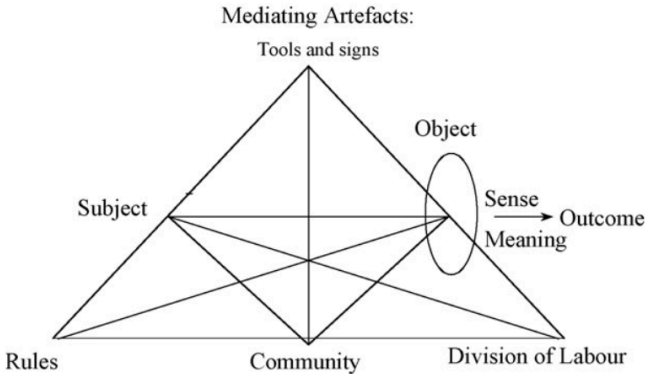

Figure 1. The structure of an activity system (Engestrom, 2015, p. 63)

In educational research, technology as a mediated artifact is becoming more prevalent, with the use of AT as a framework and visual model (Issroff & Scanlon, 2002; Kapelinin & Nardi, 2006). Through technology, the focus of AT is "on purposeful, mediated, human social activities" (Kapelinin & Nardi, 2006, p. 27) through analysis of social interactions and perceptions.

In music education research, the use of AT as a framework has gone relatively unused (Burnard & Younker, 2008; Welch, 2007), although Burnard and Younker suggested that the Engestrom model of AT was a valuable framework for peer collaboration, specifically in music composition. Burnard (2007) indicated that AT was useful when examining the intersections of creativity and technology as the model "provides a means of tracking, over time, the interconnections between creativity and technology embedded, enabled, and/or central to teaching and learning" (p. 45-46). Under this framework, students' perceptions of collaboration can be understood through identifying characteristics of interaction, based on group assignment with technology as a mediation tool for music composition.

Purpose of the Study

The purpose of this study was to examine upper elementary students' experiences in a technology-mediated collaborative music compositional activity. The goal of this study was to understand the effect of group assignment on students' perceptions of working collaboratively. Further, this study was designed to illuminate students' interactions and final products within a group structure as well as identify the effect of technology as a mediation tool. This study aimed to contribute to the existing body of research in understanding students' perceptions of collaboration where technology mediates creative activities (Burland & Davidson, 2001; Hewitt, 2008; Wallerstedt, 2013) and propose implications for educators concerning collaborative activity planning and group selection.

Research Questions

The research question for this mixed methods study were as follows:

1) How do upper elementary students perceive collaboration in a group-based, technology-mediated music composition activity?
2) Is there a significant difference in students' perceptions of collaboration based on their group assignment, as measured by the Collaborative Composition Through Technology Assessment (CCTTA)?
3) Based on group assignment, are there differences in the nature of students' interactions in collaboration?
4) How does group assignment influence the quality of students' compositional products?

Significance of the Study

There is a great deal of literature concerning students' experiences in creative collaborative activities in the elementary music classroom (Burland & Davidson, 2001; Burnard

& Younker, 2008; MacDonald, Miell, & Morgan, 2000; Wiggins, 1994; Wiggins, 1999). Furthermore, the use of technology as a mediation tool in creative endeavors has also been studied (Dillon, 2003; Dillon, 2004; Hewitt, 2008). Several researchers have investigated students' attitudes in collaborative work through the use of classroom instruments (Faulkner, 2003; Kaschub, 1999), performance-based instruments (Hopkins, 2015), and technology (Cremata & Powell, 2017).

While researchers have uncovered the importance of how students are grouped in collaborative creative activities (MacDonald, Miell, & Morgan, 2000), there remains a need for comparing students' perceptions in group work based on their group selection. This study was designed to address this limitation.

Delimitations

This study is limited to the elementary general music setting. While the bulk of research in technology-mediated collaborative composition has been conducted in elementary general music settings, it is likely that findings may be similar in scope if conducted with older students. This study is limited to the elementary general music setting largely in part to the researcher's expertise in that particular field.

Organization of the Following Chapters

The remainder of this paper is organized into four additional chapters, references, and appendices. Chapter 2 includes a detailed literature review of existing research in the area of collaboration related to creativity, social interactions, technology, and perceptions. Chapter 3 outlines the research methodology, including reasoning for selecting a mixed methods design. Also included in this chapter will be the selection of the participants, study procedures, data collection methods and implementation, and procedures for analysis. Chapter 4 presents findings

of the data sources, including the questionnaire, video observations, product rating scale, and student interviews. Additionally, this chapter will summarize the findings based on research questions previously posed by the researcher. Chapter 5 contains a discussion of the results, based on the integration of the quantitative and qualitative data, implications for the field, suggestions for future research, and the researcher's professional and personal reflections. The document concludes with a bibliography of sources and appendices.

Definition of Terms

CCTTA

The Collaborative Composition Through Technology Assessment is the survey instrument adapted for this research study. The CCTTA consists of three constructs related to students' perceptions of working together: collaboration, interactions, and technology. A fourth section includes items related to demographic and prior musical/technological experience.

Creativity

The term "creativity" can be confusing, as it can have many meanings. In terms of music education, Webster (2002) defines creativity as "the engagement of the mind in the active, structured process of thinking in sound for the purpose of producing some product that is new for the creator" (p. 5).

Creative activities

Fundamental ways in which humans engage in creative behavior. Composition is a rehearsed creative activity, ending in an original work. Improvisation is typically a creation of music that is "in the moment" or in "real time" but can also be rehearsed, resulting in altered products.

Collaboration

An umbrella terms for the structures of collaborative learning and cooperative learning. Collaborative learning "engages students as active participants in that they are placed in situations in which they have to explain what they are doing and why they are doing it and take account of the views expressed by others." (Hunter, 2006, p. 78). Cooperative learning is a formal, highly structured collaborative approach to learning. Cooperative learning contains five critical elements:

1) Positive interdependence of group members

2) Individual accountability
3) Face-to-face interaction
4) Interpersonal and small group skills
5) Group processing

According to Hunter, "whichever construction we use, the reference is to learning that involves students in working with others and, crucially, learning together." (p. 76)

Musical communication

In a collaborative music setting, musical communication is typically a non-verbal form of communication where children express their ideas through the music itself.

Technology Mediation

In the context of technology, mediation can be defined as the tool used as interaction between learners and the learning outcome (Alavi & Leidner, 2001). When viewing technology through creative activities, Burnard (2007) paints a picture of mediation where creativity is an internal process and technology is the external strategy.

Verbal communication

Utterances voiced by participants. A more specific form of verbal communication is transactive. In exploring the social nature of musical collaboration, transactive communication "builds upon and extends ideas that have already been voiced (either by the self or another person)" (MacDonald & Miell, 2000, p. 61).

2 REVIEW OF THE LITERATURE

This literature review examines research that explores collaboration as it pertains to the elementary music classroom. This review will explore the contexts of formal collaborative structures in education, collaboration in music education, creativity, social interactions, technology integration, and perceptions. The discussion of collaboration pertaining to music education will focus on compositional activities.

As these respective contexts are examined, it is important to note a limitation in the literature: the effect of group assignment on students' perceptions in technology-mediated collaborative composition. A review of research in multiple collaborative contexts is necessary in order to investigate students' experiences of collaboration. This review does not include all literature related to the topics of collaboration, composition, and technology-mediation. This review does, however, include seminal and representative works that serve as examples for related research. Such works are frequently cited in more current publications related to a similar topic. In a recent study, Hopkins (2019) examined the group composing processes of lower secondary orchestra students. The citation of works in the introduction to his study served as the most current example for justifying citations of seminal and representative works included in the current study.

Formal Collaborative Structures in Education

Collaboration in learning has been well documented throughout history (e.g., Dewey, 1938/2015; Johnson & Johnson, 1992; Mead, 1934/2015; Slavin, 1995; Vygotsky, 1978). Collaboration, also known as group learning, refers to a variety of instructional methods where students are encouraged to cooperate together (Peklaj & Vodopivec, 1999).

Formally, group learning is understood by two structures: cooperative learning and collaborative learning. Although they differ in name, both learning structures are designed for interdependence (Bruffee, 1995), where the ultimate goal is to "help students learn by working together on substantive issues" (p. 12). Interdependence in group learning is defined as shared common goals, where working collaboratively is beneficial for both the individual and the collective group (Johnson, Johnson, & Holubec, 1990). The success of the group is dependent on the participation of all group members.

Cooperative Learning

Cooperative learning is a highly organized group learning structure designed for achieving academic objectives and heightening social skills (Kaplan & Stauffer, 1994). As early as the 1970s, cooperative learning gained prominence in educational settings through the work of Johnson and Johnson (1992) and Slavin (1995). According to these researchers, the premise of cooperative learning is that when compared to working independently, working together toward a common objective can lead to greater achievement of that objective.

Integral to the success of cooperative learning strategies are five elements that structure group activities: positive interdependence, face-to-face promotive interaction, individual accountability, interpersonal skills, and group processing (Johnson, Johnson, & Holubec, 1990). Through positive interdependence, the efforts of individual group members are required for the success of the collective. Each member contributes to the group. Group members are typically assigned a specific role or task. Through face-to-face promotive interaction, communication is vital in order to explain various task assignments. Social influences of peers encourage promotive interaction, in an effort to support each group member's learning. In the third element, individual accountability is assessed by group members related to the performance of task

achievement. Assessments in task completion is also a function delivered by the teacher. The fourth component is the appropriate use of interpersonal and small group skills. The teacher typically models development of interpersonal skills in cooperative learning. Additionally, it is common for teachers to control the selection of group members based on the dynamics of student interactions. The final element is group processing. This element is reflective, as group members describe each other's peer strategies and behaviors that contribute to task completion.

Cooperative learning groups are identified by three types of member structure: formal groups, informal groups, and cooperative base groups. The teacher carefully selects members in formal groups. Tasks are crafted for specific content-related activities. Informal groups are less structured in task assignments, often designed for the discussion and review of information. Cooperative base groups are designed for longevity. Group membership can last the duration of a school year, as compared to a cohort in higher education.

Collaborative Learning

While the goals of collaborative learning are similar to that of cooperative learning, there are stark differences in how these goals are approached. Folio and Kreinberg (2009) describe the differences between the formal structures: "Cooperative learning is teacher centered and seeks to produce a 'correct' answer. . . who is in complete charge of the class at all times. Collaborative learning is learner centered and seeks to empower students to discover information by working together within groups" (p. 165). The learner centered approach to group work is reflected by the assigned activities, such as open-ended tasks, project-based learning, and problem-solving undertakings.

Roberts (2005) identifies several benefits of collaborative learning: promote critical thinking skills, actively involve students in the learning process, develop a social support system,

build diversity understanding, increase student self-esteem, and develop a positive attitude toward authority figures. These collaborative benefits enable students to build problem solving skills by utilizing negotiation techniques.

Formal Group Learning Structures in Music Education

Music education research concerning formal group learning structures has been relatively limited. The use of cooperative learning has been somewhat studied in elementary music settings (Cornachhio, 2008; Veenman, Kenter, & Post, 2000). In secondary school settings, the use of cooperative learning was investigated in band (Cangro, 2004; Compton, 2015; Whitener, 2016) and choral (Inzenga, 1999; Varvarigou, 2016) settings. Similarly, research in collaborative learning strategies was limited to secondary school settings in orchestra (Harrington, 2016) and choral (Timbie, 2016) settings.

Publications dedicated to practitioner teaching and learning has also been limited. In 1994, MENC published a guide on the design and implementation of cooperative learning structures in music classrooms (Kaplan & Stauffer, 1994). Books by Huffman (2012) and Katz and Brown (2011) included specific cooperative learning lessons designed for primary-aged students.

Differences in Formal Group Learning Structures

The use of cooperative and collaborative learning strategies can cause confusion in the literature. Luce (2001) notes that collaboration can be characterized as an "umbrella" term that "includes a variety of approaches of cooperation and collaboration" (p. 20). These approaches emerge from interactions between student groups, as well as students and teachers. It is important to note that even though cooperative and collaborative learning are two versions of a similar concept, there are differences between them. While the teacher remains the authority

figure in cooperative learning, collaborative learning goals shift influence to the student, creating a more autonomous atmosphere. Cooperative learning risks imitating authoritarian behaviors, while collaborative learning sacrifices a guaranteed accountability (Bruffee, 1995).

Many researchers do not make a distinction between cooperative and collaborative learning (Chinn, 2010), as both structures share similarities. In this study, students will work together in small groups in a creative activity. Elements from both formal structures will be utilized in this study. The cooperative learning elements of promotive interaction and group processing is essential in understanding group selection based on how students communicate and reflect. Conversely, the creative activity in the current study is open-ended in structure, designed as a student-centered endeavor. In that respect, the open-ended structure in the current study is closely aligned with the collaborative learning structure. For purposes of the current study, the term "collaboration" will act as an umbrella definition for both cooperative and collaborative learning designations.

Collaboration in Music Education

Students working in collaboration can provide more than an increase in student achievement. The experiences of students engaged in a shared environment may also benefit their positive attitudes, cognitive development, and self-esteem (Kaplan & Stauffer, 1994). Collaborative efforts "not only meet educational goals, but also lead to more pro-social attitudes and behaviors among students" (Kaplan & Stauffer, p. 5).

The need for collaboration is important, if only for the benefits of social interactions (Kaplan & Stauffer, 1994). In music education, collaborative efforts can enhance not only social interactions of children but musical achievement. According to Kaplan and Stauffer, the incorporation of collaborative activities works toward "accomplishment of a music learning

objective and development of cooperative skills, such as being a good listener, or encouraging good ideas" (Kaplan & Stauffer, 1994, p. 2).

While the majority of the focus from the literature underscores collaboration in terms of student participation and achievement, an increasing amount of the literature also focuses on the role of the teacher. Through the incorporation of collaborative music activities, educators' roles and responsibilities shift from teacher-centered learning to student-led decision-making (Wiggins, 1999). Teachers must shift their focus to facilitation, allowing students to achieve musical goals through their own mutual decisions.

While research in collaboration in music classrooms is relatively limited (Luce, 2001), there has been significant research in other subject areas, such as language (e.g., Hall & Burns, 2018) and mathematics (e.g., Alabekee, Samuel & Osaat, 2015). Proponents of collaboration often emphasize its importance by incorporating a variety of student abilities, as it benefits both social and academic principles (Kaplan & Stauffer, 1994). For example, the social aspect of collaboration can give students unique perspectives on diversity, such as working with special needs students (Jellison, Draper, & Brown, 2018).

Collaboration Compared to Individualistic and Traditional Learning in Music Education

Individualistic learning hinders communication among fellow peers (Johnson & Johnson, 1992). In individualistic learning, "students work by themselves to accomplish learning goals unrelated to those of the other students. Thus, the student seeks an outcome that is personally beneficial and ignores the goal achievement of other students" (Johnson & Johnson, 1992, p. 122). The objectives achieved in collaboration are dependent upon the mutual goals of others, as learning in an individualistic setting is only determined by one's self (Hwong, Caswell, Johnson, & Johnson, 1993). Individualistic learning is often teacher-centered in its approach (Johnson,

Johnson, & Holubuc, 1990), comparable to the traditional teaching practices used in music education.

Collaborative work has been readily used in elementary and secondary school settings, through general music practices and performance-based groups. Compared to individualistic instruction, the effects of collaboration were investigated in the general music elementary classroom. Cornacchio (2008) found positive effects of collaboration over individualistic instruction in elementary compositional activities. Pre and post-tests were given individually to participants based on music achievement. Participants were assigned to one of two treatment groups: collaborative groups and individualistic. Both treatment groups composed music based on specified rhythmic patterns and solfege tones. Results showed that while there was no significant difference between participants' post-test scores between collaborative and individual conditions, there was a significance in pre and post-test scores in the collaborative group. Furthermore, those in collaborative groups exhibited more observed on-task interactions than students who composed individually.

Performance-based classes in secondary school settings are historically steeped in a traditional, teacher-led rehearsal model. Complete saturation of teacher control in performance-based instruction may limit students' ability for decision making and social development (Harrington, 2016). Integration of collaboration in traditional teacher-led instruction can sometimes be challenging, as students may have difficulty adapting to a more student-centered approach to learning (Cangro, 2004). To ease this challenge, Compton (2015) incorporated collaborative practices as a rehearsal technique. The use of student-led rehearsals was incorporated as a collaborative setting for a band acting as the treatment group. The control group incorporated teacher-led rehearsal techniques. Independent raters evaluated the respective

groups' performance. Results from the raters' scores indicated a significant difference in overall band performance. The treatment group performed better than the band with teacher-led rehearsal techniques. Compton suggested factors to consider when incorporating cooperative learning in secondary performance-based groups. These factors included group structure, time management, and the importance of the teacher's role as facilitator.

Collaboration can be an effective means for enhancing music literacy in the secondary performance-based music setting through the use of specific group strategies. Inzenga (1999) observed ninth-grade choral students in two cooperative groups. Analysis of observations uncovered collaborative strategies that were used by the cooperative groups. These strategies included: modeling, clarification, prior knowledge activation, predicting and question generating, thinking aloud, summarization, and direct explanation. Students in collaborative groupings demonstrated significant gains in music reading achievement pre and post-test scores, as measured by the Iowa Tests of Music Literacy assessment.

Collaborative strategies can also improve listening skills. Holloway (2001) investigated the effects of cooperative learning and traditional learning on listening acquisition skills, specifically in melodic and meter recognition. Students in collaborative groups demonstrated significant gains in listening achievement over students taught through the traditional, teacher-led method of instruction.

Collaboration and Musical Creativity

While there is a great deal of research in the fields of creativity and collaboration, there has been minimal attention in the combination of the two concepts (Baloche, 1994; Luce, 2001) even though, according to MacDonald, Miell & Morgan (2000), "music is one of the curriculum areas where children very commonly work together" (p. 406).

Working collaboratively can lead to higher levels of creativity. Baloche (1994) measured changes in levels of student creativity in collaborative groupings. Not only did students score higher in creative thinking tests, but social factors improved, including an increase in self-esteem. Other areas with increased scores included cooperation, goal interdependence, goal cohesion, and support. Support was categorized into student academic support, student personal support, and teacher personal support.

Collaboration can enhance the process of musical creativity through endeavors such as composition (Cornacchio, 2008) and improvisation (Beegle, 2010). The use of collaboration can heighten students' interactions with peers and encourage a positive learning experience. It is through group-based interactions that students are at the core of their own instruction by incorporating personal experiences and strategies for student-based instruction (Brown, 2008). Collaborative creative activities promote peer interactions and encourage creative thinking (Menard, 2013).

Collaborative Composition in the Elementary Music Setting

While group composing has been an important part of research internationally, it remains limited in the United States (Cangro, 2016). In the elementary setting, much of this research has focused on "traditional" forms of composition, using classroom instruments for music making (Hopkins, 2015).

Through the use of traditional compositional forms, many researchers have focused on modes of children's communication in the elementary general music setting (MacDonald, Miell, & Morgan, 2000; Wiggins, 1994; Wiggins, 2000). Further discussion of communication modes will be outlined in the next section of this chapter. In secondary school settings, Hopkins (2015)

investigated the collaborative compositional practices of students in instrumental performance groups.

Other researchers have examined collaborative composition through various social groupings, investigating the effects that grouping has on communication and the final product (Burland & Davidson, 2001; MacDonald, Miell, & Mitchell, 2002). Further, research has been conducted to uncover the nature of collaboration through social interactions (Burnard & Younker, 2008). Veloso (2017) sought to understand the nature of embodied processes in collaborative composing.

Unique to collaborative composition is the importance of individual ideas to the collaborative effort (Faulkner, 2003). Group members negotiate individual ideas in an effort to create a final collective product. This negotiation process produces a shared understanding of the overall collaborative effort.

> Group. . . composing clearly facilitates that dynamic dialogue and collaboration, a reactive and reflective educational process that motivates change and facilitates personal, social, musical and creative development. These processes can and do lead to individual acts of creativity, shared and validated by the social group and in tum increasing shared knowledge and understanding. (Faulkner, 2003, p.120)

The researcher concluded by stressing the importance of the individual's experience as integral to a collective composition activity.

Open-Ended Task Structures in Collaborative Music Composition

Relevant to the implementation of collaborative composition activities is the nature in which the creative task is assigned. Allsup (2016) emphasized the importance of open-endedness in creative activities through the Deweyian (1900/1990) thought of using "natural resources."

Through the resources of communication, inquiry, construction, and artistic expression, children are in control of their own learning. It is through this student-centeredness that children ask questions and have a desire to solve problems. For Allsup (2003), children working freely in an open environment of exploration is integral to creating a democratic space. Dillon (2003) echoes this sentiment, emphasizing how open-ended task structures are central to discovery and exploration processes. Specific to creative music activities, open-ended tasks have no "correct" answer. MacDonald, Miell, and Morgan (2002) describe open-ended tasks in a similar description to creative problem solving by saying that "collaborators need to develop their own ways of working towards what they themselves have defined as a creative solution" (p. 150).

Kaschub (1999), using the term "umprompted," defined open-ended tasks as "not defined by the teacher, but the student is responsible for defining their own parameters" (p. 4). The use of open-ended tasks in collaborative composition has been studied in both traditional (Kaschub, 1999; MacDonald, Miell, & Mitchell, 2002) and technology-mediated activities (Dillon, 2003; Hewitt, 2008). Task parameters have varied in how open-ended tasks instructions are given to children. For example, Hewitt (2008) directed students to "compose a piece of music that sounded good to them" (p. 15). Other researchers have used open-ended tasks, with the only stipulation being that a composed song should have a clear beginning and clear ending (Morgan, Hargreaves, & Joiner, 2000). Kaschub (1999) and Faulker (2003) found that students preferred open-ended tasks over those with more structured parameters.

Collaboration and Social Interaction in Elementary Music Creative Activities

The social nature of collaboration is essential for student realization of achievement. Interactions between social and academic goals are paramount for group success. Collaborative experiences "are designed to focus student attention on developing specific social skills as they

work together" (Kaplan & Stauffer, 1994, p. 10). It is this direct attention to social needs that makes collaboration a valuable addition to an existing music curriculum, especially when considering its extension into creative activities.

Research concerning social interactions in creative activities has focused primarily on compositional processes (Stauffer, 2001; Wiggins, 1994) and forms of communication (Hopkins, 2015; MacDonald, Miell, & Mitchell, 2002; Wiggins, 2000).

Compositional Processes in Collaborative Musical Creative Activities

Examining the processes that children exhibit through creative activities is important in understanding the musical development of children (Stauffer, 2001). According to Kratus (1989), this process typically begins with some form of exploration, where the discovery of sound will ultimately shift into the development of creative ideas. Stauffer (2001) described a child's composing processes through strategies of exploration and development using a computer software program. Over the course of her study, the child became more fluent in compositional strategies, as well as having an increased awareness of internalizing music choices. Stauffer asserted that the composition process included the interactions of time, tool, and technique, "including time to explore and become familiar with the medium [technology], time to find [children's] own strategies and gestures, and time to practice using them" (p. 18). Stauffer's case study observed only one child. It is included in this section, however, as Stauffer presented implications for collaborative composition, saying that collaborative efforts may have limitations with her assertions, including time for exploration, group size, and technological availability.

In examining peer interactions during creative compositional projects, Wiggins (1994) analyzed the nature of children's learning strategies to solve problems in a fifth-grade classroom, observing small-group composition projects. Results indicated that the students developed a

predetermined holistic idea of what the finished compositional product might be. Furthermore, the groups exhibited a three-stage process during group learning strategies (whole-part-whole). The first stage, whole group, consisted of initial planning of the final product, reinforcing the holistic approach that the groups demonstrated. This reflective stage also developed students' instrument selection for performance of the final product. In the second stage, independent practice, each participant explored motivic development separately. In the third and final stage, whole group, the participants reconvened for evaluative comments and practice of the final product. This study further suggests that the groups incorporated purposeful planning in their practice, as opposed to random exploration.

Role assignments within collaborative groupings can affect the nature of compositional processing. Beegle (2010) found that social roles in collaboration efforts were often correlated to musical roles. Four components of collaboration emerged from the study: role assignments, exploration, discussion, and negotiation. It was important to note that these components were not necessarily sequential, as groups frequently moved in and out of various components. Interestingly, the social relationships between students affected the final product. In musical terms, common themes emerged in collaborative planning. These themes were: memorization, initiation, and motivic development.

Using a systems model for analysis, Burnard and Younker (2008) found that collaborative groups exhibited well-established forms of social interactions. The success of students working together depended on factors such as instrument selection, instrument training, and prior musical knowledge. The differences in the nature of the compositional task resulted in different levels of exploration, modeling, and practicing. The success of these interactions

demonstrated the importance of assigning groups according to children's musical background and instrumental experience.

Communication in Musical Creative Activities

Communication is vital for children in order to learn from others (MacDonald & Miell, 2000). This communication can be either verbal or musical.

Verbal Communication. Several researchers have explored the importance of verbal communication in collaborative compositional activities (Charissi & Renta, 2014; Hewitt, 2008). MacDonald, Miell, and Mitchell (2002) paired 40 girls into friendship and non-friendship groups. The participant groups were given 20 minutes to compose a piece of music on a keyboard. The researchers found that collaborative groups formed through student selection exhibited a higher level of verbal dialogue than non-friendship groups. Verbal dialogue was also voiced by participants as expressions of feelings, as well as a means to discuss successive steps in compositional processes (Charissi & Renta, 2014).

Verbal dialogue was also examined to determine how musical concepts were articulated during composition. Wallerstedt (2013) found that while children were consistently engaged in verbal dialogue, communication was restricted in terms of musical knowledge. Students rarely articulated their musical intentions and posed few questions regarding the nature of the activity. Children in the compositional activity used invented concepts in place of musical terms. These invented terms were used as a communicative tool for discerning the task, creating music, and sharing experiences. The importance of linking children's prior knowledge to musical concepts could benefit communication, both verbally and musically, during children's collaborative activities.

Transactive communication. A more specific form of verbal communication is transactive communication. The presence of transactive communication is crucial to quality group work. MacDonald & Miell (2000) defined transactive communication as "communication which builds upon and extends ideas that have already been voiced" (p. 61). Several researchers have indicated the importance of group membership in verbal, transactive communication (Hewitt, 2008; MacDonald, Miell, & Mitchell, 2002), most importantly through friendship groups.

Researchers investigating technology use in collaborative composition indicated similar findings regarding the presence of verbal communication. The purpose of Hewitt's (2008) study was to identify and analyze transactive communication using a computer for composing. Results indicated that transactive communication accounted for 37% of all coded recorded sessions.

Musical communication. Musical communication was also found to be an essential part of students' interactions in creative collaboration. As a non-verbal communicative form, musical communication distinguishes creative musical activities apart from other respective subject contents (Hopkins, 2015). Many researchers have found that musical communication played a larger role than verbal dialogue in understanding collaborative compositional processes (Hopkins, 2015; Wiggins, 2000).

Musical communication was a crucial component in students' efforts to create a final creative product. Wiggins' (2000) examined the nature of shared understanding in collaborative composition. Musical communication was found to be integral to the realization of the final product. While verbal communication among group members was present in collaborative compositional activities, dialogue was found to be evaluative in nature, commonly used for

judgment purposes. Musical communication was the group members' preference over verbal communication in terms of expressing musical ideas.

In a performance-based setting, Hopkins (2015) examined how group members used forms of communication (verbal and musical, non-verbal) in their compositions. Results showed that while group members utilized both forms of communication, all groups spend a larger percentage of time engaged in musical communication.

Shared understanding. In terms of collaboration, shared understanding was identified as "an understanding that the combined expertise of the group often exceeds that of the individuals who comprise the group, making the collaborative effort a more powerful platform for problem solving and decision making than the work of an individual might be" (Wiggins, 2000, p. 67).

In observing student interactions during creative problem-solving experiences, Wiggins (2000) analyzed shared understanding as an influential factor in student success. This shared understanding among group members included: understanding of the problem, strategies used to solve the problem, and music, in general. Findings indicated that in terms of the creative process, group members' shared understanding was realized through the final product, based on musical elements of that product. These elements were shared through musical communication. The nature of shared understanding was characterized by the group's vision of their respective work. This vision was deemed greater than any individual idea within the group. Creative activities using collaboration can lead to student success and benefit the individual through motivation, empowerment, and exploration, and higher levels of creativity, all within a safe environment where students were free to express original ideas.

Group Selection in Creative Music Collaboration

While communication is central to collaborative activities, the nature of group selection can be just as significant. When assigning children to collaborative groups, teachers commonly select students based on either musical ability or friendship (MacDonald, Miell & Morgan, 2000). Either selection is based on the decision to actively engage children in a social context.

Friendship groups. Allowing students to select their own groupings in collaborative compositional activities can have meaningful effects on their social interactions (Burland & Davidson, 2001), which has "the potential to create an effective working environment, with good interactions. . . to produce high quality results" (p. 47). As mentioned previously, children that have experience working together can promote a shared understanding, in an effort to generate more musical ideas among groupmates (Wiggins, 2000). Researchers found that allowing children to select their own groupmates can have meaningful effects on the processes and products of creative activities (Charissi & Renta, 2014; MacDonald, Miell, & Mitchell, 2002; MacDonald, Miell, & Morgan, 2000; Hewitt, 2008).

In a seminal study, MacDonald, Miell & Morgan (2000) investigated the effects that friendship might have on collaborative interactions while performing a compositional task. Forty 7th grade students were either assigned to non-friendship pairs or asked to select a friend as a partner. Using non-friendship pairs as the control group and friendship pairs as the experimental group, participants were given 15 minutes to compose a piece of music about the rain forest using percussion instruments. There were statistically significant findings in the friendship groups. Not only was there a greater use of transactive communication in the friendship groups, but the quality of the compositions was rated higher than that of the non-friendship groups. "This enhanced communication between friends is likely to be because their established shared knowledge and pattern of interacting allow them to anticipate each other's ideas" (MacDonald,

Miell, & Morgan, 2000, p. 411). Friendship enhanced communication through shared knowledge and also increased musical communication through gesturing.

Comparable to the previously mentioned study, MacDonald, Miell, and Mitchell (2002) focused their investigation of friendship and non-friendship groups on 8-year old and 11-year old pairs. Results indicated that the younger aged children paired in friendship groups scored higher in compositional product scores and achieved higher levels of meaningful verbal dialogue when compared to the non-friendship groups. In contrast to the former study (MacDonald, Miell, & Morgan, 2000), there were no significant differences in compositional product scores or verbal dialogue between the friendship and non-friendship groups in the older aged children. The researchers did state, however, that the compositional assignment was much more highly structured and less open-ended than the compositional task of the younger children, which may have required less negotiation in collaboration.

In a similar study, Burland & Davidson (2001) investigated the influence of various groupings on collaborative composition. The researchers focused on the quality of the compositional product and the quality of students' social interactions. Various groupings consisted of: random assignment, friendship groups, and non-friendship groups. Results showed no significant differences between groups in product scores. However, there were meaningful effects observed on the quality of social interactions in friendship groups. These effects were attributed to established methods of peer interactions, including shared understanding, completing work in a timely manner, and minimal off-task behaviors.

As mentioned previously, Hewitt (2008) found that transactive verbal dialogue was a central communicative component in technology-mediated creative composition. The use of transactive dialogue depended on the individual differences between children within their

groupings. These variables included: friendship, prior experience of working together, tendency to lead, academic ability, and musical expertise. Transactive dialogue was higher in friendship groups and groups with experience working together. These communication variables suggest valuable insight on the selection of collaborative groups to gain maximum transactive communication.

Non-friendship groups. Several of the previously mentioned studies compared friendship groups to non-friendship groups. Often times, students were randomly assigned to collaborative groupings (Burland & Davidson, 2001).

In other instances, students are grouped according to musical background and instrumental experience. According to Burnard and Younker (2008), grouping students based on musical experience can be vital in group interaction, particularly in finding a balance in role assignments. In contrast, Seddon and O'Neill (2003) found that students grouped with similar instrumental experience had difficulty with exploration processes in creative composition, as formal training hindered the ability to create music outside of the traditional parameters of instrumental instruction.

Collaboration and Technology-Mediated Creative Activities

The use of technology in collaboration has now become a mainstay in music classrooms through the use of interactive whiteboards, computer software programs, and handheld devices to enhance student interaction (Gall & Breeze, 2005; Nolan, 2009). In creative activities, many researchers suggest that the use of technology is more accessible for students (Bolton, 2008; Hickey, 1997; Webster, 1998). Furthermore, the use of technology as a mediation tool can enhance students' self-motivation in the engagement of creative activities (Kim, 2013).

The use of non-traditional notation is viewed by many as changing the way that children interact through collaboration, allowing more students access to composition (Charissa & Renta, 2014). Non-traditional icons can be used as visual representations of various musical elements. Through these representations, elementary-aged students' fluency in compositional strategies is heightened (Stauffer, 2001). Many technology-mediated programs offer pre-recorded loops and sequencing samples that are not available in traditional instrumental mediation tools (Dillon, 2004; Gall & Breeze, 2008).

According to Dobson and Littleton (2016), "music education is supported by an increasing range of digital technologies that afford a remarkable divergence of opportunities for learning within the classroom" (p. 330). It is not surprising that with the rise of digital technology in music classrooms, technology-mediated composition is establishing a solid foundation in music education research. Software programs that have been examined as compositional mediation tools have been: *GarageBand* (Ankney, 2012; Bolton, 2008; Cape, 2014), *ejay* (Dillon, 2003; Gall & Breeze, 2008); *Making Music* (Stauffer, 2001), *Impromtu*, *Hyperscore*, *O-Generator* (Ackney, 2012), Sibelius *Groovy Shapes,* and *JamMo* (Charissi & Rinta, 2014). Researchers are continually investigating technology-mediating programs through the compositional processes that students experience (Dobson & Littleton, 2016).

Technology-Mediated Compositional Processes in Creative Activities

Compositional processes in traditional, instrumental collaborative activities were discussed previously in this chapter. Processes in technology-mediated collaborative composition have also been researched (Dillon, 2003; Dillon, 2004; Gall & Breeze, 2008; Hewitt, 2008; Savage, 2005). In regard to technology use, the primary emphasis in examining processes has focused on exploration (Dillon, 2003). The communicative dialogue of groupmates is integral to

the discovery of compositional processes. Forms of communication, such as verbal dialogues and non-verbal, musical gestures are essential in determining exploratory behaviors. Therefore, many of the studies cited in this section describe how communicative utterances are central to understanding compositional processes.

Dillon (2003) conducted a series of studies to examine the collaborative processes of technology-mediated composition, specifically analyzing the nature of dialogue. The most commonly occurring dialogues revealed: suggestions, where new musical ideas were formed; extensions, where those ideas continued to develop; and questions. Most importantly, through dialogue, participants achieved a shared understanding of the compositional task. According to Dillon's analysis, this shared understanding came in the mediated communicative forms of verbal utterances, non-verbal musical cues, and the use of technology. Integral to the success of this open-ended task was the processes of discovery and exploration.

Exploration in collaborative composition can be quite complex. Often, processes can take place within the scope of exploration (Dillon, 2004). Such processes can pertain to the discovery of sampled sounds, followed by reflection and the editing of selected sampled sounds. Throughout this process, ultimate decisions in creative music making were made.

Exploration of sound can be the dominant process in collaborative composition when technology mediates the activity. Charissi and Rinta (2014) explored the musical and social behaviors of primary-aged students using compositional software that allowed participants to select musical elements and patterns using colorful, non-traditional visual representations. While three processes emerged (sound exploration, planning of musical choices, and assessment of musical choices), sound exploration was the dominant process in music making. Furthermore,

interactions within group members revealed several types of verbal and non-verbal communication, observed at varying times within respective processes.

Visual representations in technology-mediated compositional programs can also provide a shared space in the negotiation process of music meaning through creative endeavors. In terms of collaboration, Gall and Breeze (2008) discovered that the foundation of students' communication was based on the visual representation of the computer display. Such representations were visually appealing through colors, shapes and overall design. Control was an observed issue in collaboration, as students negotiated control through divergent compositional ideas. Physical control of the computer was also reported as an issue. The researchers emphasized the importance of role assignments as children worked together in composition, particularly through issues of equity and physical control of technological devices.

The use of sound generation in compositional activities through technology-mediation can be developed at a more rapid pace than traditional composition. Savage (2005) conducted a comparative case study to observe how students composed through technology. According to Savage (2005), "the ease of access into sound 'worlds' and the manipulative and transformational power of [technology] allows for these ideas to be quickly developed and realized" (p. 173). Four compositional processes also emerged from the study. The importance of exploration as the initial process to technology-mediation was crucial, as children needed "an opportunity to play with and explore sounds with the new technologies being used" (p. 175). In the subsequent process of Selection, the development of ideas occurred, where group members ultimately rejected or improved upon compositional ideas. Through the process of Structuring, all ideas were considered as the composed piece was considered as a comprehensive whole. Finally, through the process of Evaluating and Revising, the culmination of compositional ideas

was reflected upon. It was in this final evaluative stage where group members had the opportunity to return to other processes, where new understandings of decisions could be possible.

E-Collaboration in Music Compositional Activities

Technology-mediated compositional collaboration is not just designed for formal classroom use. The use of digital networks can allow students freedom and agency in creative endeavors. Through the use of online collaborative technologies, students can go beyond the walls of a classroom while interacting with others that are not tangibly present. Cremata and Powell (2017) investigated students' experiences in an online music collaboration project. Through the use of an online compositional tool, participants worked with musicians from around the world. Exploration was encouraged, as a means to create a sense of personal agency in the open-ended activity. Each student's creative processes were unique, as each e-collaboration displayed distinctive forms of music choice, modes of communication, and decision making. Overall, students felt an increased sense of agency by creating their own experiences in learning.

The use of creative activities can be developed using online communities, in an effort to collaborate, explore, and share ideas. Dillon (2012) transformed the creative musical software jam2jam into an open-source tool. Open-source tools are "typically created as a collaborate effort in which programmers improve upon the [selected program] and share the changes within [a] community" (Webopedia, n.d.). The use of open-source tools was a means to collaborate beyond traditional classroom walls. According to Dillon, in using jam2jam as an open source version, "users improvise with musical and visual elements in real time, performing and improvising together as part of a virtual ensemble exploring musical styles like reggae, country, hip hop, and

techno" (p. 173). The use of open-source programs emphasizes the process of exploration, focusing on performance and collaboration, in and out of an educational setting.

GarageBand as a Mediation Tool

As a standard feature on the iPad tablet, GarageBand has become readily available to children everywhere. Access to GarageBand has made an already existing impact across music education fields, particularly in compositional activities (Ankney, 2012). Ankney offers a detailed description of the popular application:

> GarageBand offers an array of composition possibilities for individuals of many differing ability levels. Like other sequencer programs, GarageBand allows musicians to record directly into the interface. A novice can compose using loops (repeated motives) or a MIDI keyboard, while an experienced musician can compose music using all of the notational features: loops, standard notation, and recorded clips. Users can also create loops to be saved and used as needed. (p. 19)

While the use of GarageBand allows for greater ease in compositional activities, the program can be a powerful tool in musical skills and knowledge. Applying GarageBand as a mediation tool can motivate children to develop a positive self-concept and increased satisfaction in composition (Bolton, 2008). In the literature, however, there are few studies where GarageBand is the means for compositional mediation.

Using GarageBand as a mediation tool for composition, Cape (2014) explored the potential of technology as a means to encourage student agency and creativity. Participants explored GarageBand through a researcher facilitated tutorial, as well as time for exploration and experimentation. Findings revealed that both the creative process, as well as the final compositional products, were unique to each student, stemming from their own musical ideas

and preferences. With its vast array of sound choices, using GarageBand as a mediation tool can create meaningful musical experiences, producing a strong sense of agency in students.

The use of GarageBand can assist with acquiring compositional skills and knowledge. Bolton (2008) explored the use of technology-mediated composition through the personal narrative of a 12-year old child with little musical experience. With support from an online music specialist, the student explored and experimented with music composition, culminating into a final compositional project. The participant's attempts at composition became increasingly innovative through exploration, positively perceiving the technological approach to compositional learning. This study emphasized how GarageBand could be used to support those with limited knowledge of notational skills.

Perceptions of Collaboration in Musical Creative Activities

Research regarding perceptions in collaborative practices is relatively limited. The overall opinions of collaborative work, however, is positive from both student and teacher perspectives (Bolton, 2008; Cape, 2014). When compared to individualistic endeavors, students preferred working in collaborative groupings (Faulkner, 2003; Kaschub, 1999). Researchers focusing on teacher perceptions viewed collaborative practices as a means to develop more meaningful creative experiences for students (Gruenhagen & Whitcomb, 2014) as well as heighten teachers' understanding in technological pedagogy (Stanley, 2012). Researchers focusing on perceptions of collaboration have been studied through creative activities, particularly composition. The attitudes expressed by participants in collaborative composition were often directly related to the mediation form by which music was made.

Teacher Perceptions of Collaborative Creative Activities

Teachers' attitudes regarding collaboration are often related to understanding how their students interact in creative activities. Gruenhagen and Whitcomb (2014) examined teachers' attitudes on their improvisational practices in elementary general music classrooms. Participants described creative collaboration in terms of better understanding student-teacher relationships. The teachers interviewed in the study co-created criteria and assessments in improvisational activities. Teachers also reported that students were more successful in their improvisations when they were more involved in the creation of their own music. These perceptions strengthened the need for student-centered learning in creative activity planning.

Music educators have shared their perceptions of collaboration concerning their students' learning. Stanley (2012) examined elementary music teachers in a collaborative teacher study group. Teachers shared their attitudes regarding collaborative practices in their elementary classrooms. Participants mutually created three *Principles of Collaboration* concerning their experiences with collaboration. These principles were: (1) Collaboration facilitates student self-expression and independence, (2) Students share goals, with the teacher allowing space for student-student interactions, and (3) The teacher provides the necessary background skills, then facilitates as needed, helping students achieve a shared goal (p. 65).

Student Perceptions of Musical Creative Activities

Attitudes of students in collaborative activities have been investigated in terms of how creative activities have been mediated. In the traditional style of mediation, classroom instruments have been used in elementary school settings (Faulkner, 2003; Kaschub, 1999). Similarly, students in performance-based ensembles used their respective instruments to create music in small, collaborative groupings (Hopkins, 2015).

Traditional mediation. Students in elementary school settings perceived collaborative composition as an effective way of music making. In Faulkner's (2003) investigation, students' perceptions spanned across compositional processes and products in the context of social interactions and student agency. Results indicated positive attitudes of students toward composition and understanding music. Students valued musical input from individual group members, as each participant generated a variety of musical ideas in a collective composition activity.

In a secondary, performance-based setting, Hopkins (2015) found a high level of enjoyment and satisfaction from students in group composition. Analysis revealed a strong correlation between positive student perceptions and compositional product scores. This finding indicated the importance of student attitudes on the quality of compositional products.

Technology-mediation. The use of technological devices in collaborative composition can enhance the creative process as a new resource to create music through ready-made music materials (Crow, 2006). Examples of this new material consist of DJ remix software, loop-based sequencers, and musical accompaniment generators. These new musical options in technology offer creative choices that traditional mediated forms do not possess. Technology-mediation, then, can heighten the engagement of students in creative activities, enhancing their overall perceptions of collaborative composition (Kim, 2013).

With the use of e-collaboration activities, students have the ability to compose outside the boundaries of traditional, formal classroom instruction. In Cremata and Powell's (2017) investigation of an online music collaboration project, students reported a high level of enthusiasm for the compositional assignment. As students worked with musicians from around

the world, participants experienced a sense of empowerment in the creative process. These perceptions reflected student-centered learning through the use of creative activities.

GarageBand is a compositional application that is easily accessible to students in creating music (Ankney, 2012). Students have perceived the use of the GarageBand interface positively in research studies. Students expressed that the use of GarageBand in creative activities provided a positive self-concept and a strong sense of self-confidence in compositional abilities, especially to those that lacked musical knowledge (Bolton, 2008; Cape, 2014). This increase in confidence could be attributed to the wide variety of sound choices that the interface offered. Cape (2014) described how the use of GarageBand in collaborative decision-making was meaningful in the instruction of musical elements:

> Participants were both aware of and able to make musical decisions about phrasing, tempo, timbre, texture, dynamics, and affect. Because those concepts were encountered and applied organically in the project of creating music rather than isolated and approached artificially through a particular lesson, the students experienced a greater sense of satisfaction and ownership of their knowledge (p.14).

This heightened gratification of collaboration was also reflected by the students' eagerness to share their respective products.

Conclusion

An extensive review of the literature disclosed the effectiveness of collaboration through a variety of contexts. These contexts included: collaboration in music classrooms, creativity, social interactions, technology mediation, and perceptions. When compared to individualistic or traditional learning, collaboration enhanced student achievement (Faulkner, 2003; Kaschub, 1999). This achievement was not partial to music instruction, as collaboration enhanced student

achievement in other subject areas, such as mathematics and language. Furthermore, the use of collaboration in traditional, instrumental settings increased divergent decision-making, improved listening skills, and heightened notational literacy (Cangro, 2004; Harrington, 2016; Holloway, 2001).

In a creative context, the use of collaboration can lead to higher levels of creative thinking (Baloche, 1994). This heightened sense of creativity is realized through compositional (MacDonald, Miell, & Morgan, 2000; Burnard & Younker, 2008) and improvisational (Beegle, 2010) activities. Student groups developed specific learning strategies when working together. Students have benefitted from collaboration through motivation, empowerment, self-esteem, and autonomy.

In terms of social interactions, findings from the literature uncovered several central themes through student interactions. Communication is essential in collaborative efforts (Wiggins, 2000). Transactive communication is vital for student achievement in collaboration (Hewitt, 2008; MacDonald, Miell, & Mitchell, 2002). Musical communication is equally important, which not only benefits the final created product but the process itself (Hopkins, 2015; Wiggins, 2000). It is through the use of collaboration that students developed a shared understanding of knowledge in their mutual learning. Researchers have also found the importance in examining the nature of group structure, or selection of students, in collaborative settings (Burland & Davidson, 2001; Gall & Breeze, 2008). Researchers found justification for grouping students with friends, as well as grouping students with varying musical abilities. The selection of group structure can considerably affect the level of communication within a group.

Technology as a mediation tool extends a new dynamic for collaborative composition (Dobson & Littleton, 2016). Software applications, such as GarageBand, can generate overall

positive perceptions in creative activities. With an emphasis on exploration, the use of open-ended tasks has the means to uncover new possibilities of compositional processing, producing a democratic sense of agency in students.

Students' perceptions of collaborative composition have mostly been investigated through traditional forms of mediation including classroom instruments (Faulker, 2003; Kaschub, 1999) and performance-based instruments (Hopkins, 2015). Some researchers have measured students' perceptions quantitatively, through survey methods (Faulker, 2003; Hopkins, 2015). In technology-mediation, qualitative methods were used to describe students' attitudes regarding the nature of digital interfaces (Bolton, 2008; Cape, 2014).

This study aims to contribute to the existing body of research in understanding students' perceptions of collaboration where technology mediates creative activities. The effect of group assignment will be quantitatively and qualitatively measured on students' attitudes of group work. Researchers comparing the effects of group selection have focused primarily on compositional quality (Burland & Davidson, 2001; MacDonald, Miell, & Mitchell, 2002; MacDonald, Miell, & Morgan, 2000). There remains a need for comparing students' perceptions in group work based on group selection. Additional aims of this study seek to compare the effects of group assignment on compositional quality, compositional processes, and modes of communication. Results can then be compared to the existing body of research. Therefore, the results of this study may hold implications for the design of collaborative groupings in student creative work.

3 METHODOLOGY

As shown in Chapter 2, previous research indicates that student collaboration in general music classrooms is facilitated in three contexts: in the development of creativity, during social interactions, and through technology.

The previous chapter reviewed research outlining the benefits of collaboration in elementary music education. Students' perceptions of creative collaborative activities have only received marginal attention, far less in technology-mediation capacities. Furthermore, research on the effect of group assignment in creative activities has focused primarily on the realization of completed products. There remains a need for comparing students' perceptions in collaboration based on group assignment. This study was designed to address this limitation. The purpose of this study was to examine the experiences of upper elementary students in a technology-mediated collaborative compositional activity. The goal of the study was to understand the effect of group selection on students' perceptions of collaboration. The following questions guided this study:

1) How do upper elementary students perceive collaboration in a group-based, technology-mediated music composition activity?
2) Is there a significant difference in students' perceptions of collaboration based on their group assignment, as measured by the Collaborative Composition Through Technology Assessment (CCTTA)?
3) Based on group assignment, are there differences in the nature of students' interactions in collaboration?, and
4) How does group assignment influence the quality of students' compositional products?

Theoretical Framework and Theoretical Model

The nature of identifying students' experiences can be qualitative, as an inductive approach with open-ended, exploratory data. On the other hand, these experiences can also be statistically measurable (Bowles, 1998; Grbich, 2013), viewed deductively in quantitative data. Hence, a mixed methods approach was possible for this study. The integration of differing methodologies is grounded in pragmatism. Pragmatism "seeks ways through the polarized quantitative-qualitative debate to find practical solutions to the problem of differing ideologies and methodologies" (Grbich, p. 27).

The use of pragmatism as a theoretical framework in the current study is twofold. First, by creating a hybrid of methods, this research philosophy can be an effective means for providing a comprehensive examination of students' experiences in a technology-mediated collaborative music composition activity. Using a pragmatic stance in mixed methods allows the researcher to use different paradigms, or approaches to qualitative and/or quantitative data (Johnson & Onweugbuzie, 2004).

Secondly, pragmatism can be defined through Dewey's (1938/2015) theory of experience, as it applies to the current study in the context of collaboration. According to Dewey, an individual's prior music experience, in composition and/or technology, can shape present experiences through the situational influence of collaboration. Furthermore, the situational influence may vary based on specific groupings and past experiences. Collaboration can be realized through Dewey's (1916/1944) interpretation of "conceiving the connection between ourselves and the world in which we live" (p. 344).

The use of Activity Theory (AT) as a theoretical model serves as a holistic extension of Dewey's theory of experience, with individual experiences (Barrett, 2005) shaping creative

collaboration. Students' experiences of working collaboratively may be greatly affected by changes in group membership and mediating artifacts (technology), which in turn can affect the division of labor and the outcome (final composition product).

Methodology and Research Design

This study used a mixed methods approach as a methodology. The mixed methods approach combines qualitative and quantitative methods and data to provide a broader perspective of the problem. The advantage of "the combination of data allows the [researcher] to view the phenomenon under study from different perspectives." (Grbich, p. 25). The purpose of initiating a mixed methods design for this study was to corroborate findings using multiple sources of evidence (DeCuir-Gunby & Schutz, 2017).

The mixed methods approach for this study was convergent in design, as well as parallel in its scope (DeCuir-Gunby & Schutz, 2017). Consistent with a convergent parallel design, the data were collected concurrently. The qualitative and quantitative data were analyzed separately. Once the findings for each respective data were analyzed, the data were integrated. The purpose of the convergent parallel design was to develop a more comprehensive understanding of the problem (Creswell & Plano Clark, 2011). This understanding was achieved by collecting different, yet complimentary data.

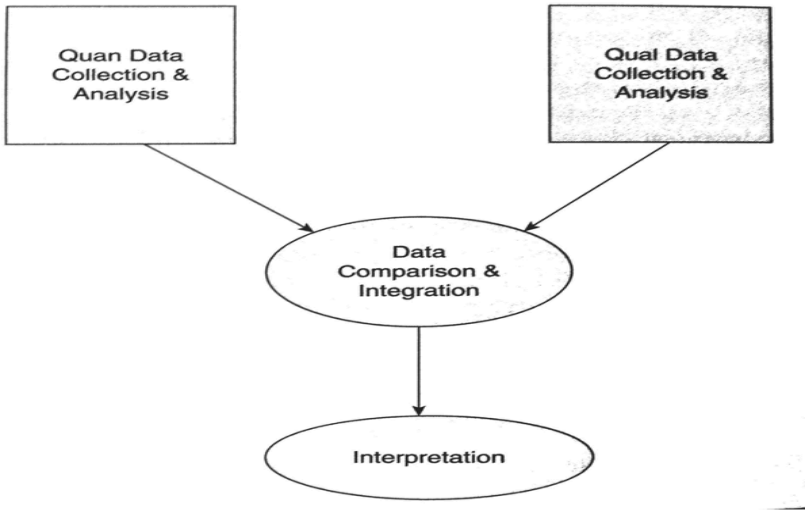

Figure 2. Display of Convergent Parallel Design (DeCuir-Gunby & Schutz, 2017, p. 92)

According to DeCuir-Gunby and Schutz (2017), "the quantitative and qualitative data are designed to support each other, demonstrating that [the researcher] is making the same claims using different types of data" (p. 92). In terms of this study, quantitative data included a questionnaire, featuring Likert-type items, compositional product ratings, and a quantified time analysis from video observations. Qualitative data included open-ended questions from the questionnaire and semi-structured interviews. The questionnaire in this study contained both quantitative and qualitative items. According to Johnson and Turner (2003), the convergent parallel design is ideal for questionnaires with mixed items. Quantitative and qualitative responses were first analyzed separately. Results were subsequently integrated and appropriate conclusions were made.

Selection of Sites and Entry into the Field

This study was conducted at Mid-City School (MCS), the pseudonym for an independent school located in a major urban city in the Southeast. MCS is a member of the Southern Association of Independent Schools (SAIS). The school serves 382 students, ranging from 3-year-olds to 7th grade. The school asserts itself as one of the most diverse school populations among independent schools in the area, with 47% of the school's students identifying as children of color. School administration gave no specific breakdown of demographics pertaining to the school student population. Further, no public records of demographic information were found. To reflect the community that MCS serves, financial aid is offered to those families that need additional assistance. Approximately 17% of school families receive financial aid. As part of the educational philosophy of the school, every student has a right to learn as their "authentic self," as a unique learner. Students learn by doing, incorporating project-based learning experiences as a means to solve problems and become innovative solution builders. Instructional design is flexible, as collaboration among grade level teachers is expected. The school is not bound by state educational requirements but adheres to guidelines as recommended by the SAIS. Communication skills are a key component for the vision of the school. Every child is encouraged to find their "voice" and develop communication skills to make their voice heard.

Entry into the Field. Prior to the current research study, I conducted a pilot study at MCS with 5th grade participants. Following permission from the cooperating music teacher, the Head of School at MCS approved my entry into the field. A permission letter was composed by the administration, as part of my successful IRB application for work on my pilot data.

Researcher-Classroom Teacher Relationship. The cooperating music teacher at the school site and I had a preexisting professional relationship. I had been an instructor for the Fall 2017 offering of an undergraduate General Music in Early Childhood course, and the

cooperating teacher had hosted several observation sessions and teaching demonstrations for my students as part of the course.

Classroom Context. The cooperating teacher occasionally integrated collaborative activities with students during formal music instruction. Creative activities, particularly composition, were not typically part of the regular curricular model at MCS. Furthermore, technology was rarely incorporated into classroom practices. Each student in the school was assigned an individual iPad tablet at the beginning of the school year. GarageBand was a standard tablet application on every student iPad at the school site. A detailed description of GarageBand and its features were outlined on page 38 of Chapter 2.

While the cooperating teacher was integral to the completion of the pilot study, she was not a part of the current study as she took a leave of absence when the study was conducted in the spring of 2018. An interim teacher was already selected for replacement and the researcher was active in communicating with the interim teacher regarding the current study, its protocols, and its implementation. The interim teacher was presently employed at the school site as a general music instructor for 6th and 7th grade classes. The role of the interim teacher for this study included a general presence in the room, as required by law, and responsibility for students who chose not to participate in the study.

Selection of Participants

The target participant population for this study was upper elementary students, focusing particularly on two classes of fourth-grade (N = 40) students in one independent school located in a major urban city in the Southeast. This study used purposeful sampling. According to Creswell (2013), purposeful sampling gives the researcher freedom to select individuals and sites for a study so that "they can purposefully inform an understanding of the researcher problem and

central phenomenon in the study" (p. 156). As technology was central to the research questions of this study, the availability of iPads in the selection site was crucial in initiating the research activity. Every student at MidCity School was assigned an iPad at the beginning of the school year. The daily use and availability of iPads at MidCity School was a primary factor in selecting the site for the study, as well having the appropriate age group to recruit participants. Prior to the current study, fifth grade students (N = 34) at the same school site participated in a pilot study. The pilot study included the Collaborative Composition Through Technology Assessment (CCTTA) questionnaire and data collection protocols of the collaborative composition activity. All students who wished to be included in the study, within the parameters of 4th grade, intact classes, were allowed to do so.

Study Procedure. The two classes that comprised the sample were intact, heterogeneous classes. Participants who were assigned to groups by the researcher were divided into groups of three. Optimal collaborative membership can range from two to six members (Kaplan & Stauffer, 1994). In prior research related to technology-mediated collaborative composition, student groupings consisted of two to three members (Charissi & Renta, 2014; Dillon, 2003; Gall & Breeze, 2008; Hewitt, 2008; Wallerstedt, 2013). As the total number of participants per class did not allow for all groups to have a total membership of three, two of the assigned participants were placed in one of the existing groups for a total of four members in the respective group. Participants who were instructed to select their own groupings were encouraged, but not required, to form into groups of three. No participants who were asked to select their own members were forced into groups, as to meet the encouraged group membership of three. The selected grade level totaled two classes at the school site. For purposes of this study, the classes were referred to as Class A and Class B.

The literature is clear regarding the impact of group selection. While some researchers argued the importance of working with friends (MacDonald, Miell, & Morgan, 2000), others stressed the necessity of grouping students based on musical ability (Burnard & Younker, 2008; Hewitt, 2008). In an effort to balance group selection, students in Class A (n = 20), were assigned to groups according to musical ability. Prior to her leave of absence, the cooperating teacher created a class list of students in Class A categorized by their music ability from their regular music classes. Music grades based on classroom music activities were part of the cooperating teacher's categorization process. Based on these recommendations, the researcher created the group assignments for Class A and initiated these assignments. Each group consisted of members with both high and low music scores, as categorized by the cooperating teacher. Class A had a total of six assigned groups. Four groups contained three participants and two groups contained four participants. Class B (n = 20) participants were given the freedom to create their own groupings with researcher assistance to ensure that group assignment commenced in an orderly fashion. Class B had a total of seven groups. Four groups consisted of three participants, two groups consisted of two participants, and one group consisted of four participants. Once groups were formed, students were placed in various areas of the music classroom, as instructed by the researcher. The interim teacher was present in all classes, as required by law. The interim teacher had no role in the facilitation of the current study. The interim teacher was, however, responsible for those students who chose not to participate in the current study.

Researcher Role. My roles at this school site were as a researcher and facilitator. Researcher roles included audio/visually recording collaborative group sessions, conducting interviews, and administering the questionnaire. In addition to my role as researcher, I took on an

active role in the music classroom at MCS by implementing and facilitating all phases of the current study. Having expert knowledge in GarageBand software and iPad use, my role as facilitator was to ensure that participants understood the basic functions of the iPad interface. As the compositional activity was open-ended in structure, facilitation was necessary to establish a basic level of competency in GarageBand for all participants. The implementation of the pilot study in March of 2018 gave me a preexisting active presence at MCS. This existing presence allowed myself as a researcher to understand established behaviors and regulations at the school site. This understanding was critical as a participant observer, according to DeWalt and DeWalt (2011), for learning how children react and respond in the context of MCS.

In an effort to show appreciation to the school community for their participation in this study, I agreed to rehearse and direct the school chorus during the cooperating teacher's leave of absence. The school chorus rehearsed after school every Thursday for one hour from 3:15 pm to 4:15 pm. The school chorus consisted of approximately 75 students from grades two through seven. Many of the students who participated in the current study, or previously participated as part of the pilot study, were members of the school chorus.

Data Collection Methods

Data Sources

CCTTA Questionnaire. The Collaborative Composition Through Technology Assessment (CCTTA) was a paper-and-pencil questionnaire developed for the quantitative portion of the current study (see Appendix B). The CCTTA was administered immediately following completion of the compositional activity. All participants completed the CCTTA. This questionnaire was designed to gather data regarding students' attitudes of collaboration, based on their group assignment in a technology-mediated composition activity. The CCTTA was adapted

by the researcher from previous surveys related to student collaboration (McManus & Gettinger, 1996; Rossing, Miller, Cecil, & Stamper, 2012; So & Brush, 2007; Veenman, Kenter, & Post, 2000). According to Johnson and Morgan (2016), adapting gives the researcher flexibility in retaining original items, revising items to fit the need of the context, and develop new items to fill in possible gaps.

The survey consisted of 17 Likert-type items, six open-ended questions, and seven nominal/ordinal items pertaining to demographics and musical/technological experience. There has been an on-going debate throughout the literature regarding point selection in Likert scale survey design. Krosnick and Presser (2010) suggested that in terms of reliability, some scale lengths are preferable, particularly 5- or 7-point scales, noting that the studies "generally support the notion that reliability is lower for scales with only two or three points compared to those with more points, but suggest that the gain in reliability levels off after about seven points" (p. 272). The CCTTA included seven-point Likert scaled items.

One item in the CCTTA pertained to gender identification. For purposes of analysis, the item was dichotomous in nature, giving only the choices of "male" or "female." The item, however, was worded in a manner conducive to selecting a gender choice that the participant identified with, rather than biological in nature.

The CCTTA comprised three sections pertaining to collaboration. The first section was designed to gather data concerning the overall nature of collaboration among students, specifically students' preferences for group learning. This section was adapted from McManus and Gettinger's (1996) student survey rating of third-grade students' positive and negative aspects of working in groups. This survey was implemented in the general classroom setting. Items appropriate for use in this study were incorporated into the first section of the CCTTA.

The second section of the CCTTA measured students' perceptions of group interactions during collaboration and was adapted from portions of two surveys. The portion of the first survey was associated with cooperative learning and student attitudes in the primary school setting (Veenman et al., 2000). The portion of the adapted survey was related to students' attitudes of interaction in a collaborative environment. Items appropriate for use in this study were incorporated into the second section of the CCTTA. Additionally, So and Brush (2007) developed a survey for collaborative learning in a blended learning environment. One portion of that survey measured students' attitudes of social presence in a collaborative setting. Concerning group interactions, social presence was defined to include communication, a feeling of connectedness, and the development of interpersonal relationships. The third section of the CCTTA measured students' attitudes toward technology in the context of collaboration and music composition. The third section of the CCTTA was adapted from Rossing et al. (2012). In that study, a survey was designed to measure the perceptions of university students' learning with mobile tablets, specifically iPads. Specific items from this survey were deemed age-appropriate for the participant population of the current study. Further, both open-ended questions from Rossing et al.'s study were unchanged when used for the current study.

The CCTTA was accompanied by open-ended questions to allow students opportunities to further elaborate on their perceptions of collaboration. Advantages to open-ended questions in survey construction allow participants the opportunity to elaborate on Likert items in their own words, with the possibility of more closely describing their real views (Fowler, 2012). Open-ended questions followed each respective section in the questionnaire and were adapted from the previously mentioned sources, as listed in the overall CCTTA construction.

The CCTTA contained seven additional items equally important to the Likert scaled items and open-ended questions. One item was nominally scaled to represent the participants' gender identification. The remaining six items were ordinally scaled to gather information on the participants' previous and current experience with music activities and technology, respectively.

Interviews. In the current study, the researcher conducted semi-structured interviews at the conclusion of questionnaire implementation (see Appendix A). The researcher randomly selected ten students, five per class, to participate in interviews. Interviews were based on Roulston's (2010) guidelines for semi-structured interview design. According to Roulston, semi-structured interview questions are used as a "guide" or starting point. While questions may not be asked in sequential order, follow-up questions can be initiated in an effort to uncover a deeper understanding of the original guiding question. Open-ended questions used in the semi-structured interviews were similar in scope to Faulkner's (2003) interview methods. In his study, Faulkner used interviews as a primary means to investigate perceptions of group composing in students aged 11-15. Many of the questions in Faulkner's semi-structured interviews were appropriate for use in the current study. In addition, the interview format allowed for elaboration of CCTTA responses resulting in a rich description of students' perceptions of working in collaborative groups, gathered insights related to participants' interactions during the composition activity, and attempted to gain an understanding of technology as a mediation tool for composition.

Participant Observation. Observation is a primary form of data collection in qualitative research (Creswell, 2013). According to Creswell, the researcher must identify their role or position in the observational process. These positions can be as a participant, non-participant, or middle ground. In the current study, I assumed the position of participant observer, which signified "taking part in the daily activities, rituals, interactions, and events of a group of people

as one of the means of learning… aspects of their life routines" (DeWalt & DeWalt, 2011, p. 1). As a participant observer, I assumed the position of facilitator in all aspects of the study. From the six to seven collaborative groups formed in each class, I selected four groups for audio/visual recording, for a total of eight groups. The primary purpose for audio/visually recording eight participant groups was for analysis of each groups' compositional processes and communication modes. Previous research has examined the nature of collaboration in a socio-cultural environment (Burland & Davidson, 2001; Burnard & Younker, 2008; MacDonald, Miell, & Morgan, 2000; Wiggins, 1994), as well as the use of verbal and non-verbal communication (Hewitt, 2008; Wallerstedt, 2013). The primary purpose of participant observation in this study was to examine the nature of students' interactions in the context of a technology-mediated musical composition activity, with specific regard to compositional processes and verbal and musical communication.

Time Analysis. Data related to students' compositional processes and communication was time analyzed and correlated with the students' respective group assignments. The time analysis yielded a percentage of researcher-observed compositional processes and tallies of communication utterances for each student group. The final compositional percentages and communication totals were analyzed and compared to group assignments.

Audio-visual recordings. The use of audio-visual recording was also employed. Audio-visual recordings were analyzed for indications of each student group's compositional processing and communication utterances during the activity.

Product Rating Scale. The final collaborative group compositional products were assessed by independent raters (see Appendix C). These raters were fellow doctoral students with practitioner knowledge of creative activities. To assess the overall quality of the composition,

raters scored compositional products from an instrument designed to assess various constructs of children's creative works (Hargreaves, Galton, & Robinson, 1996). The scoring scale was a variant of the original scale which consisted of a series of 14 bipolar constructs and was scored on a 7-point Likert scale. That measurement scale, in adapted forms, had been used considerably in previous research in regard to collaborative composition (Burland & Davidson, 2001; Miell & MacDonald, 2000; Morgan et al., 2000). For the variant scale used in the current study, ten constructs were deemed appropriate for technology-meditated assessment. They were as follows: evocative-unevocative; unvaried-varied; simple-complex; unoriginal-original; ineffective-effective; unstructured-structured; ambitious-unambitious; disjointed-flowing; aesthetically unappealing-appealing; and, technically unskillful-skillful (in reference to technology-mediation). The final score for each composition was a mean score taken from all independent rater scores. The purpose of rating the final compositional products was to assess the quality of works in relation to group assignment. The use of final composition product scores has been used in prior research in terms of collaborative composition. For instance, group scores have been analyzed in conjunction with group assignments and gender (Burland & Davidson, 2001; Hopkins, 2015) and communication (Morgan, Hargreaves, & Joiner, 2000).

In summary, Table 1 illustrates the research questions of the current study, the related data sources, and their connections to theory.

Table 1

Research Questions, Data Sources, and its Connection to Theory

Research Questions	Data Sources	Connection to Theory
How do upper elementary students perceive collaboration in a group-based, technology-mediated music composition activity?	CCTTA questionnaire (Likert items and open-ended responses) Interviews	According to Dewey (1938/2015), an individual's past experience can shape the present experience through the context of collaboration (also known as situational influence).
Is there a significant difference in students' perceptions of collaboration based on their group assignment, as measured by the CCTTA?	CCTTA questionnaire (Likert items)	Situational influence may be shaped from specific groupings.
Based on group assignment, are there differences in the nature of students' interactions in collaboration?	Participant observation Interviews	Communication (verbal and non-verbal gestures) as how one sees themselves in the environment around them. The roles that one plays depends on the setting (Mead, 1938).
How is the quality of students' compositional products influenced by group assignment?	Composition Product Score	The use of Activity Theory as a means to understand how collaborative compositional experiences through group membership can affect the final product (Barrett, 2005).

Data Collection Procedures and Implementation

Data collection for this study took place in six regularly scheduled general music class sessions, three sessions for Class A and three sessions for Class B. No data were collected until the study was approved by Georgia State University's Institutional Review Board. Data collection occurred during the participants' regularly scheduled general music time. Each class period spanned 55 minutes in length, meeting once weekly.

The compositional activity for each of the four selected groups was recorded by one camera per group, placed at an angle to capture interactions throughout the compositional activity. Groups were placed in various corners of the music classroom, in an effort to reduce external noise during the activity. In the pilot study, groups were also recorded by camera during the compositional activity. All participant voices were clearly understood and interactions were distinctly recognized. Since the current study took place in the same music classroom, similar recording protocols were adopted.

Study Phases

The study was divided into four phases: (1) Phase One: GarageBand Tutorial/Individual Exploration; (2) Phase Two: Collaborative Composition Activity; (3) Phase Three: Questionnaire Implementation; and (4) Phase Four: Student Interviews. Each phase will be described below.

Pre-Phase. Prior to Phase One initiation, the researcher introduced the study in a preliminary visit to the potential participants in their regular fourth grade classroom. Students were given an overview of the study and they were invited to participate. Students were asked to take home a parent Consent Form (see Appendix D). Prior to the start of Phase One, students with signed parental Consent Forms were read a verbal assent script (see Appendix E) by the researcher. Affirmative responses to the assent script were marked on the parental form. Only students with signed parental consent forms and affirmative assent responses were invited to participate in the current study. There was no power relation between the researcher and the participants, as the current study had no influence on participants' grades.

Students who chose not to return the parent permission form and/or affirm the assent script remained in the classroom under the supervision of the interim music teacher. Non-participating students were assigned an individual activity created by the researcher for use on

the students' school-assigned iPad, using headphones as a means to reduce external classroom noise during the study implementation. The non-participating students were seated in a separate part of the music room, away from video recording devices.

Phase One

GarageBand Tutorial. The researcher spent a total of 25 minutes at the beginning of Session One explaining operational procedures for navigating GarageBand. At the research site, each student received a school-issued iPad tablet at the beginning of the school year. Every student-issued tablet was updated to iOS 11, Apple's operating system. Included in this update was GarageBand, version 2.3, for iPad.

As part of the tutorial section of Phase One, the researcher described recording procedures for GarageBand, as well as instrument options for composition. GarageBand offered a variety of instrument choices and percussion beats and loop tracks. The purpose of detailing each instrument choice, along with researcher-led demonstrations, was to make each participant comfortable with the operational procedures of the GarageBand application.

Individual Exploration. The remaining 30 minutes of Session One was dedicated to students' individual exploration of GarageBand. Students were given the freedom to explore sounds and instrument choices within the GarageBand interface, as well as the option to record instrument sounds and test operational procedures as outlined in the Tutorial portion of Phase One. The researcher was available to answer any questions from the participants pertaining to the operation of the interface.

Phase Two

Collaborative Composition Activity. Phase Two occurred during Session Two of the study, as well as the beginning of Session Three. At the beginning of this phase, collaborative

groups were selected. As mentioned previously in the *Selection of Participants* section, collaborative groupings in Class A were assigned by the researcher. The researcher selected groups based on musical ability of each student to create balanced groupings, as established from previous recommendations of the former cooperating teacher. In the interest of time, Class A groups were selected prior to Phase Two. Class B selected their own groups, with the researcher available for facilitation. The selection/assignment of groups took no more than five minutes of the class period. The five minutes designated for the selection/assignment of groups was implemented in the pilot study. Student groups that formed early sat with their group and waited for selection to be completed. In the current study, groups that formed early waited until the compositional activity began to ensure that both classes had equal time in the compositional activity.

Groups were assigned by the researcher to work in various areas of the room, as a means to minimize the noise level for each group during the collaboration time. The researcher assigned one student-issued iPad from each group to be used for the composition activity. All other students were asked to place their student-issued iPads in a secure, common area in the music room. Each group was given an index card with their assigned group name. Each group name was comprised of grade level, class research group, and group number. For example, one group within the 4th-grade class designated as a teacher-assigned group was labeled as 4A1, for purposes of identification in data collection.

The collaborative groups were asked to compose a piece of music in GarageBand. The researcher instructed the student groups that the compositional piece should have a clear beginning and a clear ending (Morgan, Hargreaves, & Joiner, 2000). No further instructions were given to the student groups, in terms of compositional guidance. Wiggins (1999) cautioned that

too many restrictive instructions in compositional activities could hinder the creative process. Prior research, in terms of technology-mediated composition, followed similar open-ended task structures (Cape, 2014; Wallerstedt, 2013). The students were given 40 minutes in Session Two for the composition activity, as well as an additional 20 minutes in Session Three, for a total of 60 minutes for the activity. This timeframe was informed by previous studies that have developed collaborative compositional activities for elementary-aged students that were fewer than 60 minutes in duration (Burland & Davidson, 2001; Hewitt, 2008; MacDonald & Miell, 2000; MacDonald, Miell, & Mitchell, 2000; Wallerstedt, 2013).

At the close of the composition activity, the students' group compositions were transferred to the researcher's computer via AirDrop. AirDrop allows for transfer of files among Apple devices via wireless network. The researcher's computer supported AirDrop and was connected to the school site's wireless network.

Phase Three

Questionnaire Implementation. In Phase Three, students completed the Collaborative Composition Through Technology Assessment (CCTTA). This phase was implemented at the completion of Phase Two, which concluded after minute 20 of Session Three. The purpose of the CCTTA was to assess participating students' perceptions of their collaboration during the Collaborative Composition Activity, as outlined in Phase Two and described on page 48. Before the CCTTA was administered, the researcher explained the process for answering the questionnaire and read the first question as an example. The researcher monitored the class during administration of the CCTTA. Time allotted for completion of the CCTTA was 30 minutes.

All participants completed the questionnaire at the close of Session Three. Every participant answered all Likert items. A small number of open-ended responses were left blank by three participants. Completion of the CCTTA by all participants was achieved in fulfillment of the designated allotted time. In the pilot study, participants also completed the questionnaire in the allotted time.

Phase Four

Student Interviews. In the one to two days following the dedicated class time allowed for the first three phases of this study, ten students participated in interviews. The researcher randomly selected five students from each participating class. Each participant was notified in advance and reminded that they could withdraw from this portion of the study. They were re-informed that they would not be identified in any reporting of the interviews. Each individual interview session was approximately eight to ten minutes in duration. Interviews took place at a time as scheduled by the classroom teacher. All interviews took place in a small, enclosed office located within the general music classroom and were audio recorded for transcriptions to facilitate coding and analysis.

Open-ended questions were included in the interviews (see Appendix A). The primary goal of the interviews was to elicit detailed student responses pertaining to their perceptions of the collaborative compositional activity. Semi-structured, open-ended questions were designed to gather rich data concerning the participants' interactions in collaboration, as well as enable students to provide details of those interactions during the composition activity.

Table 2 provides an overview of all phases, including duration of each phase, as well as data that was collected.

Table 2

Overview of Phases of the Study

	Phase Implementation	Duration	Data Collection
Session One	*Phase One:* GarageBand Tutorial	25 min	Consent/Assent prior to start
	Individual Exploration	30 min	
Session Two	*Phase Two:* Collaborative Composition Activity	40 min	Recorded group observations
Session Three	(cont.)	20 min	Field notes Final group compositions
	Phase Three: CCTTA Questionnaire administration	30 min	CCTTA
Time as scheduled by regular classroom teacher	*Phase Four:* Participant Interviews	8-10 min per participant	Recorded interviews

Data Analysis

Qualitative Data

The qualitative data in this study came from semi-structured interviews and open-ended responses taken from the CCTTA. Data collected from student interviews were audio recorded. Interviews were transcribed for coding and the identification of general themes. Transcriptions were first analyzed using open coding. According to Saldana (2016), coding can be used in two cycles, to capture the complex processes in data. Concept coding and in-vivo coding comprised the first cycle. Concept coding analyzed the conceptual processes of the participants' experiences and perceptions of collaborative activities. In-vivo coding was important in this study, as many of the participants' comments from qualitative data were directly associated with themes derived from concept coding. The second coding cycle in qualitative data analysis was pattern coding,

which condensed several analytic data units. At the conclusion of the data coding cycles, major themes were identified concerning students' perceptions of collaboration.

Quantitative Data

Quantitative data consisted of Likert-scaled items taken from the CCTTA questionnaire, analysis from quantified data of observational audio/visual recordings, and ratings from the Product Rating Scale. Participant responses to the CCTTA were recorded into SPSS, v. 25 for analysis. Likert-scaled items were analyzed using SPSS for descriptive statistics and Chi-square tests. Additionally, independent t-tests were implemented to determine if significant relationships existed between perception scores of student-selected and researcher-selected groupings.

A time analysis of compositional processes and communication utterances from audio/visually recorded observations were quantified and analyzed through SPSS to seek comparisons to group assignment. The time analysis protocol was similar to Kratus' (1989) study of children's compositional processing, where compositional processes were identified and timed during participant observation. A mean of all compositional processes from each collaborative group was taken and quantified into percentages. Individual instances of an identified mode of communication exhibited by respective group members were tallied. Each instance was coded and ultimately quantified into mean percentages of various communication modes. Hopkins (2015) used a similar method of itemizing communicative instances and converting totals into mean percentages.

The Product Rating Scale consisted of three scores per group, representing three independent rater scores. The three scores were totaled and a mean score was produced for each collaborative group. Mean scores were analyzed through SPSS using t-test analysis to seek and identify any significant differences in association with group assignment.

Pilot Study Overview

Three months prior to the current study, a pilot study was conducted at the same school site with 5th grade participants (N = 34). The purposes of the pilot study were: (a) to implement the data collection phases of the current study, and (b) to measure the reliability of the Collaborative Composition Through Technology Assessment (CCTTA) questionnaire pertaining to students' perceptions of the study. The pilot study spanned four weeks.

The implementation of the study phases proved to be successful in the pilot initiation. The study phases remained unchanged for the current study. Furthermore, eight student groups were visually/audio recorded during the course of the compositional activity. Recording procedures, including placement of recording devices, were adjusted for optimal viewing quality for the current study.

The implementation of the CCTTA in the pilot remained unchanged for the current study. While the pilot study version of the CCTTA was not analyzed for results pertaining to research, an inter-reliability analysis was conducted. The pilot study version of the CCTTA was found to be reliable. Cronbach's alpha for the total mean score of the CCTTA was .82. More specifically, internal consistency for each section of the CCTTA was found to reliable. Cronbach's alpha for Collaboration, Interaction, and Technology was .67, .80, and .72, respectively.

One adjustment was made to the CCTTA prior to implementation in the current study. Question 13, "Some kids in my group didn't participate," was a duplicate of Question 6. Question 13 was deleted for the current version of the CCTTA. All other items from the CCTTA were unchanged for the current study.

Limitations

Two common limitations in mixed methods research are less-than-ideal sample size (Ogwuegbuzie & Collins, 2007) and overall length of the study (Gay, Mills, & Airasian, 2009). These two common limitations were present in the current study. The first limitation was the overall length of the study. The researcher was granted full permission by MCS administration to be in the school for the study, including the use of regularly scheduled music classes and additional time for introduction of the study and interviews. This study, however, was limited to the school calendar, as data collection was scheduled for the last three weeks of the school year. Ideally, observations should occur for a longer length of time to assess student collaboration more effectively.

The second limitation was the small sample size resulting from purposeful sampling. Ogwuegbuzie & Collins (2007) recommend that the minimum sample size for correlational mixed-methods research is 64 participants in an effort to gain adequate statistical power. This recommended sample size was not possible in the current study. While the population for this study was purposefully sampled, the limited number of participants yielded results that may not be generalizable.

4 RESULTS AND ANALYSIS

The first section of this chapter reports the findings by data source. Data sources included: the CCTTA questionnaire, the Collaborative Composition Product Rating Scale, video observations, and participant interviews. The second section of the chapter summarizes the findings based on research questions previously posed by the researcher.

CCTTA Questionnaire

All participants completed Likert items of the Collaborative Composition Through Technology Assessment (CCTTA). Data were transferred by the researcher into SPSS Statistics Version 25. This software was used to complete all statistical analysis.

One demographic item was posed in the CCTTA to gain an understanding of the participants' gender identification. The population was relatively evenly distributed between males (n = 21) and females (n = 19). This population can be further presented by group assignment. In the researcher-selected groups (RSG), gender of participants was relatively evenly distributed between males (n = 11) and females (n = 9). In the student-selected groups (SSG), the population was evenly distributed between males (n = 10) and females (n = 10). As previously mentioned in the "Selection of Sites" section of Chapter 2, no specific demographic information for the school site was available. Administrators from MidCity School broadly described the school population as 47% of students identifying as children of color. As a reflection of this disclosed information, the CCTTA did not include items specific to demographic information. Review of the video data, however, inferred that the proportion of race and ethnicity of the participants broadly matched the school's demographic information.

As mentioned in Chapter 3, the CCTTA was comprised of three sections pertaining to participants' perceptions of a technology-mediated collaborative compositional activity. The first

section was designed to gather data regarding participants' preferences for group learning. This section was titled Collaboration. The second section measured students' perceptions of group interactions during collaboration. This section was titled Interaction. The third section of the CCTTA measured students' attitudes toward technology, particularly in the context of collaboration and music composition. This section was titled Technology. Additionally, a fourth section followed the three sections of the CCTTA. This section was designed to gather information regarding participants' prior and current musical experiences, along with participants' prior and current experiences with technology. This section was titled Music and Technology Experience.

The CCTTA was found to be reliable. An analysis was performed by the researcher to ascertain the internal consistency of the questionnaire. Cronbach's alpha for the total mean score of the CCTTA was .88. More specifically, internal consistency for each section of the CCTTA was found to reliable. Cronbach's alpha for Collaboration, Interaction, and Technology was .80, .83, and .70, respectively.

Questions 1-8, Collaboration section

The collaboration section of the CCTTA consisted of six Likert items pertaining to group learning. These items were based on a 7-point scale, from 1 being "strongly disagree" to 7 being "strongly agree." Additionally, Questions 7 and 8 were open-ended questions designed to gather a more detailed description of participants' perceptions related to their respective preference to group work.

Questions 1-6. Table 3 presents descriptive statistics for Questions 1-6. Means and standard deviations are listed for each item, and categorized by group assignment. Furthermore, the overall mean and standard deviation for participants' perceptions of Collaboration is listed.

Table 3

Descriptive Statistics for Collaboration Section of CCTTA, Based on 7-point Scale

	RSG (n = 20)		SSG (n = 20)	
Item	M	SD	M	SD
1. I liked working with my group members.	5.18	1.50	5.50	1.24
2. I feel like I got to know the other kids in my group better.	4.10	1.37	3.30	1.69
3. Some kids in my group didn't participate.*	5.35	1.63	5.80	1.50
4. It's fun to work with other kids when creating new music.	5.48	1.87	5.90	1.33
5. It's boring to work in groups.*	5.65	1.60	6.00	1.26
6. The kids in my group got along with each other.	5.32	1.55	5.83	1.31
Total Collaboration Mean	5.17	1.17	5.39	0.95

*reversed scoring used

Analysis of Questions 1-6. An independent t-test was performed on the mean Collaboration score to determine significance between RSG and SSG groups. Results indicated no significance in Collaboration perceptions of RSG participants (M = 5.17, SD = 1.17) over SSG participants (M = 5.39, SD = 0.95), $t(38) = -.62$, $p = .54$.

Question 7: "Would you rather create music in a group or by yourself?" In Question 7, participants were asked their preference of working with others in regard to the recently completed compositional activity. Space was provided below the question for participants to record their response. While the majority of students wrote their preference in the space provided, others circled their preferred choice from the typed question itself. Results from the

RSG indicated that 8 participants (40%) preferred to work in a group and 12 participants (60%) preferred to work independently. Results from the SSG group indicated that 15 participants (75%) preferred to work in a group and that five participants (25%) preferred to work independently. The total from both groups indicate that 23 participants (58%) preferred to work in a group, while 17 participants (42%) preferred to work independently. Results are shown below in Figure 3.

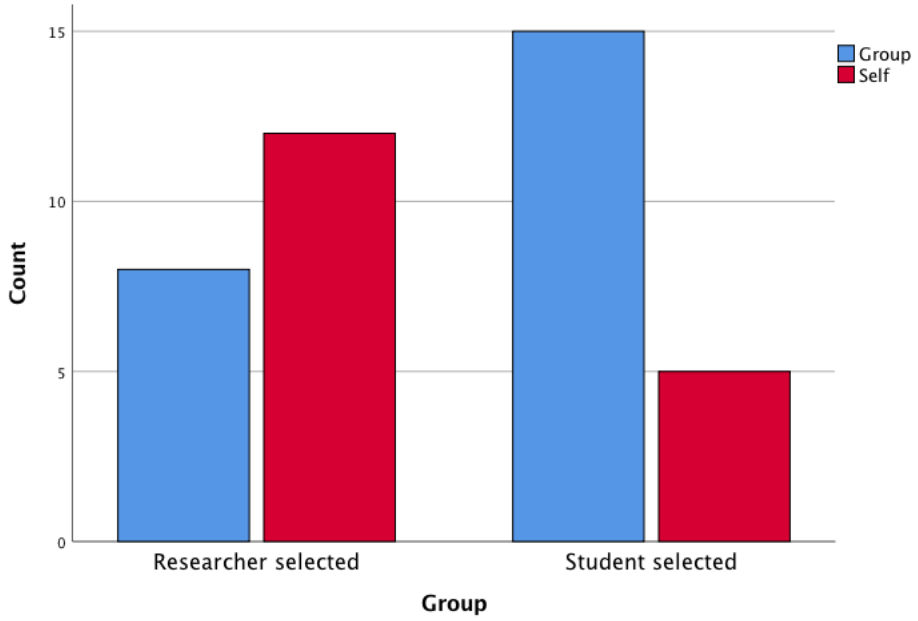

Figure 3. *Participant preference of collaborative work or independent work.*

Question 7 analysis. A chi-square of independence analysis was performed between RSG and SSG to determine if there was a significant relation in participants' preference for working collaboratively on the compositional activity. The relation of activity preference between groups was significant, X^2 (1, N = 40) = 5.01, p = .03. The findings from the analysis showed that students in the SSG group preferred working in groups over the RSG, which preferred to work independently in lieu of their selected group.

Question 8: "Why did you answer that way?" Question 8 was an open-ended question designed to gain a deeper understanding of Question 7 responses. Participants provided a written explanation as to their preference for group work on the compositional activity. From the written answers provided, two categories were identified from participants who preferred working in groups. One category was identified for those who preferred working independently.

Group Work Category I: Enjoyment. From the 23 participants that preferred working in groups, eight participants listed enjoyment with others as why they selected this method of working.

- "It's fun to work with people" (RSG, Male, Questionnaire ID #6)
- "I like working with other people" (RSG, Female, Questionnaire ID #19)
- "Because it is fun and exciting to work in a group" (SSG, Female, Questionnaire ID #24)
- "It is more fun to work in groups" (SSG, Male, Questionnaire ID #28)
- "It is more fun to learn [with] the people in your group" (SSG, Female, Questionnaire ID #34)

Group Work Category II: Multiple Voices. Participants that preferred group work appreciated ideas and opinions from their fellow group mates, as a means to create a higher quality final product.

- "Because you have more than one opinion" (RSG, Male, Questionnaire ID #8)
- "Because I like that there is what other people think is cool in the music" (RSG, Male, Questionnaire ID #9)
- "Because you get to talk with other people and you get new ideas and tips" (SSG, Female, Questionnaire ID #25)
- "I think everybody should put [their] ideas together" (SSG, Male, Questionnaire ID #29)

- "Because I liked seeing how everybody's music is different" (SSG, Male, Questionnaire ID #32)
- "You can work with friends, collaborate, share ideas to make better music" (SSG, Female, Questionnaire ID #37)

Independent Work Category: Freedom of Decision. Those participants who preferred working independently cited the freedom to make their own musical decisions as the primary reason for not wanting to work with others. Several participants, however, mentioned that they although they enjoyed working in their respective group, they would still prefer independent work over group work.

- "Because I get to make my own decisions" (RSG, Female, Questionnaire ID #3)
- "Because then I would be able to choose what music to put in the song" (RSG, Female, Questionnaire ID #7)
- "Because I would have been able to make it just the way I want" (RSG, Male, Questionnaire ID #14)
- "Because sometimes [group members] do not agree with your choices. Also, they could not like your music" (RSG, Female, Questionnaire ID #17)
- "It would be easier, and you could do what you want" (SSG, Female, Questionnaire ID #22)
- "It is easier to make and decide what to do when you are the one in charge" (SSG, Male, Questionnaire ID #38).

Questions 9-16, Interaction section

The Interaction section of the CCTTA consisted of six Likert items pertaining to working together in a collaborative setting. These items were based on a 7-point scale, from 1 being

"strongly disagree" to 7 being "strongly agree." Additionally, Questions 15 and 16 were open-ended questions.

Questions 9-14. Table 4 presents descriptive statistics for Questions 9-14. Means and standard deviations are listed for each item, and categorized by group assignment. Furthermore, the overall mean and standard deviation for participants' perceptions of Interaction are listed.

Table 4

Descriptive Statistics for Interaction Section of CCTTA, Based on 7-point Scale

	RSG (n = 20)		SSG (n = 20)	
Item	M	SD	M	SD
9. I was able to share the music I created with my group.	5.12	1.82	5.45	1.82
10. My music suggestions were used in the group composition.	4.73	1.65	5.35	1.76
11. When we worked in groups, I feel like I did my best in helping with the composition.	5.65	1.50	5.90	1.37
12. I think our group was focused on the composition and didn't play around.	5.13	1.52	5.30	1.30
13. My group members helped each other out when working on our composition.	5.45	1.57	5.65	1.50
14. I was happy with my group's final composition.	5.23	1.98	6.30	1.38
Total Mean	5.22	1.25	5.65	1.10

Analysis of Questions 9-14. An independent t-test was performed on the mean Interaction score to determine significance between RSG and SSG groups. Results indicated no

significance in Interaction perceptions of RSG participants (M = 5.22, SD = 1.25) over SSG participants (M = 5.65, SD = 1.10), $t(38) = -1.18$, $p = .24$.

Independent analysis of Item 14. While Item 14 was included in the Interaction section of the CCTTA, an additional t-test was performed due to the item's relationship to the final compositional product. Results for Item 14 indicated a marginally significant difference in participants' overall final compositional product, where the SSG (M = 6.30, SD = 1.38) may have had a more positive perception than the RSG (M = 5.23, SD = 1.98), $t(38) = -.41$, $p = .053$.

Question 15: "What was your favorite part about working in your group?" Question 15 was an open-ended question designed to gain a deeper understanding of the group dynamic of interaction during the compositional activity. Participants provided a written explanation as to their favorite part of working with their respective group. From the written answers provided, two categories were identified from participants' favorite part of working in a collaborative group.

Category I: Getting ideas from others. Many participants, primarily in the RSG, expressed their favorite part of group work as gaining ideas from other members. Of the 20 participants in the RSG, 10 participants (50%) expressed their favorite part of group work as a means of collaboration with others.

- "Getting to hear other ideas and strategies" (RSG, Female, Questionnaire ID #3);
- "Trying what other people thought" (RSG, Male, Questionnaire ID #5);
- "We made a good song together with teamwork" (RSG, Female, Questionnaire ID #7);
- "That everyone was ok with someone else sharing their opinion" (RSG, Male, Questionnaire ID #9);

- "Seeing what my partners would do" (RSG, Female, Questionnaire ID #17;)
- "My favorite part about working in a group is that everyone has different ideas and it's fun combining all the ideas" (SSG, Female, Questionnaire ID #21).

Category II: Working with friends. Many participants, primarily in the SSG, expressed their favorite part of the compositional activity as having the opportunity to work alongside their friends. Of the 20 participants in the SSG, eight participants (40%) expressed their favorite part of group work as a means of collaboration with others.

- "Getting to be with my friends and using our iPads" (SSG, Female, Questionnaire ID #22);
- "I was with my friends and I could do work with someone" (SSG, Male, Questionnaire ID #33);
- "Creating music with my friends…and the music" (SSG, Female, Questionnaire ID #37).

Question 16: "What was your least favorite part about working in your group?" Question 16 was an open-ended question designed to gain a deeper understanding of the group dynamic of interaction during the compositional activity. Participants provided a written explanation as to their least favorite part of working with their respective group. From the written answers provided, two categories were identified from participants' least favorite part of working in a collaborative group.

Category I: Group dynamics. As RSG and SSG were selected in different ways, the dynamics of each group varied. These differing dynamics were expressed particularly through Question 16 in the form of two subcategories.

Integration of individual ideas not fully realized. Many participants expressed their least favorite part of working collaboratively as not having their musical ideas put into the final

compositional product. In some examples, ideas were originally incorporated, but ultimately deleted by overall group consensus. For other participants, individual ideas were not even considered.

- "Not putting in everything I wanted" (RSG, Male, Questionnaire ID #5);
- "The music we made was not really my idea" (RSG, Female, Questionnaire ID #7);
- "My idea did not get saved as much as I liked" (SSG, Male, Questionnaire ID #32);
- "We had to delete one of my contributions" (SSG, Female, Questionnaire ID #35).

Unequal role assignments. Exclusive to the RSG was frustration in how participants were able to contribute to the composition. In several responses, RSG participants felt like unequal contributors in their ability to express their individual ideas, as other members would dominate the activity.

- "When someone else would take over" (RSG, Female, Questionnaire ID #11);
- "Some people did not agree and get a chance to do anything" (RSG, Female, Questionnaire ID #17);
- "They didn't always listen to my idea" (RSG, Female, Questionnaire ID #18);
- "Is that they didn't let me do anything" (RSG, Male, Questionnaire ID #20).

Category II: Off-task frustrations. Participants emphasized off-task behaviors as frustrating during the activity. There were four specific references to "arguing" from the open-ended responses. Other participants referenced distractions and lack of focus as their least favorite part of working in a group.

- "Sometimes people didn't focus" (RSG, Male, Questionnaire ID #14);
- "Getting distracted with other groups" (SSG, Female, Questionnaire ID #24);
- "That we kind of got off topic" (SSG, Male, Questionnaire ID #28).

Questions 17-23, Technology section

The Technology section of the CCTTA consisted of five Likert items pertaining to group learning. These items were based on a 7-point scale, from 1 being "strongly disagree" to 7 being "strongly agree." Additionally, Questions 22 and 23 were presented as open-ended questions.

Questions 17-21. Table 5 presents descriptive statistics for Questions 17-21. Means and standard deviations are listed for each item, and categorized by group assignment. Furthermore, the overall mean and standard deviation for participants' perceptions of Technology is listed.

Table 5

Descriptive Statistics for Technology Section of CCTTA, Based on 7-point Scale

	RSG (n = 20)		SSG (n = 20)	
Item	M	SD	M	SD
17. I like working with iPads to create music.	6.05	1.88	6.45	0.88
18. I would rather use iPads instead of regular instruments to create music.	5.10	2.13	4.56	1.99
19. GarageBand was easy to use in my group.	6.28	0.91	6.35	1.04
20. Using the iPad motivates me to create more music.	4.75	1.92	5.08	1.49
21. I had difficulty using the iPad when creating music in my group.*	6.30	1.03	5.80	1.82
Total Mean	5.70	1.01	5.65	1.13

*reversed scoring used

Analysis of Questions 17-21. An independent t-test was performed on the mean Technology score to determine significance between RSG and SSG groups. Results indicated no

significance in Technology perceptions of RSG participants (M = 5.70, SD = 1.01) over SSG participants (M = 5.65, SD = 1.13), $t(38) = .15$, $p = .89$.

Question 22: "What did you like about using your iPad to create music?" Question 22 was an open-ended question designed to gain a deeper understanding of the use of technology as the primary means for creating music during the compositional activity. Participants provided a written explanation addressing what they liked about using the iPad for music creation. From the written answers provided, two categories were identified from participants' answers in regard to what was viewed positively from working with this technological device.

Category I: Ease. Participants from RSG and SSG overwhelmingly suggested the ease of the iPad as a means to creating music. From the 40 participant questionnaires, fifteen participants (38%) used the word(s) *ease/easy* in their respective written responses. Many participants offered more detailed explanations of the ease of the iPad, highlighting editing capabilities during music creation. Other participants compared the iPad to the use of "real" instruments, and the convenience of using technology in place of traditional instruments in composition.

- "It was easier than making music with real instruments" (RSG, Female, Questionnaire ID #7);
- "That you could loop some things which made it easier to play" (SSG, Female, Questionnaire ID #22);
- "When we recorded something we didn't want, we could delete" (SSG, Male, Questionnaire ID #29);
- "I liked how easy it was to make music" (SSG, Male, Questionnaire ID #31);
- "It was easy to organize" (SSG, Male, Questionnaire ID #38).

Category II: Variety of choices. Several participants found favor in the variety of choices that GarageBand had to offer, in terms of music creating. Many responses elaborated on what those choices were.

- "How you can add effects and modify your music" (RSG, Female, Questionnaire ID #3);
- "That there were tons of different ways to play music" (RSG, Male, Questionnaire ID #8);
- "I liked it because I could use different instruments at the touch of a button" (RSG, Female, Questionnaire ID #15);
- "I liked that there were a lot of different instruments that you could use and experiment with" (SSG, Female, Questionnaire ID #21);
- "You have all of the instruments to use that you may not own in real life" (SSG, Female, Questionnaire ID #37).

Question 23: "What did you not like about using your iPad to create music?"

Question 23 was the second open-ended question designed to gain a deeper understanding of the use of technology as the primary means to creating music during the compositional activity. Participants provided a written explanation addressing what they did not like about using the iPad for music creation. From the written answers provided, three categories were identified from participants' answers in regard to what was viewed negatively from working with this technological device.

Category I: Interface. Many participants viewed iPad use negatively, primarily from use of the interface. Malfunctions and sound quality were specific examples of technical difficulties that were experiences from the activity. Other participants found the program confusing or

difficult to use, a seemingly opposite trend from the majority of participants that found the iPad interface easy to navigate.

- "It was kind of confusing to work with" (RSG, Female, Questionnaire ID #7);
- "If you press something wrong, you have to restart" (RSG, Male, Questionnaire ID #9);
- "When it froze" (SSG, Male, Questionnaire ID #32);
- "The keyboard is hard to play" (SSG, Female, Questionnaire ID #35);
- "The audio sounded bad recorded on the regular iPad" (RSG, Male, Questionnaire ID #38).

Category II: Physical control. Many participant responses included dissatisfaction with their individual use of physical control of the iPad. This was also expressed previously in Question 16 as some participants believed that unequal role assignments prevented individual musical ideas to be fully realized in the composition.

- "They're always hogging the iPad" (SSG, Female, Questionnaire ID #23);
- "We struggled to share [the iPad]" (SSG, Male, Questionnaire ID #29);
- "When my group members took [the] iPad" (SSG, Male, Questionnaire ID #39).

Category III: iPad not viewed as an "instrument." Several participants expressed their views as iPads not being an equal substitute for traditional instrument use. While participants in Question 22 conveyed the ease of the GarageBand interface as a means for instrument substitution, other participants voiced opinions that real instruments were preferred for composition.

- "How you can't actually use real instruments" (RSG, Female, Questionnaire ID #3);
- "Not playing on real instruments" (RSG, Male, Questionnaire ID #5);

- "I didn't like that it didn't have the same feeling as playing an actual instrument" (SSG, Female, Questionnaire ID #21).

Questions 25-30, Music and Technology Experience section

The Music and Technology Experience section of the CCTTA consisted of six questions related to participants' current and former experience with music and technology. The first part of each question was followed by closed-ended response options. The second part of each question allowed for open-ended responses from the participant for elaboration of their respective answer.

Question 25: "Do you take or have you taken private music lessons?" In Question 25, participants were asked to indicate any prior or current music lessons they may have taken. Participants were given two choices, either marking Yes or No. Space was provided below the question for participants to include what instrument and/or voice that lessons were a part of. Results from the RSG indicated that 11 participants (55%) had taken or are currently taking private music lessons and that nine participants (45%) had not received private music instruction. Results from the SSG group indicate that 12 participants (60%) had taken or are currently taking private music lessons and that eight participants (40%) had not received music instruction. Total responses from both groups indicated that 23 participants (58%) had received music instruction, while 17 participants (42%) had not received music instruction. Results are shown below in Figure 4. Of the 23 participants who acknowledged taking private music lessons, 21 specified answers in the provided space indicating the instrument to which private instruction was given. From the answers provided, 12 participants had piano instruction, six participants had guitar instruction, and two had drum/percussion instruction. Singular answers included violin, ukulele, saxophone, and trumpet instruction.

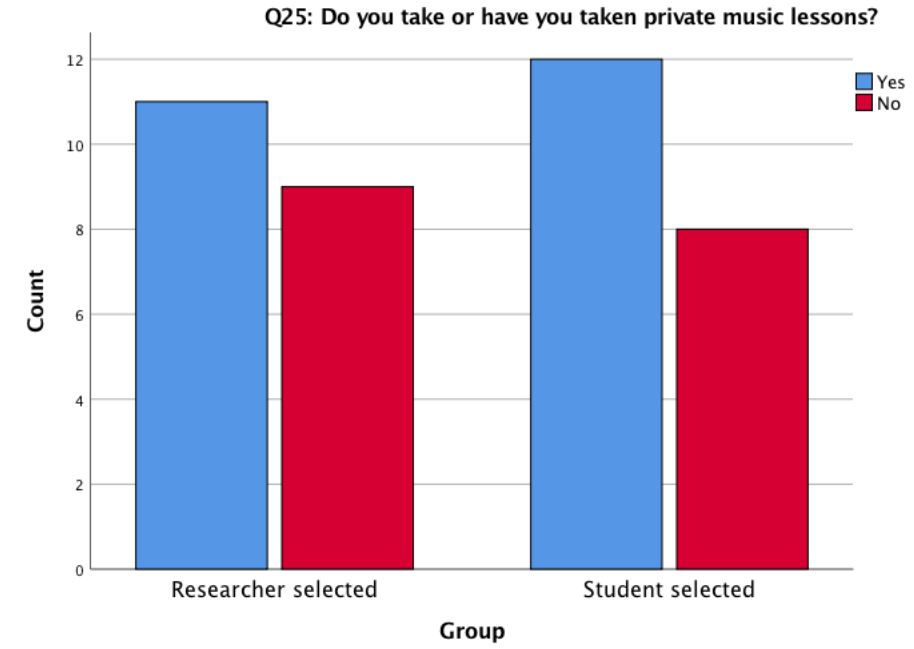

Figure 4. *Frequency of participants' experience with private music instruction.*

Question 25 analysis. A chi-square of independence analysis was performed between RSG and SSG to determine if there was a significant relation in private music instruction. The relation of private music instruction between groups was not significant, X^2 (1, N = 40) = .10, p = .10.

A three-way analysis of variance was conducted to compare the main effects of group assignment, gender, and participation in performance groups and the interaction effect between group assignment, gender, and participation on the overall mean score of the CCTTA. Results indicated no significance between the main effects of group assignment, gender, and participation in performance groups. Although there were no significant two-way interactions, a significant three-way interaction was detected, $F(1,32) = 6.80$, $p = .014$. Examination of the means across conditions shows that males in the RSG with no private music instruction (n = 4)

scored significantly higher in CCTTA perception scores than participants in other conditions (M = 6.08, SD = .43). Similarly, females in the SSG with no private instruction (n = 3) scored significantly higher in CCTTA perception scores than participants in other conditions (M = 6.36, SD = .17). Due to the small sample size and pre-existing conditions among participants in private music instruction (e.g., undisclosed duration of instruction time, prior or current instruction), the causal direction of the interaction is interpreted with caution.

Question 26: "Do you participate or have you participated in any music performing groups?" In Question 26, participants were asked to indicate participation in any prior or current music performing groups. Participants were given two choices, either marking Yes or No. Space was provided below the question for participants to include what performing groups they were a part of. Results from the RSG indicated that nine participants (45%) had participated or are currently participating in a music performing group and that 11 participants (55%) had not participated in a music performing group. Results from the SSG group indicated that 12 participants (60%) had participated or are currently participating in a music performing group and that eight participants (40%) had not participated in a music performing group. Total responses from both groups indicated that 21 participants (53%) had participated or are currently participating in a music performing group, while 19 participants (47%) had not participated in a music performing group. Results are shown below in Figure 5. Of the 21 participants who acknowledged participating in a performance group, 20 participants specified answers in the provided space indicating the type of performance group that the participant was a part of. From the answers provided, 16 participants indicated their involvement with the school chorus. Singular answers included participation in church-based ensembles, piano recitals, and school-wide performances.

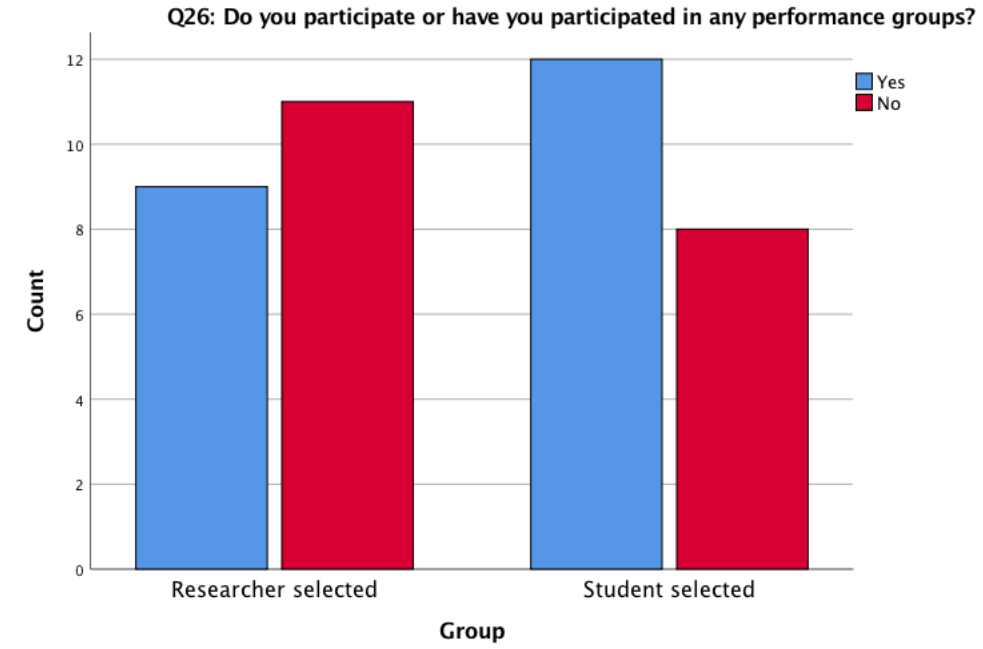

Figure 5. *Frequency of participants' experience with participation in performance groups.*

Question 26 analysis. A chi-square of independence analysis was performed between RSG and SSG to determine if there was a significant relation in performance group participation. The relation of performance group participation between groups was not significant, X^2 (1, N = 40) = .90, p = .34.

A three-way analysis of variance was conducted to compare the main effects of group assignment, gender, and participation in performance groups and the interaction effect between group assignment, gender, and participation on the overall mean score of the CCTTA. Results indicated no significance between the main effects of group assignment, gender, and participation in performance groups. Similarly, there were no significant two-way or three-way interactions detected ($p > .05$).

Question 27: "How would you describe your general use of technology?" In Question 27, participants were asked to rate their perception of general technology use. Participants were given three choices, either marking Not Very Good, Average, or Extremely Good. Results from the RSG indicated that zero participants perceived themselves as Not Very Good, 11 participants (55%) rated themselves as Average, and nine participants (45%) rated themselves as Extremely Good. Results from the SSG indicated that one participant (5%) perceived themselves as Not Very Good, 10 participants (50%) rated themselves as Average, and nine participants (45%) rated themselves as Extremely Good. Total responses from both groups indicated that one participant (2%) perceived themselves as Not Very Good, 21 participants (53%) rated themselves as Average, and 18 participants (45%) rated themselves as Extremely Good. Results are shown below in Figure 6.

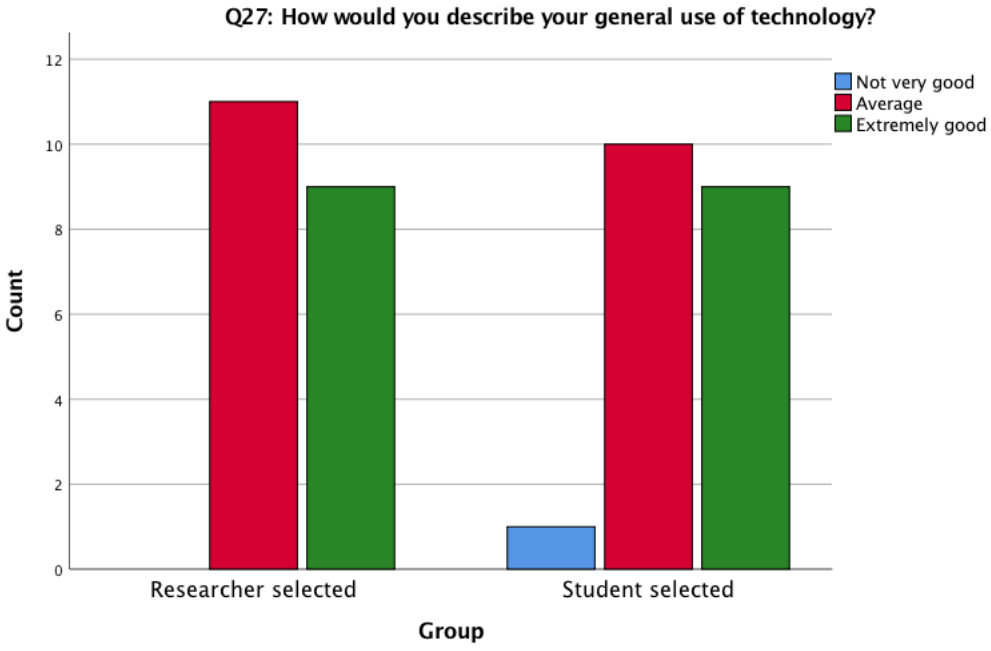

Figure 6. *Frequency of participants' description of general technology use.*

Question 27 analysis. A chi-square of independence analysis was performed between RSG and SSG to determine if there was a significant relation in perceived technology use. The relation of levels of technology use between groups was not significant, X^2 (2, N = 40) = 1.05, p = .59.

A three-way analysis of variance was conducted to compare the main effects of group assignment, gender, and general use of technology and the interaction effect between group assignment, gender, and general use of technology on the overall mean score of the CCTTA. Results indicated no significance between the main effects of group assignment, gender, and general use of technology. Similarly, there were no significant two-way or three-way interactions detected ($p > .05$).

Question 28: "How often do you use technology for music related things?" In Question 28, participants were asked to rate the frequency of technology use specifically for music related functions. Participants were given three choices, either marking Not Often, Sometimes, or All the Time. Results from the RSG indicated that zero participants used technology for music Not Often, 11 participants (55%) used technology for music Sometimes, and nine participants (45%) used technology for music All the Time. Results from the SSG indicated that one participant (5%) used technology for music Not Often, 10 participants (50%) used technology for music Sometimes, and nine participants (45%) used technology for music All the Time. Total responses from both groups indicated that one participant (2%) used technology for music Not Often, 21 participants (53%) used technology for music Sometimes, and 18 participants (45%) used technology for music All the Time. Results are shown below in Figure 7.

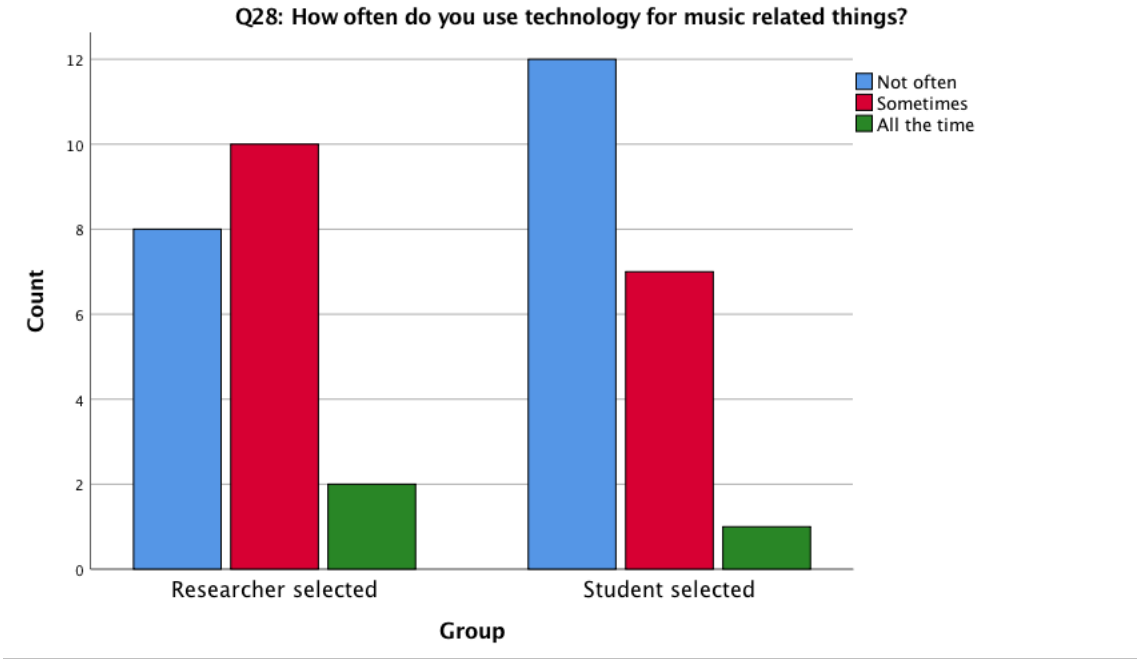

Figure 7. *Frequency of participants' experience with technology for music.*

Question 28 analysis. A chi-square of independence analysis was performed between RSG and SSG to determine if there was a significant relation in technology use for music. The relation of music technology frequency use between groups was not significant, X^2 (2, N = 40) = 1.66, p = .43.

A three-way analysis of variance was conducted to compare the main effects of group assignment, gender, and music-related technology and the interaction effect between group assignment, gender, and music-related technology on the overall mean score of the CCTTA. Results indicated no significance between the main effects of group assignment, gender, and music-related technology. Similarly, there were no significant two-way or three-way interactions detected ($p > .05$).

Question 29: "How often do you use GarageBand?" In Question 29, participants were asked to rate their frequency of the use of the GarageBand music composition application. Participants were given three choices, either marking Not Often, Sometimes, or All the Time. Results from the RSG indicated that 10 participants (50%) used GarageBand Not Often, six participants (30%) used GarageBand Sometimes, and four participants (20%) used GarageBand All the Time. Results from the SSG indicated that eight participants (40%) used GarageBand Not Often, 11 participants (55%) used GarageBand Sometimes, and one participant (5%) used GarageBand All the Time. The total from both groups indicated that 18 participants (45%) used GarageBand Not Often, 17 participants (43%) used GarageBand Sometimes, and five participants (13%) used GarageBand All the Time. Results are shown below in Figure 8.

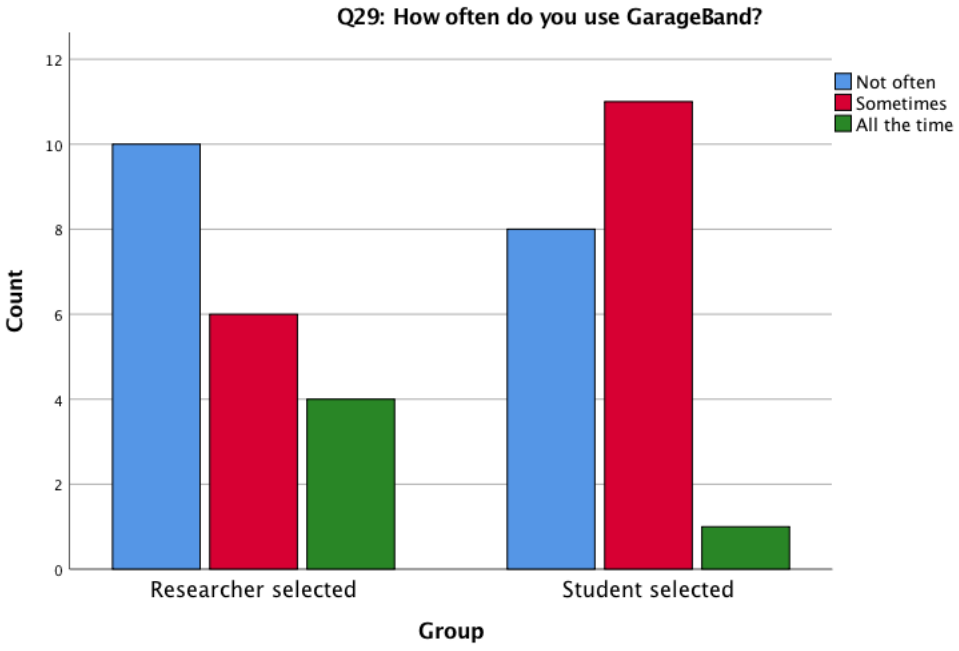

Figure 8. *Frequency of participants' experience with GarageBand.*

Question 29 analysis. A chi-square of independence analysis was performed between RSG and SSG to determine if there was a significant relation in participants' use of GarageBand between groups. The relation of GarageBand frequency use between groups was not significant, X^2 (2, N = 40) = 3.49, p = .17.

A three-way analysis of variance was conducted to compare the main effects of group assignment, gender, and GarageBand frequency and the interaction effect between group assignment, gender, and GarageBand frequency on the overall mean score of the CCTTA. Results indicated no significance between the main effects of group assignment, gender, and GarageBand frequency. Similarly, there were no significant two-way or three-way interactions detected ($p > .05$).

Question 30: "Do you use any other apps for composing?" In Question 30, participants were asked to indicate the use of technology apps, other than GarageBand, for composition activities. Participants were given two choices, either marking Yes or No. Space was provided below the question for participants to include what apps were used, if any. Results from the RSG indicated that two participants (10%) had used composition apps and that 18 participants (90%) had not used composition apps. Results from the SSG group indicate that six participants (30%) had used composition apps and that 14 participants (70%) had not used composition apps. Total responses from both groups indicated that eight participants (20%) had used composition apps, while 32 participants (80%) had not used composition apps. Results are shown below in Figure 9. Of the eight participants who acknowledged use of music composition apps, five participants specified answers in the provided space indicating the application that was used. Singular answers included F1 Studio, Piano Maestro, iTunes, and Medley.

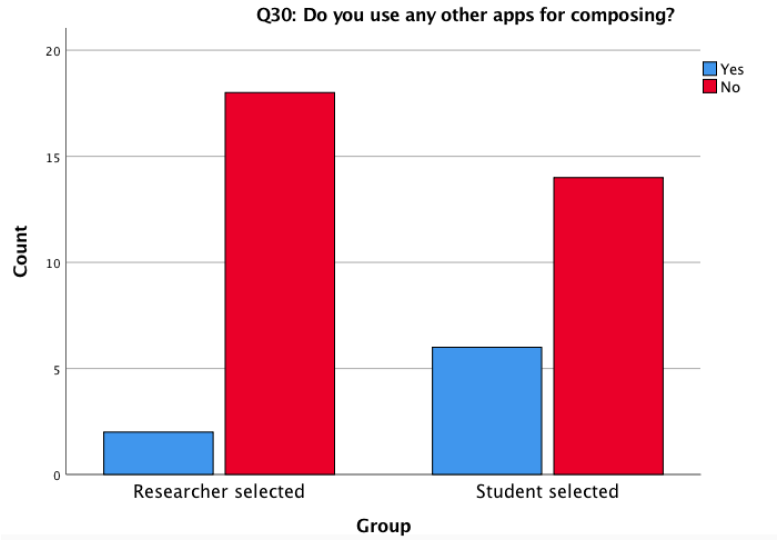

Figure 9. *Frequency of participants' experience with non-GarageBand music applications.*

Question 30 analysis. A chi-square of independence analysis was performed between RSG and SSG to determine if there was a significant relation in participants' use of composition apps, other than GarageBand. The relation of composition app frequency use between groups was not significant, X^2 (1, N = 40) = 2.50, p = .11.

A three-way analysis of variance was conducted to compare the main effects of group assignment, gender, and non-GarageBand application frequency and the interaction effect between group assignment, gender, and non-GarageBand application frequency on the overall mean score of the CCTTA. Results indicated no significance between the main effects of group assignment, gender, and non-GarageBand application frequency. Similarly, there were no significant two-way or three-way interactions detected (p > .05).

Collaborative Composition Product Rating Scale

As previously outlined in Chapter 3, a rating scale was adapted by the researcher to assess the quality of the participant groups' final GarageBand compositions. The product scale

consisted of ten individual constructs related to creative activities. Each construct was graded on a 7-point Likert scale from 1 (least of construct) to 7 (greatest of construct). The minimum score that could be achieved was 7. The maximum score that could be achieved was 70. Three raters viewed the visual/audio presentation from the researcher's files and rated each group's product. A total mean was taken from each of the rater's final score from each participant group. Table 6 outlines each individual score and the total mean for each participant group.

Table 6

Collaborative Composition Product Rating Scale Totals.

Group	Rater 1	Rater 2	Rater 3	Total Mean Score
RSG1	47	35	45	42.33
RSG2	30	51	34	38.33
RSG3	38	25	35	32.67
RSG4	31	39	34	34.67
RSG5	45	36	56	45.67
RSG6	38	38	47	41.00
SSG1	54	43	55	50.67
SSG2	57	67	60	61.33
SSG3	42	42	56	46.67
SSG4	31	40	32	34.33
SSG5	34	30	35	33.00
SSG6	20	25	22	22.33
SSG7	59	51	51	53.67

Scoring patterns from Rater 1 and Rater 3 were similar in scope among group ratings. Scores from Rater 2, however, indicated several outliers that were substantially higher or lower than the other reviewers. This is particularly evident in scores for groups RSG1, RSG2, RSG3, RSG5, SSG1, SSG2, and SSG4. The frequency of such outlier scores may have affected the analysis of the overall Product Rating Scale.

Table 7 displays a ranking of product scores by all groups. Scores are ranked from the highest overall mean score to the lowest overall mean score. Four SSG groups occupy the top four scores from the study, followed by five RSG groups. The remaining scores in the lower part of the rankings are mixed between RSG and SSG scores, respectively.

Table 7

Ranking of Group Product Scores, Based on Overall Mean of Independent Raters

Ranking	Group	Mean Score
1	SSG2	61.33
2	SSG7	53.67
3	SSG1	50.67
4	SSG3	46.67
5	RSG5	45.67
6	RSG1	42.33
7	RSG6	41.00
8	RSG2	38.33
9	RSG4	34.67
10	SSG4	34.33
11	SSG5	33.00

Table 7 (continued).

12	RSG3	32.67
13	SSG6	22.33

Product Rating Scale Analysis

The overall rating score mean for the SSG (n = 7) was 43.14 (SD = 13.69). The overall rating score mean for the RSG (n = 6) was 39.11 (SD = 4.87). An independent t-test was conducted to determine if these scores were significant between groups. Although the overall mean score for the SSG was higher than the RSG, results indicated no significant difference in product scores between groupings, $t(7.71) = -.727$, $p = .489$. Levene's test indicated unequal variances ($F = 7.97$, $p = .02$), so degrees of freedom were adjusted from -.682 to -.727.

Video Observations

In this source, data were gathered from video observations of eight groups (four in RSG and four in SSG) to determine the amount of time spent in compositional processes. Furthermore, a tally of verbal, non-verbal, and off-task communication was gathered.

Time Analysis

Video observations were reviewed to uncover various compositional processes used during the technology-mediated activity. The following compositional processes were observed, along with descriptions that define how each process was determined in the time analysis.

- Sound exploration: Group explores sound sources in GarageBand. The sound exploration is not recorded into composition.
- Compositional development: Group explores sound sources in GarageBand. The sound exploration is recorded into composition. This process ends when group begins to record.

- Selection/Revision. Group begins to record selected sound source. The source is then revised through editing and/or re-recording of selected sound.
- Cumulative review: Group edits/revises composition as a whole entity, revising all sound sources. This is different than the Selection/Revision process, which only revises the selected sound source from the Compositional Development process.

Each process was observed and recorded in seconds by the researcher. The number of seconds for each process was totaled and then converted to minutes and seconds. Table 8 outlines each process by group.

Table 8

Time Devoted to Observed Compositional Processes by Group (minutes:seconds)

Group	Sound Exploration	Compositional Development	Selection/ Revision	Cumulative Review
RSG1	5:05	33:23	14:48	8:24
RSG2	5:37	20:09	21:28	14:41
RSG3	5:23	13:11	25:38	18:34
RSG4	16:39	9:29	19:40	14:47
SSG1	23:28	19:02	12:12	5:12
SSG2	18:33	7:00	26:17	5:13
SSG3	32:23	7:25	9:55	23:40
SSG4	3:29	23:34	20:16	25:31

Independent t-tests were performed to determine any statistical significance between groups in observed compositional processing. Means were analyzed in seconds. In Sound Exploration

(SE), results indicated that time devoted to Sound Exploration of RSG participants (M = 491.00, SD = 306.57) over SSG participants (M = 682.65, SD = 682.65), $t(16.93) = -2.89$, $p = .01$) was statistically significant. Levene's test indicated unequal variances ($F = 6.10$, $p = .02$), so degrees of freedom were adjusted from 23 to 16.93. In Compositional Development (CD), results indicated no significant difference in time devoted to Compositional Development of RSG participants (M = 1143.00, SD = 571.44) over SSG participants (M = 898.23, SD = 460.49), $t(23) = 1.18$, $p = .25$. In Selection/Revision (S/R), results indicated no significant difference in time devoted to Selection/Revision of RSG participants (M = 1223.50, SD = 243.57) over SSG participants (M = 1044.31, SD = 394.49), $t(20.2) = 1.38$, $p = .18$. Levene's test indicated unequal variances ($F = 7.809$, $p = .01$), so degrees of freedom were adjusted from 23 to 20.2. In Cumulative Review (CR), results indicated no significant difference in time devoted to Cumulative Review of RSG participants (M = 846.50, SD = 228.65) over SSG participants (M = 943.00, SD = 609.01), $t(15.55) = -.53$, $p = .60$. Levene's test indicated unequal variances ($F = 89.52$, $p = .00$), so degrees of freedom were adjusted from 23 to 15.55. Figure 10 shows the mean percentage of time used by groups in observed compositional processes.

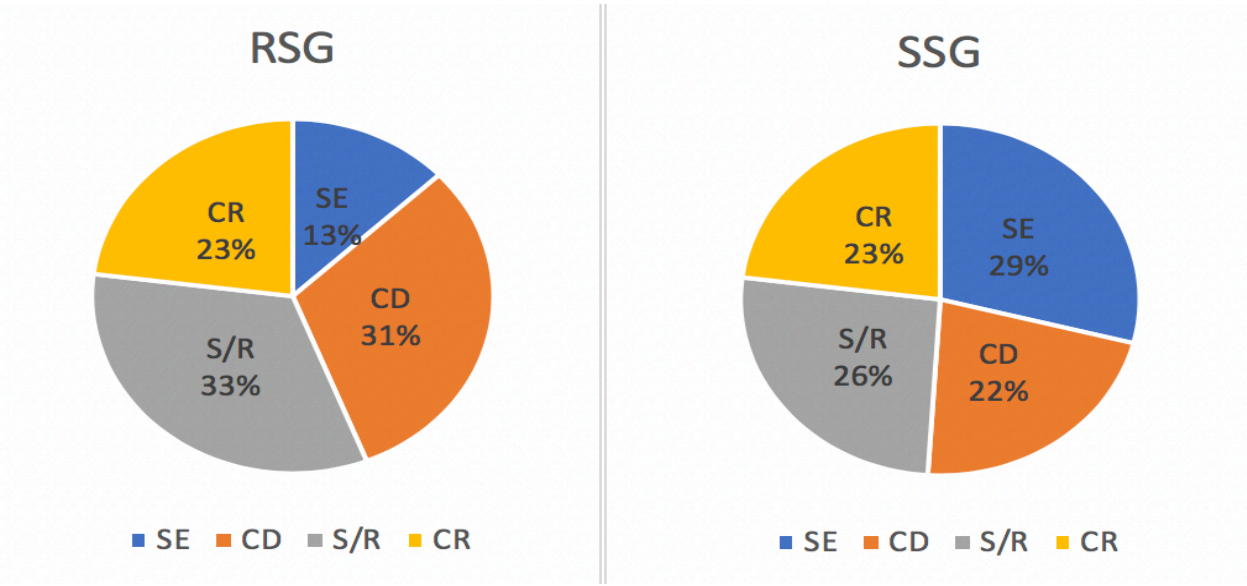

Figure 10. *Mean percentage of compositional processes by group.*

Note. SE= Sound exploration, CD= Compositional development, S/R= Selection and revision, and CR= Cumulative Review.

Communication Modes

Group members' instances of various communication modes were simultaneously tallied by the researcher in the video time analysis. Similarly, the analysis documented instances of off-task behaviors. Communication modes were recorded and coded during the video observation analysis of the compositional activity. Three modes of communication were observed: verbal communication, non-verbal/musical communication, and off-task behaviors. Verbal communication was observed in the form of utterances that groupmates engaged in. Non-verbal/musical communication was observed in the form of physical gestures and musical sounds/patterns during the activity. Off-task behaviors were recorded as verbal or non-verbal occurrences that either distracted from or was not part of the compositional activity.

Verbal Communication. A total of seven distinctive verbal codes were observed: negotiation, discussion, approval, disapproval, arguing, technical, and role assignments. Table 8

outlines verbal codes that were observed during video observation analysis. In Table 9 below, verbal codes are accompanied by code descriptions and participants' examples of verbal utterances.

Table 9

Observed Verbal Communication Codes

Verbal Code	Description	Participant Utterances
Negotiation	Questioning and/or making democratic decisions based on sound sources selected for the group composition.	"Should we do a fade out at the end?" "We could use this for the ending." "We could stop it right here and loop it forever! Let's go to [measure] 9."
Discussion	Dialogue related to the activity as a whole entity, but not related to a pre-selected sound.	"What do you think would be good for dubstep?" "Can we do a different type of guitar, please?" "We still need something for [measures] 25 and 26."
Approval	Verbal approval pertaining to a group decision or action.	"Oh, that sounds cool!" "Perfect timing." "Everybody, I need a high-5 for that!"
Disapproval	Verbal disapproval pertaining to a group decision or action.	"I told you, it's off timing." "That's horrible. That's way off key." "What you did with the drums doesn't sound right to me."
Arguing	Verbal disapproval between two or more group members.	Member 1: "Wait, practice more before you record…" Member 2: "Stop!"

Table 9 (continued).

Technical	Dialogue related to technical aspects of the digital interface.	"How do you get rid of this [sound selection]?' "How do you do multiple instruments at one time?"
Role Assignment	Dialogue related to roles within the group.	"It's his turn to do the instruments." Member 1: "I'll do the drums…" Member 2: "I'll do the muted…"

Non-verbal/musical communication. A total of eleven distinctive non-verbal/musical codes were observed: active listening, singing/chanting, dancing, rhythmic counting, body percussion, hand snatching, head nodding, laughter, eye contact, facial expressions, and pointing. Six codes in this analysis were strictly non-verbal gestures, with no musical context. Table 10 outlines non-verbal/musical codes that were observed during video observation analysis. Non-verbal/musical codes are accompanied by code descriptions of gestures.

Table 10

Observed Non-Verbal/Musical Communication Codes

Code	Description
Active Listening	Group listening of a musical selection with intent make an informed decision on the compositional activity.
Singing/Chanting	Singing of melodies or chanting of lyrics during experimentation or replay of composed musical phrases.
Dancing	Body movement to selected musical passages.
Rhythmic Counting	Counting beats to selected musical passages.
Body Percussion	Using the various parts of the body to beat rhythmic phrases to selected musical passages.

Table 10 (continued).

Hand Snatching	Physically removing or attempting to remove a group members hand to stop control of iPad use during compositional activity.
Head Nodding	Nodding head to either beat of a selected musical passage or as a non-verbal gesture as approval to a musical selection.
Laughter	Laughing at a musical selection, particularly during Sound Development, and especially during the use of Voice Changer feature on GarageBand.
Eye Contact	Making eye contact with another group member with intent to communicate approval of a selected passage.
Facial Expression	Various expressions of the face to express either approval or disapproval of a selected passage.
Pointing	Use of finger to point to a selected passage for greater attention or to non-verbally direct attention to a specific sound choice.

Off-task behaviors. A total of six distinctive off-task behaviors were observed: Camera distraction, looking around, playing around, off-task conversation, walking away, and distracting noises. Table 11 outlines off-task behaviors that were observed during video observation analysis. Off-task codes are accompanied by descriptions of behaviors.

Table 11

Observed Off-Task Behavior Codes

Code	Description
Camera distraction	Group members distracted by means of recording for observations. Observed behaviors included group members playing with device, drawing attention away from compositional activity.
Looking around	Members are distracted by other groups, other items in their assigned area, or looking away from group interactions with activity.
Playing around	Members are engaged with physical "horse play" or using iPad with intent to not engage in compositional activity.
Off-Task Conversation	Members engaged in verbal dialogue that was not focused on the compositional activity.
Walking away	Members would walk away from group.
Distracting Noises	Members would make noises, either with mouth or hands, in an effort to distract other group members from the activity.

Communication Mode Totals and Analysis. It is important to note that each instance of an observed communication mode was recorded as one occurrence. During the analysis, there were several examples of the same code tallied more than once during an observed process, as they were two separate occurrences. For example, group RSG1 used the verbal communication code "Negotiation" two distinct times during one observed session of "Compositional Development." This was marked as two occurrences. Codes within each communication mode were totaled and are listed in Table 12.

Table 12

Communication Mode Totals by Group

Group	Verbal	Non-Verbal/Musical	Off-Task
RSG1	26	27	4
RSG2	44	32	12
RSG3	40	48	1
RSG4	35	25	20
RSG Totals	145	132	37
SSG1	35	28	2
SSG2	20	28	7
SSG3	27	23	3
SSG4	41	22	3
SSG Totals	123	101	14

Independent t-tests were performed to determine any statistical significance between groups in observed communication modes. In verbal communication, results indicated no significant difference in number of codes of RSG participants (M = 36.25, SD = 7.02) over SSG participants (M = 31.54, SD = 8.44), $t(23) = -2.07$, $p = 15$,

$p = .40$. In non-verbal/musical communication, results indicated that the number of codes of RSG participants (M = 33.00, SD = 9.43) over SSG participants (M = 25.00, SD = .81), $t(12.94) = 2.92$, $p = .02$) were statistically significant. Levene's test indicated unequal variances ($F = 10.52$, $p = .00$), so degrees of freedom were adjusted from 23 to 12.94. In off-task behaviors,

results indicated that the number of codes of RSG participants (M = 9.25, SD = 7.72) over SSG participants (M = 3.46, SD = 2.07), $t(12.45) = 2.51$, $p = .03$) were statistically significant. Levene's test indicated unequal variances (F = 29.81, p = .00), so degrees of freedom were adjusted from 23 to 12.45.

Participant Interviews

Semi-structured interviews were conducted at the close of the compositional activity and questionnaire implementation. The purpose of the interviews was to gain a deeper understanding of perceptions of working collaboratively, understanding the compositional process of working corporately on the assigned activity, and highlight technology as a mediation tool in collaborative composition. The researcher created a set of guiding questions to glean a better understanding of participants' experiences in the compositional activity. Many of these guiding questions were created as an extension of specific open-ended questions from the CCTTA.

Ten students participated in the interview process. Five students were selected from the RSG and five students were selected from the SSG:

- Alison, Female, RSG1
- Larry, Male, RSG1
- Arnold, Male, RSG3
- Liz, Female, RSG3
- Tom, Male, RSG4
- Deb, Female, SSG1
- Harriet, Female, SSG1
- Matt, Male, SSG3
- Marco, Male, SSG4

- Susan, Female, SSG5

An examination of interview transcripts identified several themes in relation to several aspects of this study. These themes included collaborative decision-making properties, technology as a mediation tool, perceptions of group membership, and descriptions of the compositional process.

Group Decision-Making Properties

Several participants expressed their views of how decisions were made during the compositional activity. Conversely, the participants voiced their frustrations regarding hinderances in the process of making these decisions. While collaborative musical decisions were ultimately made, they were not made without difficulty.

Democracy as decision-making. Participants conveyed a sense of democracy in the decision-making process of music making. Five of the participants specifically referenced "taking turns" as a means of making the collaborative activity equitable to all members of their respective groups. Marco expressed this equity by explaining that "we each did one instrument and we kept doing one each so it would be fair… so one of us wouldn't do four and the other would do, like, two." Susan echoed this sentiment by saying, "we took turns. If we both liked it, then I would put it in and if it was [the other groupmate's] idea, then she would put it in." Harriet had a more all-inclusive approach to decision-making. She defined it as "everyone allowing everyone to put ideas in and just sort of trying to work together."

The majority of the participants cited voting as a means to put a musical idea into the composition. As Arnold states, "let's say I like the song, but it's not only for me to listen to, it's for other people to listen to." Voting as a means for democratic decision-making was articulated in several ways:

- "First somebody would think of an idea and somebody else would approve it," (Alison);

- "We just said, majority of us, there's two people that want it and one person that doesn't, so we're just going to do the thing that the two people want," (Liz);
- "We did a guitar and bass, but we decided what we wanted to put in it… we voted," (Harriet).

Disagreement as (in)decision-making. While decisions were ultimately made in a democratic way, participants expressed their frustrations when negotiating the final decision. Seven participants found disagreement, or not having an individual idea incorporated, as the most difficult part of working in their respective groups. This was especially difficult toward the beginning of the compositional activity. Marco stated that "there were just a few options, and some people wanted one option and other people wanted other options, and we couldn't really decide at first." While this process was frustrating to some, decisions were eventually made through turn-taking and voting. According to Larry, "sometimes we would have arguments about which [ideas] to choose and then we talked about it and we fixed it." Disagreements were especially difficult for Harriet:

> Sometimes someone would want to add this instrument but [it] didn't go well with [the song]. Two of the people would really like it and one person really didn't like it, but they would find a way to work [together]. That was probably the hardest part. (Harriet)

While many participants negotiated for a chance to have their individual ideas heard, Liz took a more passive, non-confrontational approach. She stated that her groupmates "wouldn't listen to my ideas, sometimes. I just kind of went with their ideas."

Technology as an Easy Mediation Tool

When asked what the participants liked about the iPad for composing, several participants referenced the ease of the interface for music making. Specific examples from

GarageBand were cited as a means for "easier" composing. Alison loved the ability to modify and edit musical phrases and sections. Larry found the Autoplay feature helpful by composing from pre-existing loops. According to Larry, "the iPad already had a little bit of songs in it, so we could use that and then compose our song with it." While most groups used the instrument feature to customize their songs, Tom preferred the Live Loops section, which offered longer pre-arranged musical phrases.

Comparing technology to "real" instruments. Many of the participants compared the iPad and GarageBand to working with "real" instruments, referencing the traditional method of composition. Many of the interviewees' sentiments found technology to be easier in music making, offering convenience, a wider variety of choices, and the ability to compose without being skilled in any particular instrument.

- "I think the iPad would be better if you're not good at playing instruments because it's a little bit easier, so you can learn off of that," (Deb);
- "I think it was a little easier than using something here, like an instrument. I like the way that we could work with each other, because if we used a real instrument, [then] I don't think it would work. Real instruments are fun but it would be hard to record and I think GarageBand makes it really easy to record," (Matt);
- "I think on GarageBand you can find so many instruments in there, so there's a lot of different choices you have whereas… you have a more limited choice if you play with real instruments," (Susan).

Compositional Development Through Experience

The theme of experience was unexpected, as it was not inferred by the guiding questions developed for this study. Several participants stated how having prior musical experience with

particular instruments guided their suggestions for compositional ideas. Susan shared her instrumental experience by specifically stating that she took private piano lessons. Harriet shared her thoughts about her groupmates that used previous instrumental experience to guide decision-making. She stated that her groupmates "somehow wanted to add [specific] instruments that they played and I thought that would be cool because maybe they would know some cool tune." Deb indicated that she currently private lessons in piano, as well as percussion. She also plays the ukulele. In her group, all participants had some experience in a particular instrument. Deb thought that this instrumental experience was the catalyst for their member selection by saying that "everyone in the group knew how to play an instrument, and we knew we worked well together because we have played instruments together."

While musical experience played a prominent role in compositional decision-making, so did that of technology. Matt's experience with GarageBand played a major role with his student-selected group. He specified which sound sources he used the most, as that experience became an integral part of his group's composition:

> I've been looking through GarageBand for a long time and I've looked through almost everything. I've looked specifically on stuff, like, let's say keyboard and guitar… and looked through all the details so I picked a lot of keyboard and a little bit of guitar. (Matt)

Matt's experience with GarageBand also took somewhat of a leadership role within the group, saying that he "taught them a little bit [of GarageBand]."

Group Membership

Participants were asked to share their opinions of how their respective groups were assigned to them. The majority of those interviewed from the SSG preferred selecting their own group members for the activity. Many students favored working with friends. Marco specifically

referenced working with friends for composing music. Harriet and Susan both referenced working with people that they knew they worked well with. Susan used her own judgement to determine her group making decisions. She says, "I know who I work best with and I feel like I get distracted when I don't work with people . . . that I don't know."

Shared understanding. I asked a follow-up question to participants regarding why they preferred selecting their own group members. Responses to the follow-up question mirrored Wiggins (1994) observations of shared understanding between group members, where similar problem-solving strategies stemmed from understanding the dynamics between group members. In Deb's words, "I think it was fun picking our own group, because we picked people that we knew we could work well with." Harriet described shared understanding as communicating in a more holistic approach to the overall composition:

> I tried to choose people that I knew I worked well with, so that I would be able to communicate with them better. Since I knew these people really well, they all had a clear idea…on what they wanted to do. (Harriet)

Larry and Liz were in RSG groups and preferred selecting their own groups. When asked why they would rather pick their own groups, Liz referenced shared understanding "because we kind of all think the same and we would have created a pretty good song, I think." Larry echoed the same sentiment, saying that "my friends agree with most of the things that I like, so it would be easier to choose."

Group size. Aside from views on group assignment, participants had strong attitudes related to the size of their respective groupings. While the majority of groups in both RSG and SSG were comprised of three students, there were a few groupings of four and two, respectfully. For the majority of the participants that were interviewed, three was the maximum number

preferred. Arnold, who was in a group of four, gave the widest group size parameter, saying "I think that two to five is good, but if it gets more than that, it can get a little crazy." Just as Arnold thought a larger group might prove to be tumultuous for music making, Marco reiterated a similar opinion: "I think it would have been better if our group was a little smaller because it was kind of chaotic because everybody wanted to go at the same time."

Others argued that a larger group would hinder an individual's ability to successfully contribute music ideas to the corporate body. Harriet thought that more group members would hinder the overall communication of the group. Tom, who specifically preferred a group of two, believed that disagreement would be the major flaw of a larger group:

- "Because when there's three [members], you have too many different ideas…so you're always going to be arguing over what to do, and if you have one person, you can come up with your own stuff, but it's not going to be as fun" (Tom, in a group of three);
- "I like working with the group. I'm normally better with up to three people because I sort of don't like having all these people, and some of them don't communicate well. I like having less people" (Harriet, in a group of three);
- "I think since we had three people we all had a bunch of different ideas, but we didn't like all the ideas. So maybe if it was a two-person group, it would have been easier" (Deb, in a group of three);
- "I think three would be good because it's not too big but not too small. If you had two [members], then you have less ideas in the group" (Marco, in a group of four);
- "I think it would have been harder with a group of four because there's so many people in it and we wouldn't get to put as much of our own music ideas in there" (Susan, in a group of two).

Process Descriptions

Participants offered descriptions of working together to form a song. These descriptions can be linked to the formal compositional processes that were observed by the researcher in the video observation time analysis. From the observational analysis, four compositional processes were observed: Sound exploration, compositional development, selection/revision, and cumulative review.

Several participants portrayed Sound Exploration as random selection that eventually formed a coherent song. In the words of Tom, "we tried different things and ended up deleting a lot." In Susan's group, Sound Exploration naturally developed into a theme, or the beginning of Compositional Development: "We played around a little bit with strings…and we found the sequence bass that we could add onto it, and eventually it stated to come into a slow rock song." Arnold's approach was to take music that group had already incorporated, and exploring sound sources to add to the piece: "Well, we just play music. If it sounded good, we would record it, and if it went with the [existing] music, we would keep it. If it didn't go with it, we would delete it and try and different one." Arnold went on to say, "I just thought of a tune that would match a rhythm and we put it in to see it matched the whole song." Arnold's description of selecting sound sources was part of the overall Compositional Development of his group's song, as he described building upon existing ideas. Deb's group gauged the style of their entire group composition based on the first sound selection. According to Deb, "after we put down the first instrument, I kind of figured out what the song was going to be a little bit like." To Liz, the overall revision of the composition, or Cumulative Review, required that it "had to be edited a lot and make sure that it was organized."

Throughout all compositional processes observed, negotiation was crucial for overall sound selection. Participants' descriptions of negotiating portrayed helping each other throughout the process, in an effort to incorporate as many individual ideas as possible. Matt's group considered all individual musical suggestions, and which ones would be the most beneficial for the song: "We looked at possible things that we could make and we had all our ideas. We thought of which ones sounded the best for the specific song . . . the type of song that we wanted." For Marco and his group, negotiation was determining instrumental sounds that was appropriate once a theme had been decided. According to Marco, "we all kind of decided on what theme it was going to be and we helped each [other] decide what instrument would go well with what we already had."

Summary

The overall results from each data source were outlined above. Data source findings, however, span across several of the research questions posed in this study. Four research questions were delineated at the beginning of this study: (1) How do upper elementary students perceive collaboration in a group-based, technology-mediated music composition activity?; (2) Is there a significant difference in students' perceptions of collaboration based on their group assignment?; (3) Based on group assignment, are there differences in the nature of students' interactions in collaboration?; and (4) How is the quality of students' products influenced by group assignment? A summary of the results will be outlined by Questions 1 & 2, Question 3, and Question 4.

Research Questions 1 & 2: How do upper elementary students perceive collaboration in a group-based, technology-mediated music composition activity? Is there a significant difference in students' perceptions of collaboration based on their group assignment?

The overall results from the quantitative portion of the CCTTA revealed positive perceptions of working collaboratively by both RSG (M = 5.36, SD = .94) and SSG (M = 5.56, SD = .90) group sets. The analysis of the CCTTA was divided by sections, as the questionnaire was designed to examine different perception constructs during the compositional activity.

Collaboration preferences. In the Collaboration section of the CCTTA, there was no significance between groups ($p > .05$) in perceptions of working collectively from the quantitative portion of the questionnaire. In the open-ended questions that accompanied the Collaboration items, however, there was a significant difference between groups in preference of working individually versus collaboratively ($p = .03$). Of the RSG participants (n = 20), 60% would have preferred to work independently on the composition activity. Conversely, 75% of the SSG participants (n = 20) preferred to work in their groups for the activity.

Open-ended responses and interviews indicated reasons for this significant difference in work preference. Members of the RSG had difficulty with their groupmates, citing disagreement in sound selection and arguments amongst members. RSG members preferred autonomy in decision-making, giving a greater sense of ease in all music making choices. Contrary to the RSG, the SSG members preferred working in groups because of the freedom to select friends and those that they felt they could work well with. SSG members enjoyed getting different ideas and suggestions from others. Interviews from SSG members included descriptions of shared understanding amongst friends, allowing similar ideas to create a more productive atmosphere of collaboration.

Attitudes regarding interaction. In the Interaction section of the CCTTA, there was no significance between groups ($p > .05$) in perceptions of working with group members from the quantitative portion of the questionnaire. The open-ended questions that accompanied the

Interaction items revealed that gaining ideas from others was an essential part of working together. Analysis from participant interviews uncovered that groups would employ a democratic approach to sound selection. This approach was described through taking turns and various methods of voting to final decision making. One difficult part of interacting with group members, according to participants, was not having more individual music suggestions incorporated into the corporate composition. While negotiating individual musical ideas would ultimately lead to a group consensus, disagreements in the process of negotiating was frustrating to many participants. Many disagreements were instigated by participants' attempts to incorporate their individual ideas into the composition. Some disagreements during the negotiation process spawned into arguments, particularly in the RSG groups, as an eventual consensus came at the cost of frustration and angst.

Perceptions of technology in composition. In the Technology section of the CCTTA, there was no significance between groups ($p > .05$) in perceptions of the use of technology as a mediated tool for group composition. The responses to open-ended questions that accompanied the Technology items revealed that using the iPad and the GarageBand interface offered a variety of choices that made composition easy and fun. The use of Autoplay and pre-existing loops offered an incentive to produce more creative sounds. GarageBand offered a variety of sound effects, along with the ability to edit, modify, and delete quickly. Participants expressed that technology-mediation in composition was an easy means to create music. This ease through the use of technology was often compared to the traditional use of composition with the use of real instruments. Participant interviews indicated strong views in regards to the use of technology over instruments. Several participants thought that having experience in playing a particular instrument was advantageous for the use of traditional composition. Furthermore, grouping

members with like instrumental experience would create a stronger compositional product, regardless of the mediation tool used for composing.

In terms of negative views of iPad use, participants expressed concerns with malfunctions in the interface, as well as confusion in operating the application. Participants were also frustrated with physical control of the iPad. Many participants voiced concern with the inability to share ideas when iPad control was not rendered to them.

Group size. The lack of physical control of the iPad prompted participants to articulate their opinions of appropriate group size for the compositional activity. While the majority of collaborative groups consisted of three students, some RSG group sets contained four members, while a few SSG group sets were comprised of two and four, respectively. Analysis of participant interviews discovered that students preferred group pairings of either two or three members in a group. According to participants, having more than three group members could cause confusion and chaos in the negotiation process of music creation, hindering communication and the ability to create a quality product. Furthermore, the desire for smaller groupings could allow more individual musical ideas to be considered for a corporate composition.

Research Question 3: Based on group assignment, are there differences in the nature of students' interactions in collaboration?

Time analyzed compositional processes. A time analysis was performed in the video observations to determine compositional processes observed in groupings. Four processes were observed by the researcher. Furthermore, each process was timed and totaled to compare differences between RSG and SSG group sets.

The four processes observed by the researcher were: (1) Sound Exploration, where groups explored sound sources that were ultimately not used for the composition; (2) Compositional Development, where a sound source was explored and eventually used in the group composition; (3) Selection/Revision, where the selected sound source was recorded and revised by the group membership, and (4) Cumulative Review, where all previously recorded sound sources were revised as a complete compositional entity. Participant interviews detailed each process, explaining in their own words how their respective groups worked through the compositional activity.

Upon review of video observations, each example of a particular process was identified and timed. Identifications of each process were totaled for each respective group. Results indicated that there was a statistical significance in the mean of total time spent in the Sound Exploration process between RSG and SSG participants ($p = .01$). There was no statistical significance between RSG and SSG groups in the processes of Compositional Development, Selection/Revision, and Cumulative Review ($p > .05$). RSG spend 13% of total activity time in Sound Exploration, while SSG spend 29% in this process. In the observed process of Compositional Development, RSG spent 31% of total time to SSG's 22%. The Selection/Revision process yielded 33% of time spent for RSG and 26% of time for SSG. The Cumulative Review process was equal in percentage time, at 23, respectively.

Communication modes. The time analysis of group's compositional processes coded and tallied various modes of communication. Three modes of communication were present: verbal, non-verbal/musical, and off-task behaviors. Coding of communication instances identified several forms of communication. Verbal forms of communication included: negotiation, discussion, approval, disapproval, arguing, technical aspects, and role assignments.

Non-verbal/musical forms of communication included: active listening, singing/chanting, dancing, rhythmic counting, body percussion, hand snatching, head nodding, laughter, intentional eye contact, facial expressions, and pointing. Forms of off-task behavior included: camera distractions, looking around, playing around, off-task conversations, walking away, and distracting noises.

Instances of all three modes of communication were tallied. In the RSG, verbal, non-verbal/musical, and off-task behaviors totaled 145, 132, and 37, respectively. In the SSG, verbal, non-verbal/musical, and off-task behaviors totaled 123, 101, and 14 respectively. Analysis yielded no statistically significant difference between RSG and SSG participants in occurrences of verbal communication modes. There were, however, statistically significant differences between RSG and SSG participants in occurrences of non-verbal/musical communication modes ($p = .02$) and off-task behaviors ($p = .03$).

Research Question 4: How is the quality of students' products influenced by group assignment?

Each of the collaborative groups' final compositional products were scored by three independent raters. The Product Rating Scale was based on ten separate creative constructs and designed to rate the quality of the groups' compositions. One Product Rating Scale score ranged between 7 (lowest possible score of quality) and 70 (highest possible score of quality). Scores from each independent rater were totaled and a mean score was calculated for each group. Analysis revealed no significance difference in product rating scores ($p > .05$) even though the SSG had a higher overall mean (M = 43.14, SD = 13.69) than the RSG (M = 39.11, SD = 4.87).

While the results of the Product Rating Scale brought little clarity to the quality of the final group composition, there may be a difference in the participants' perceptions of how they

viewed their final products. Question 14 of the CCTTA asked participants if they were happy with their group's final composition. SSG participants (M = 6.30, SD =1.10) were happier with their group's final compositional products over that of their RSG counterparts (M = 5.23, SD = 1.25). Analysis revealed a marginal significance between groups regarding positive perceptions of product quality (p = .053).

5 INTERPRETATION AND DISCUSSION

This study contained reports of students' perceptions in a technology-mediated compositional activity. Participants expressed their opinions of working collaboratively in a 60-minute GarageBand activity. Perceptions were based on the selection of collaborative groupings. Students were either selected by the researcher or were given the freedom to designate their own groupings.

Again, the purpose of this study was to examine upper elementary students' experiences in a technology-mediated compositional activity. Research questions were:

1) How do upper elementary students perceive collaboration in a group-based, technology-mediated music composition activity?
2) Is there a significant difference in students' perceptions of collaboration based on their group assignment, as measured by the Collaborative Composition Through Technology Assessment (CCTTA)?
3) Based on group assignment, are there differences in the nature of students' interactions in collaboration?
4) How does group assignment influence the quality of students' compositional products?

Summary of the Methods

A mixed methods approach was selected to explore students' experiences in collaborative composition. Specifically, this mixed methods approach took the form of the Convergent Parallel Design of DeCuir-Gunby and Schutz (2017). In this design, quantitative and qualitative data were analyzed separately and integrated for interpretation.

The study was divided into four phases. In Phase One, fourth-grade participants were given a researcher-led tutorial on navigating procedures for the GarageBand interface. Individual

exploration time was given to the students following the tutorial. In Phase Two, groups were formed. Groupings from the research-selected class totaled six. Groupings from the student-selected class totaled seven. Groups were then given 60 minutes to compose a song using GarageBand as the mediation tool. In Phase Three, participants completed the Collaborative Composition Through Technology Assessment (CCTTA). A total of 40 students completed the questionnaire. Phase Four consisted of ten participant interviews. The interviews were designed to gain a deeper understanding into the experiences of the collaborative compositional process. Eight groups were video recorded during the activity.

Conclusions

This study was grounded in pragmatism, as introduced in Chapter 1. In the pragmatic work of John Dewey (1938/2015), an individual's past experience can shape the context of the present environment. In the current study, perceptions of individuals were paramount to understanding the differences of group assignment for the compositional activity.

The systems model of Activity Theory (Engestrom, 2015) was integral to understanding the integration of quantitative and qualitative data sets from this study. The visual representation was useful in making sense of the interrelated elements that comprised the vast amounts of data in this study. This visual representation helped generate a greater understanding of the relationships of key elements in interpreting data based on the assignment of collaborative groupings. Similar to Welch's (2007) study, I adapted the generic model of Engestrom's visual representation of Activity Theory to illustrate key components of data in this study. In this adapted model, the "subject" (the individual), "rules" (open-ended task structure), and "mediating artifact" (technology through iPad/GarageBand) were unchanged when integrating data from RSG and SSG group sets. The adapted model is illustrated in Figure 11.

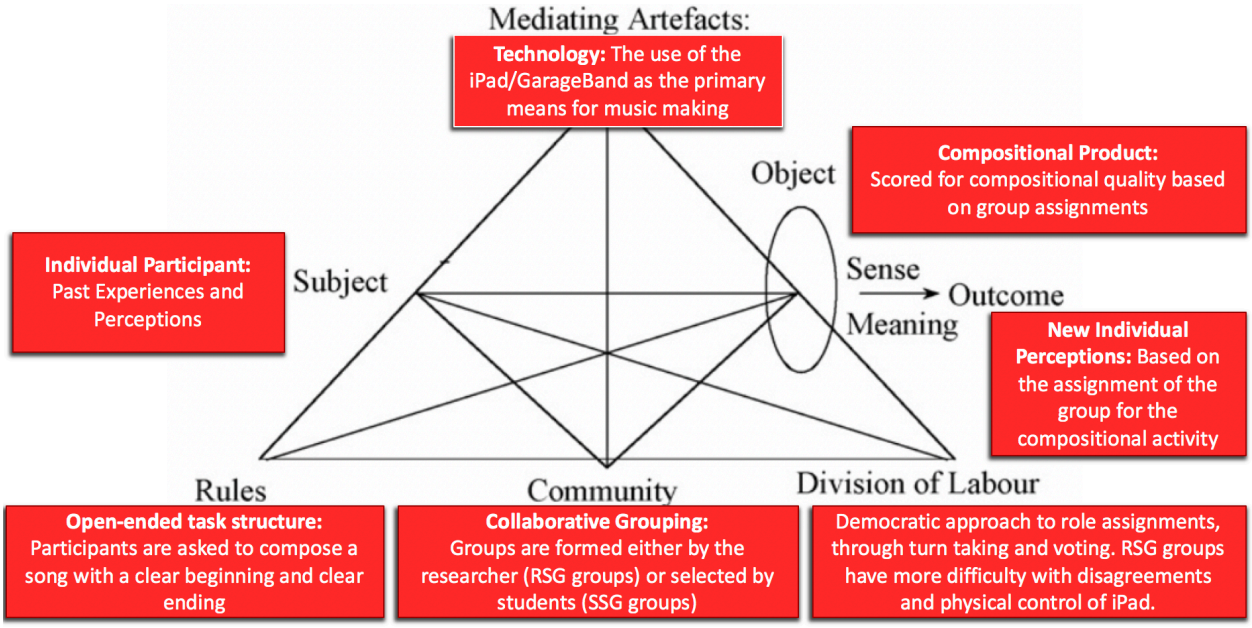

Figure 11. *An example of an activity system that frames an individual within experiences situated through technology-mediated collaborative composition (adapted from Engestrom, 2015, p. 63).*

The analysis of both quantitative and qualitative data as separate entities did little to inform the interpretation of results. Its integration, however, contributed to several key discussion points from the overall findings. As outlined in Chapter 3, the parallel convergent design was selected for this study as the set of methods used for data collection, analysis, and interpretation. In the parallel convergent design, interpretation represents an integration of quantitative and qualitative analysis. According to Creswell and Plano Clark (2011), data consolidation is a strategy used in convergent design analysis for interpretation of results. Data consolidation, or merging, is "the joint review of both data types to create new or consolidated variables or data sets. . ." (p. 213). One option for merging is a side-by-side comparison, where quantitative results and qualitative findings are presented together. The interpretation of the results from this study closely align with this strategy in Chapter 5. In this study, discussion points from data findings represented an integrated interpretation of the results. The effect of

group assignment on students' experiences in a compositional activity is discussed through three lenses: students' perceptions, compositional processes and communication, and the final product.

Effect of Group Assignment Through Students' Perceptions

This discussion point directly relates to Research Questions 1 and 2 of the current study. The quantitative portion of the CCTTA revealed that students in both group sets positively perceived working collaboratively in the compositional activity. While there were no statistically significant differences in perceptions between groups, as measured by the quantitative portion of the CCTTA, there was an overall sense of enjoyment in working together. These positive perceptions were similar to findings by Hopkins (2015), where students reported a high level of enjoyment and satisfaction in creative collaborative work. More specific to technology were findings from Cremata and Powell (2017), where students' perceptions of compositional work through technology created a sense of enthusiasm in collaboration. Participants expressed that hearing opinions and suggestions from other group members was part of their overall enjoyment of working together.

Differences in group selection. Students in the student-selected groups (SSG) preferred working collaboratively over their researcher-selected group (RSG) counterparts. This was a significant finding from the CCTTA. According to CCTTA results, 60% of RSG participants would have preferred to have worked independently. Forty-two percent of RSG students reported that disagreements among group members played a major role in wanting to work autonomously. Similarly, 40% of RSG students reported that unequal role assignments among group members led to overall dissatisfaction. Among this frustration was a lack of integration of individual ideas into the collective composition. Faulkner (2003) stressed the importance of integrating individual

ideas in the formation of collaborative compositional products. Off-task behaviors and arguing were also central to RSG students' desire to work independently.

SSG groups, however, embraced working together. Seventy-five percent of SSG participants preferred working collaboratively in the compositional activity. In a previous study, students in groups familiar with working together preferred working collaboratively to independent work (Kaschub, 1999). Similarly, Faulkner (2003) found that student groups preferred composing collaboratively over independent conditions. These previous findings are similar in scope to SSG participants' desire to work collaboratively rather than independently. Four of the five SSG participants that were interviewed articulately expressed that the ability to select friends and those that they worked well with created a greater atmosphere of productivity for creative music making. Harriet specifically referenced that she could communicate better with those that she knew. Similarly, Susan expressed that selecting groupmates that would not distract her was vital to her respective group selection process. Relative to RSG participants' reports of off-task frustrations was Burland and Davidson's (2001) findings that friendship groups had a greater tendency to avoid conflict. In Burland and Davidson's study, SSG group members attributed the desire to work together with a shared understanding of knowledge, as they have "established methods of interaction, and will have developed a way to share ideas . . . and compromise" (p. 53). Participants expressed the importance of selecting friends because of the ability to work well together. These perceptions are similar to previous studies (MacDonald, Miell, & Morgan, 2000; Hewitt, 2008) that emphasized the importance of friendship in group selection.

Three participants in the SSG reported that similar backgrounds in experience were important in creative music making, which could have played an important role in group

selection. To Deb, selecting students with similar instrumental backgrounds was essential. She said, "everyone in the group knew how to play an instrument, and we knew we worked well together because we have played instruments together." Matt's experience with GarageBand was important to his need to seek members who liked technology. Attitudes of preferring members with similar music experience were not shared by RSG participants, which could offer a greater argument for student-selected groupings. In other words, similar instrumental or technological backgrounds could be part of a shared understanding between potential group members. Experience, then, could be a contributing factor for student-selected groupings. Burnard and Younker (2008) found that instrumental experience is a tool that can "shape interaction during composing and arranging tasks" (p. 63).

Democratic decision-making. Eighty percent of participants from both RSG and SSG reported voting and taking turns as a means of making musical decisions in the compositional activity. It is through this democratic decision-making process that students are free to express their musical ideas (Wiggins, 2000) and ultimately make a collective decision. For Liz and her groupmates, this democratic process of decision-making was an effective means of working through disagreements throughout the activity. For Marco's groups, decisions in sound choices were equitably made by taking turns. The decision to work democratically heightened student agency, creating an atmosphere of student-centered learning (Allsup, 2003). Specific to technology integration, an increased sense of agency was found when students created their own experiences together (Cape, 2014; Cremata and Powell, 2017).

Part of the students' choice to employ a democratic approach to decision-making could be attributed to the open-ended structure of the compositional activity. The current study was designed as an open-ended compositional task, with minimal appropriations given for specific

guidelines. This structure has been used extensively in previous research related to technology-mediated collaborative composition (Bolton, 2008; Cape, 2014; Cremata & Powell, 2017; Dillon, 2003). Kaschub (1999) found that students preferred an autonomous environment in the production of creative activities. Students in the current study reported satisfaction with their ability to make their own decisions. It is possible that the open-ended nature of the activity in the current study may be linked to participants' satisfaction with their production of original work. According to Hickey (1997), pre-determined rules can hinder the creativeness and uniqueness of the final compositional product. Aptly stated, "the more open the task, the greater the chance of a more creative product" (Hickey, 1997, p. 64).

Group size. Sixty percent of interviewed participants reported a preference for smaller groups in the compositional activity. Ideally, participants would have preferred two to three members per group. According to Marco, members in larger groups hindered physical control of the iPad. To Tom, Harriet, and Susan, a larger group size would have impeded the ability to express their respective individual musical ideas. Similarly, Arnold and Marco felt that more students in a group could cause disorder and confusion in the negotiation of musical ideas. Several contributors to research in technology-mediated creative collaboration grouped students into pairs and triads (Dillon, 2003; Hewitt, 2008).

GarageBand in collaborative composition. All interviewed participants reported enjoyment in using GarageBand as a mediation tool for composition. More specifically, part of this satisfaction came from the ease of the digital interface. According to 38% of participants in both groups, GarageBand was easy to modify, edit, and delete. During analysis of audio/visual observations, the researcher observed many participants modifying entire musical phrases and sections. Similarly, participants easily moved musical phrases to various sections of collective

compositions. This finding is similar to Bolton's (2008) assertion that the ease of composing with GarageBand can increase satisfaction and motivation in composition in the "development of a positive self-concept in the ability to compose" (p. 51). Participants found the Autoplay feature particularly helpful, as a means to select various pre-existing loops and musical phrases. Larry, Arnold, and Tom reported using this feature frequently when composing with their respective groups.

GarageBand offered a variety of options that 48% of all participants deemed useful in group composition. Live loops and sound effects were common choices that participants cited as examples. These particular aspects of GarageBand were similarly cited as an effective means to composing by Ankney (2012). Arnold reported satisfaction in the variety of instruments and variations within those instruments, enjoying the "different ways to play," in reference to instrument styles. Interview findings revealed specific examples of instruments used during the compositional activity, such as altered synthesizer sounds and rock guitar variants.

Half of the participants interviewed reported that GarageBand afforded them the ability to play instruments without experience. Students expressed satisfaction in playing virtual instrument versions of instruments that they were not otherwise skilled in. For Marco, the AutoPlay feature that accompanied instrument choices helped guided his musical selections. He stated that "you don't need to know how to read [music] much.' Similarly, the ability to play a virtual instrument was a motivator for Matt in using specific instrumental sound choices: "I like the way that we could work with each other, because if we used a real instrument, [then] I don't think it would work." Similarly, Susan appreciated having virtual versions of instruments available that would not be readily accessible in real form.

Compositional Processes and Communication

This discussion point directly relates to Research Questions 3 of the current study. Analysis of video observations of the activity revealed the types of compositional processes used by participants. Likewise, communication modes were identified.

Compositional Processes. Video observations were analyzed to identify participants' compositional processes in the collaborative activity. Analysis revealed four processes that were observed in how student groups were engaging in the activity: Sound Exploration, Compositional Development, Selection/Revision, and Cumulative Review. During Sound Exploration, group members explored sounds in GarageBand. Sound choices explored during this process were not incorporated into the composition. RSG spent 13% of their compositional time in Sound Exploration, while SSG spent 29% in the same process. While Compositional Development was still exploratory in nature, the sound sources selected by student group members were ultimately selected for incorporation into the composition. RSG spent 31% of their compositional time in Compositional Development, while SSG spent 22% in the same process. In Selection/Revision, group members recorded the previously selected sound source into the composition. Participants revised the selected sound source during this process. RSG spent 33% of their compositional time in Selection/Revision, while SSG spent 26% in the same process. In Cumulative Review, group members reviewed and revised all sound sources collectively, as a complete compositional entity. RSG and SSG spent the same amount of time in Cumulative Review at 23%.

When examining collaborative compositional processes, prior researchers have observed some form of exploratory processing (Charissi & Renta, 2014; Hopkins, 2019; Savage, 2005; Veloso, 2017). In this study, however, exploration spanned more than one categorized process. Sound Exploration was true to the exploratory nature of exploring sound sources in GarageBand.

The Compositional Development process, while still exploratory in nature, was more focused on discovering sounds that were deemed appropriate for the composition by group members. The use of the GarageBand interface may have played a part in this transition in discovering sound sources that would ultimately be used in the compositional product. Students needed "an opportunity to play with and explore sounds with . . . technologies being used (Savage, 2005, p. 175). Charissi and Renta (2014) describe how their participants' exploration of sounds developed into more structured, compositional ideas with continued use of the interface:

> … the level of [the participants'] reaction was more advanced, which means that children were responding to groups of musical sounds and the relationships between them rather than on isolated sounds. These indications of children's advanced behaviors could probably be related to their increased familiarity with the computer interface (p. 53).

The importance of exploration. As outlined by prior research in the previous paragraph, the use of exploration in multiple processes emphasizes the need for students to experiment with sound sources when technology is present. The need for exploration is necessary for students to have the ability for quality, creative work (Savage, 2005).

The time analysis revealed that groups differed in their use of the two processes related to exploration. The RSG groups spent 13% of the compositional activity in Sound Exploration. SSG groups spent 29% in the same process. RSG spent 31% of total time in Compositional Development while the SSG spend only 22% in the same process. Groups in SSG had a statistically significant higher use of time spent in Sound Exploration than the RSG groups. This finding, integrated with qualitative findings, presented an argument for differences in exploratory processes. Arnold (RSG) reported that his group discovered sounds that "sounded good" and recorded them. Arnold's description denotes more random exploration. SSG participant Deb,

however, reported that her group listened to all possible ideas from group members before she "kind of figured out what the song was going to be a little bit like." Marco's (SSG) group mutually decided on a theme before beginning the exploration process: "We kind of decided on what theme it was going to be and we help each [other] decide what instrument would go well with what we already had." These examples signified a more intentional or purposeful planning approach. Wiggins (1994) echoed the importance of purposeful planning over random exploration in creative collaborative approaches. When looking at the compositional processes of this study in total, SSG group percentages were overall more evenly distributed than their RSG counterparts.

Communication Modes. In the findings from group video observations, communication instances were recorded and tallied. Three communication modes were present: verbal, non-verbal/musical, and off-task behaviors.

Verbal communication. Video analysis indicated that seven verbal codes were used by students in group interactions of the compositional activity. Of these codes, negotiation was the most frequently reported in both RSG and SSG group sets. RSG totaled 45 instances of negotiation, while SSG totaled 35 of the same code. This is not surprising, considering the importance of verbal dialogue in collaborative composition (MacDonald, Miell, & Mitchell, 2002). Transactive communication is an important form of verbal dialogue where ideas are built upon existing verbal utterances (MacDonald & Miell, 2000). In this study, transactive dialogue was identified as a negotiation code. RSG groups had more reported instances of negotiation than the SSG groups. This was in opposition to Hewitt's (2008) findings, where transactive communication was more prevalent in friendship groups. Other verbal codes reported in this

study (i.e. approval, disapproval, arguing) were similar to Charissi and Renta's (2014) findings of verbal instances related to the expression of feelings.

Non-verbal/musical communication. Eleven non-verbal/musical codes were reported from group interactions of the compositional activity. Overwhelmingly, active listening was the most frequently reported in both RSG and SSG group sets, as this code was present in all observed compositional processes. RSG totaled 56 instances of active listening, while SSG totaled 26 of the same code. Several of the observed non-verbal codes were not musical in nature. These non-verbal codes were: hand snatching, head nodding, laugher, and eye contact. These non-verbal codes were similar to findings by Charissi and Renta (2014), where eye contact, laughing, and body movement were present.

Several non-verbal codes (hand snatching, pointing, laughing) could be exclusive to technology-mediation. Students used these non-verbal codes frequently during the activity in referencing the iPad digital interface. Gall and Breeze (2008) found that the visual representations of the computer display were the primary focal point of students' communication.

Comparing communication by group sets. Both RSG and SSG groups sets had a higher total number of codes in verbal communication than non-verbal/musical communication. In verbal communication, RSG codes totaled 145 instances, while SSG totaled 123 instances. In non-verbal communication, RSG codes totaled 132 instances, while SSG totaled 101 instances. Further, the mean of non-verbal/musical code totals for RSG groups was significantly higher than SSG groups. These findings were a bit surprising, as Wiggins (2000) found a higher level of musical communication over verbal communication in friendship groups. Hopkins (2015)

reported similar results, where musical communication was more present in collaborative groupings.

Off-task behaviors. Six off-task behaviors were observed in the video analysis. Instances of off-task behaviors in the RSG totaled 37. SSG totals for off-task behaviors totaled 14. This was a statistically significant difference. This difference could be attributed to the shared understanding that was present in the student-selected groups, resulting in fewer reported instances of off-task behaviors. Student-selected, or friendship, groupings may not always exhibit less off-task behaviors than teacher-selected groups. Friendship groups in Hopkins (2015) study were "prone to [off-task behaviors] and social loafing, in which some students allowed others to do all the work" (p. 420). Despite the risk of increased off-task behaviors, "friendship groups have the potential to create an effective working environment, with good interactions, which have the potential to produce high quality results" (Burland & Davidson, 2001, p. 47).

Compositional Product Quality

This discussion point directly relates to Research Question 4 of the current study. The final compositional products were scored by three independent raters, based on a researcher-adapted scale of ten separate constructs. The RSG mean score for the Product Rating Scale was 39.11, while the SSG mean score was 43.14. Although the SSG mean score was higher than that of the RSG, the difference was not statistically significant. This finding was similar to that of Burland and Davidson (2001), where no statistical significance was found in product scores between friendship groups, non-friendship groups, and randomly selected groups. In a similar study, however, friendship groups did score significantly higher in compositional product scores than non-friendship groups (MacDonald, Miell, & Morgan, 2000).

SSG Perceptions. According to an item from the CCTTA, students in the SSG reported that they were happier with their final compositional products than that of RSG participants. A marginal significance was found during analysis ($p = .053$). This finding could mean that although there was no difference in product scores, there may be a difference in how students perceive the final product. This could be attributed to SSG's view of shared knowledge when working together on a compositional activity, particularly through communicative behaviors. While Burland and Davidson (2001) found no significant differences between product scores in friendship and non-friendship groupings, the nature of communication in friendship groups was viewed more positively as "[friendship groups'] conversations get to extended discussion and the elaboration of ideas" (p. 53).

Implications

The views of the participants in this study could represent those of countless numbers of students in music education classrooms. It was evident that children enjoyed working together to create music. No matter what the group designation was, through disagreements and consensus, students took pride in their unique products. The collective component made composition especially meaningful to students, as collaboration in creativity presented opportunities for creative expressions that were not available in an individual setting (Veloso, 2017).

The use of compositional activities that utilize technology can reach a greater number of students than those that do not utilize technology. For those students who are not trained in the traditional style of learning notational literacy, the use of iconic representation can open the door to the creation of meaningful music (Ankney, 2012). Music educators must be aware of this. As students enter music classrooms with personal knowledge of technological devices, the task for music teachers must be to direct that knowledge for greater musical understanding. The

challenge, then, for teachers is to incorporate technology more frequently. Technology can be further integrated in teacher training through the use of creative activities, particularly by emphasizing the use of exploration.

Technology Incorporation in Teacher Training

A formidable 95% of the participants in this study rated themselves as proficient or extremely proficient in technology use. During the activity, participants guided themselves through the GarageBand interface with great ease. Students at MidCity School (MCS) were assigned their own iPads at the beginning of the school year. They took the device with them throughout most of the school day. Students were allowed to take their assigned iPads home. They completed assignments in other subject disciplines. In short, they had 24-hour access to this technology. It appeared in this study, however, that the cooperating music teacher did not utilize this resource in curricular planning. Through informal conversations, the cooperating teacher at MCS expressed that she was not comfortable incorporating technological resources in her teaching.

Incorporating additional technology training in teacher preparation programs can be an effective means of ensuring that preservice teachers are adequately prepared for technology use in music classrooms. In teaching the most up-to-date versions of technology, instructors of pre-service teachers may need to supplement beyond printed materials. For example, I recently used the Campbell & Scott-Kassner (2014) text for a Music in Early Childhood course that I taught for pre-service teachers. While comprehensive in many relevant pedagogies, technology integration was relegated to short boxes of information throughout several chapters. Many preservice teachers understand basic technology use on a personal level, yet have difficulty relating it to classroom use (Reese, Bicheler, & Robinson, 2016). With technology now an

integral part of the National Core Music Standards, future educators must be prepared to meet the needs of students, where technology is a part of daily life.

The use of technology integration can be more challenging for currently practicing educators. The incorporation of technology can disrupt traditional approaches of classroom teaching (Burnard, 2007). Yet, many teachers passively ignore a resource that is thriving in the lives of students, ultimately dismissing a potential bridge that can connect formal music instruction to what students are experiencing and exploring every day in their personal lives. Teachers must find professional development opportunities in an effort to bridge this gap in creative instruction. Many state conferences offer technology-based in-service sessions for educators to attend. Further, national music organizations, such as the National Association for Music Education (NAfME), offer a variety of on-line resources for technology integration, along with annual conferences providing hands-on professional development opportunities. Utilizing more technology-centered professional development opportunities can provide teachers with more curricular suggestions in technology-mediated lesson planning. Teachers that are more at ease with technology are more apt to incorporate it in music instruction (Bauer, W. I., Reese, S., & McAllister, P. A., 2003). Students will continue to use technology outside of formal music instruction. Our duty as music educators, according to Riley (2013), is to use technology transformatively from casual, social interactions to meaningful music practices.

Technology Incorporation in Creative Activities

Participants in this study positively perceived working collaboratively with technology. The goal for teachers is to provide opportunities for students to create music together using this resource. This may prove to be challenging for educators who have little experience with technology integration. Incorporating a new manipulative, such as technology, requires new

styles of teaching (Cain, 2004). The use of the traditional teacher-centered paradigm shifts to a more student-centered approach to learning. Participants in this study worked democratically, making their own musical decisions in creating music. Creative activities, then, can be an effective means of incorporating technology into music instruction. Campbell and Scott-Kassner (2014) suggest that teachers integrate technology in small steps, as not to overwhelm those with minimal technological experience. The use of collaboration in creative endeavors could provide teachers with an easier, yet effective, means to transition music instruction into a more student-centered approach in creative outlets.

The importance of group selection in technology-based creative activities can heighten the overall experience for students. Allowing students to choose their groupmates in creative activities could enhance the learning experience through shared knowledge, potentially employing a democratic means to music making. This was certainly the case in the current study where students that selected their own groupings worked through disagreements and differences as they worked toward their final product.

The Need for Exploration

Exploration was an important compositional process in this study. When combining Sound Exploration and Compositional Development processes observed in this study, SSG groups spent 51% of the activity in some form of exploration. Dillon (2003) stressed the importance of exploration in technology-mediated collaborative composition. As educators find solutions to classroom technology incorporation, the use of exploration is essential for creative activities, both on an individual level and through collaboration.

In this study, participants were given 30 minutes to explore GarageBand individually. Due to time constraints, this was not enough time for students to explore the vast amounts of

choices that GarageBand had to offer. This was also the case for Stauffer (2001) who expressed limitations of exploration time in her study. Allowing students time to explore is imperative for music creation. With the continued use of exploration comes music fluency and experience (Stauffer, 2001).

Future Research Recommendations

Research in technology-mediated collaborative composition has focused primarily on processes (Charissi & Renta, 2014; Savage, 2005; Veloso, 2017) and communicative dialogues that transpire within processes (Dillon, 2003; Dillon, 204; Hewitt, 2008). Research regarding students' perceptions within a particular group assignment is very limited. Additional studies are necessary to fully understand the effects of group assignment when technology mediates group composition. Recommendations include improvements to the current study, replication of the current study, and extensions in new research.

Improvements to the Current Study

While the CCTTA proved to be an adequate tool in measuring students' perceptions of the compositional activity, it did not fully integrate technology as a mediation source for composition. The CCTTA contained three separate sections measuring independent constructs of the activity. Because of this separation, each respective construct was analyzed independently. Significant findings and conclusions were more robust from the qualitative, open-ended questions that followed each respective section. Should the CCTTA be used again in future research, adjustments would be necessary. Additional open-ended questions would be added to further represent the observed compositional processes from the activity. Furthermore, open-ended questions related to the final compositional product would be necessary to further corroborate with quantitative scores from the Product Rating Scale.

As previously mentioned, exploration is essential in technology-mediated collaborative work. Participants in this study were allotted 30 minutes for individual exploration. Should this study be used again in future research, exploration time would need to be greatly expanded. GarageBand offers a wide variety of choices (Ankney, 2012), and time allocated for exploration must reflect the vast range of options in the application.

The structure of the compositional activity in this study was open-ended in nature, as few guidelines and stipulations were given to participants. The quantitative tool used for scoring the participants' final products, however, was extremely structured, consisting of ten separate constructs related to creative work. The use of a more open-ended scoring method, such as the Consensual Assessment Technique (Amabile, 1983), could prove to be more complimentary in this study, considering the open-endedness of the activity. As opposed to rating the final products, ranking them could provide a more comprehensive understanding in the differences of compositional product quality based on group assignment. The current scoring method proved to be limited in its results, as the group sample size was smaller than desired for a quantitative analysis.

Replication of the Current Study

Future researchers could replicate this study by expanding the sample size of fourth-grade participants. Researchers using a larger sample size may result in more quantitative differences in the effect of group assignment in collaborative music making. Similarly, replication of the study incorporating other grade levels could corroborate findings from the current population. A comparison between differing grade levels may offer alternate implications on how to effectively use technology in collaborative composition.

Additionally, older populations, such as students in 5th and 6th grade, may approach collaboration differently. These differences could be observed by comparing differences in time spent in respective observed compositional processes. Comparing the quality of final compositional products between grade levels may lead to greater differences in group assignment. Further, the use of older populations based on instrumental experience may yield interesting results. Such experience could compare perceptions and product quality of students in performance-based and non-performance-based classes, respectively.

Extensions in New Research

The central issue in this study was understanding the effect of group assignment on students' perceptions of working collaboratively in creative endeavors using technology. Compositional processes were observed, identified, and converted into percentages of time spent in the activity. While previous studies have identified compositional processes in technology-mediation, future research could expand on these process observations, particularly identifying detailed modes of communication within each respective process within group assignment.

One of the identified verbal codes in communication analysis was role assignments. Future research recommendations could include a detailed study of the role assignments of students within a collaborative group. These role assignments could reveal the nature of interactions in creative activities. As physical control of the iPad was an issue in the current study, a time analysis could reveal the amount of time that each participant controlled the device. The analysis of role assignments within groups could compare physical control of the device to individual suggestions made for compositional ideas.

Research in technology-mediation of collaborative composition remains relatively limited. The effect of group assignment within this subject is greatly limited. Opportunities for

study in this area are abundant, as additional research is needed. Participants in this study positively perceived working together. Students expressed their opinions regarding their interactions with groupmates and how they worked together in a collaborative, creative activity. Further research in this area can offer essential implications in understanding how students can effectively be grouped when using technology in creative endeavors.

Professional Reflections

Many of the findings in this study have reflected those of previous studies pertaining to creative collaboration, technology, and group assignment. In this study, the integration of quantitative and qualitative results was essential in order to make sense of the overall findings. Analysis of the quantitative results, for example, generated very few significant differences between SSG and RSG. There were no statistically significant differences between groups in overall perceptions (from Likert items), one significant difference in compositional processes, two significant differences in communication modes, and no significant differences in product quality. Based on the findings of the quantitative results, a reader of this study could assume that group assignment is inconsequential in the planning and implementation of collaborative creative activities. However, the analysis and integration of the qualitative results uncovered a much deeper understanding of the effect of group assignment in collaboration.

After reflecting on the overall findings in this study, I have concluded that student-selected groupings may be better suited for collaborative composition. My decision is based more on qualitative results pertaining to perceptions, compositional processes, and product quality. My justification for the use of student-selected groupings relates to shared understanding, exploration, and democracy.

Based on scores from the CCTTA, students from both group sets positively perceived working collaboratively. Furthermore, there was an overall enjoyment in students' attitudes concerning the use of technology as a mediation tool. More specifically, though, SSG participants preferred working collaboratively in this activity over RSG participants, who would have preferred to work independently. This was a statistically significant finding in my analysis. The reason for this difference could be attributed to 42% of RSG participants who cited disagreements and arguments with groupmates as problematic during collaboration. Conversely, SSG participants shared common interests, musical experience, and knew whom they worked best with. These shared interests contributed to the overall effectiveness of shared understanding in the collaborative activity. SSG was able to overcome disagreements for the greater good of the collective composition. Through shared understanding, individual ideas were negotiated with intent in order to create a quality product. As described by Wiggins (2000): "Group members judge the merit and appropriateness of individual ideas against their personal interpretation of the shared vison of the work in progress" (p. 85).

A shared vision was also observed in the exploratory-based compositional processes of Sound Exploration and Compositional Development, where SSG groups spent a statistically significantly higher amount of time in Sound Exploration. As stated previously in this chapter, SSG's vision of the final product was more purposefully planned than RSG. This purposeful planning was identified as mutually selecting a theme or genre for the composition. Through devising a preexisting theme, exploration was more intentional in scope. RSG spent more time in Compositional Planning, where the exploration of sounds led directly to recording sound sources into the composition. This denoted more random exploration. While only marginal in

significance, the differences between SSG and RSG in exploration approaches could illuminate why SSG could have perceived their final product more positively than RSG.

Eighty percent of participants in both SSG and RSG groups employed democratic methods in compositional decision-making. This statistic is extremely encouraging in understanding student-centered approaches to creative activities. Further, the open-ended structure allowed students to have the opportunity to create products that were unique to their groupings (Hickey, 1997). It is said that creative activities are designed to be student-centered, open-ended in structure, for the creation of unique products where mutual, democratic decisions can be made. Should we not give students the same democratic courtesy to mutually select group members for an activity based on the same premise?

Personal Reflections

My inspiration for researching the topic of collaborative creativity came from my personal experiences as a music educator. Having used collaborative groupings for quite some time, I saw the impact that it made on students as they shared ideas with others. Music making aside, the social implications alone give rise to the importance of students interacting with one another. Schools seem to have become more rigid in structure. With the continual demand for higher standardized test scores, the ability to simply create, let alone with others, seems to have become ancillary.

In collaborative activities, I have grouped my students in all possible ways imaginable: student-selected, teacher-selected, randomly selected, and by musical ability. Each grouping had its own respective merits. It is through this research, however, that I truly began to recognize the benefits of shared understanding. When students work together with related knowledge and similarities, true creative work can be formed.

Dr. Patrick Freer, my advisor and dissertation director, recently asked me what I would say to the "pre-research" version of myself regarding the findings of this study. The truth is, I would suggest allowing my students greater freedom to create within their own set of creative parameters. In this study, collaborative groups (including researcher-selected) created their own democratic space in which musical decisions were made. These student-created decisions were somewhat unexpected in my analysis and reflection of the results. Equally unexpected were some participants' comments relegating technology as "not being a real instrument." I think that with the prominence that technology-related music making is accomplishing in music classrooms comes the expectation to treat this mediation tool in the same respectful fashion as traditional mediational means. While the scope of the age group in this study dealt more with exploration in the technology medium, the use of technology as a "real instrument" will require practice and experience, much like our traditional practice norms of a trumpet or clarinet.

As I discovered in this research, collaboration and creativity are central to student-centered, democratic learning. Like many educators in the field may have experienced, relinquishing control was painstakingly difficult for me. Through continual planning and implementation of creative activities, however, I slowly began to see the benefits of student-led decisions, through the activity of composition.

With the steady rise of technology in music classrooms, it is clear that the use of iPads and other similar devices are here to stay. I think one of the greatest benefits of technology use in creative activities is the accessibility it offers for students. To many of my students, composing was only deemed relevant or achievable for those "historical figures in music" whose portraits are taped to the walls of music rooms. The use of the digital interface in technological devices allows students the opportunity compose, mostly through non-traditional formats. This is

particularly applicable to students who are not musically literate, nor have experience in playing an instrument. As one participant stated in a response from the CCTTA, “you don’t have to be a professionalist to make a beat.”

Many of my students are quick to correct any errors I make when discussing technological protocol in my classroom. Further, they share creative ideas with me that I could never imagine myself. With my students’ knowledge of music in technological devices, I find myself learning just as much from them as I hope they gain from my own teaching. This is how Allsup (2003) described an effective collaborative teaching environment. It is in this mutual transaction where student-based learning is at its core. This is where the marriage of collaboration, creativity, and technology thrives.

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APPENDICES

Appendix A

Interview Protocol

I. How did you come up with ideas to share with the group?
   A. How did you decide what ideas went into the composition?

II. Tell me about how you communicated with each other during the activity?
   A. What was most important?
   B. What was the most difficult or frustrating?

III. How did you feel about your group?
   a. What did you think about picking your own group (for student-selected class)
   b. What did you think about having a group assigned to you? (for teacher-selected)

IV. Tell me about using the iPad and GarageBand for composing a song?
   A. What kind of experience did you have with technology and music?

V. Is there anything else you would like to share about working on this GarageBand composing project?

Appendix B

Questionnaire

Dear student,

Please answer the following questions based on your recent experience working in your groups. Circle a number on the scale for each comment. 1 means you "strongly disagree" with the statement and 7 means that you "strongly agree" with the statement.

(1) I liked working with my group members.

1	2	3	4	5	6	7
Strongly Disagree			Neutral			Strongly Agree

(2) I feel like I got to know the other kids in the group better.

1	2	3	4	5	6	7
Strongly Disagree			Neutral			Strongly Agree

(3) Some kids in my group didn't participate.

1	2	3	4	5	6	7
Strongly Disagree			Neutral			Strongly Agree

(4) It's fun to work with other kids when creating new music.

1	2	3	4	5	6	7
Strongly Disagree			Neutral			Strongly Agree

(5) It's boring to work in groups.

1	2	3	4	5	6	7
Strongly Disagree			Neutral			Strongly Agree

(6) The kids in my group got along with each other.

1	2	3	4	5	6	7
Strongly Disagree			Neutral			Strongly Agree

(7) Would you rather create music in a group or by yourself?

_____

(8) Why did you answer that way?

_____
_____
_____
_____

(9) I was able to share the music I created with my group.

1	2	3	4	5	6	7
Strongly Disagree			Neutral			Strongly Agree

(10) My music suggestions were used in the group composition.

1	2	3	4	5	6	7
Strongly Disagree			Neutral			Strongly Agree

(11) When we worked in groups, I feel like I did my best in helping with the composition.

1	2	3	4	5	6	7
Strongly Disagree			Neutral			Strongly Agree

(12) I think our group was focused on the composition and didn't play around.

1	2	3	4	5	6	7
Strongly Disagree			Neutral			Strongly Agree

(13) My group members helped each other out when working on our composition.

1	2	3	4	5	6	7
Strongly Disagree			Neutral			Strongly Agree

(14) I was happy with my group's final music composition.

1	2	3	4	5	6	7
Strongly Disagree			Neutral			Strongly Agree

(15) What was your favorite part about working in your group?

_____
_____
_____
_____

(16) What was your least favorite part about working in your group?

_____
_____
_____
_____

(17) I liked working with iPads to create music.

1	2	3	4	5	6	7
Strongly Disagree			Neutral			Strongly Agree

(18) I would rather use iPads instead of regular instruments to create music.

1	2	3	4	5	6	7
Strongly Disagree			Neutral			Strongly Agree

(19) GarageBand was easy to use during in my group.

1	2	3	4	5	6	7
Strongly Disagree			Neutral			Strongly Agree

(20) Using the iPad motivates me to create more music.

1	2	3	4	5	6	7
Strongly Disagree			Neutral			Strongly Agree

(21) I had difficulty using the iPad when creating music in my group.

1	2	3	4	5	6	7
Strongly Disagree			Neutral			Strongly Agree

(22) What did you like about using your iPad to create music?

_____
_____
_____
_____

(23) What did you not like about using your iPad to create music?

_____
_____
_____
_____

(24) What gender do you identify with?

_____Male _____Female

(25) Do you take or have you taken private music lessons?

_____Yes _____No

If yes, what was it?

_____
_____
_____

(26) Do you participate or have you participated in any music performing groups?

_____Yes _____No

If yes, what groups and describe what it was

_____
_____
_____
_____

(27) How would you describe your general use of technology?

_____Not very good _____Average _____Extremely good

How often would you say that you use technology per day (in hours)? _____ hours

(28) How often do you use technology for music related things?

_____Not often _____Sometimes _____All the time

What type of music things? _____
_____
_____

(29) How often do you use GarageBand?

_____Not often _____Sometimes _____All the time

(30) Do you use any other apps for composing music?

_____Yes _____ No

If yes, which ones? _____

Appendix C

ID:_____ **Collaborative Composition Product Rating Scale**

Please score each GarageBand product according to the individual constructs below

1 2 3 4 5 6 7

Unevocative Evocative

1 2 3 4 5 6 7

Unvaried Varied

1 2 3 4 5 6 7

Simple Complex

1 2 3 4 5 6 7

Unoriginal Original

1 2 3 4 5 6 7

Ineffective Effective

1 2 3 4 5 6 7

Unstructured Structured

1 2 3 4 5 6 7

Unambitious Ambitious

1 2 3 4 5 6 7

Disjointed Flowing

1 2 3 4 5 6 7

Aesthetically Unappealing Aesthetically Appealing

1 2 3 4 5 6 7

Technically Unskillful Technically Skillful
(in terms of technology use)

Adapted from Hargreaves, Galton, & Robinson (1996) **FINAL SCORE**

Appendix D

(Parental Consent Form from Pilot Study)

Georgia State University, School of Music
Parent Permission Form

TITLE Examining students' perceptions of group assignment in a cooperative, technology-based compositional activity

STUDENT PRINCIPAL INVESTIGATOR Sam Holmes
PRINCIPAL INVESTIGATOR Martin Norgaard

PURPOSE
Your child is invited to participate in a research study. The purpose of the study is to gather students' perceptions on group assignment during a technology (iPad) music composition activity. The 4th grade classes at MidCity School are invited to participate. This study is part of my Ph.D. Teaching and Learning requirements at Georgia State University. Michele Smith and the administration at TCS have graciously allowed me conduct my research here.

PROCEDURES
If you decide to allow your child to participate, he/she will work on a composition project in small, cooperative groups during their scheduled music class time. Groups will be divided by either student choice or teacher assigned (randomly depending on the class). The entire research study will take no longer than three standard 55-minute music class sessions. At the end of the composition assignment, students will complete a questionnaire regarding their participation in their respective group. The questionnaire will also be completed during the third music class session. The entire sessions will be captured on video. Only the student principal investigator and Michele Smith will be present at the time of recording.

RISKS
In this study, your child will have no more risks than in a normal day of life.

BENEFITS
Your child may not directly benefit from this research. However, this study may provide a better understanding of group assignment and the use of technology-based creative activities that can better inform future music curricula.

VOLUNTARY PARTICIPATION AND WITHDRAWAL
Participation in this research is voluntary. Your child does not have to be in this study. If you decide to allow your child to be in this study and change your mind, you have the right to withdraw this permission at any time. I will also read a short assent script for your child's verbal approval. Yet, your child may withdraw at any time during the study. Whatever you decide, you or your child will not lose benefits to which you are otherwise entitled. Your child's grades will not be affected by participation or withdrawal from this study.

CONFIDENTIALITY
We will keep your records private to the extent allowed by law. Mr. Holmes and Dr. Norgaard will have access to the information you provide. Information may also be shared with those who make sure the study is done correctly (GSU Institutional Review Board and the Office for Human Research Protection (OHRP)). We will use your child's initials rather than the full name on study records. The video information will be transferred to a password protected computer and the original file on the video camera deleted. Any personal identifiers related to the video file other than the video itself will be destroyed. I would like your permission to show short excerpts of the video at scholarly conferences and other related evening though this is not a requirement for participation in this study. You can select this option below. Your child's name will not appear when we present this study or publish its results, but their faces will be seen, should you grant us permission on the selection below.

CONTACT PERSON(S)

Contact *Mr. Sam Holmes* at (404) 271-2106 or sholmes6@student.gsu.edu if you have questions, concerns, or complaints about this study. You can also call if you think you have been harmed by the study. I will happy to answer any questions you may have. Call *Susan Vogtner* in the Georgia State University Office of Research Integrity at (404) 413-3513 or svogner1@gsu.edu if you want to talk to someone who is not part of the study team. You can talk about questions, concerns, offer input, obtain information, or suggestions about the study. You can also call Susan Vogtner if you have questions or concerns about your rights in this study.

COPY OF CONSENT FORM TO SUBJECT

I will give you a copy of this consent form to keep.

If you are willing to allow your child to volunteer for this research and to be audio and/or video recorded, please sign below.

I thank you for your consideration!

_____**YES**, I allow the investigator to show short excerpts of the video information at scholarly conferences

_____**NO**, I do not allow the investigator to show short excerpts of the video information at scholarly conferences

_____

Child's Name

_____ _____

Parent or Guardian ***Date***

_____ _____

Principal Investigator, Sam Holmes ***Date***

Appendix E

Verbal Assent Script

Georgia State University, School of Music
Child Assent Form

SCRIPT (to read to participants)

You are invited to join in a fun project. The reason for this project is to see how you work together in groups while making music using iPads. The project will take place during three music class periods.

If you decide to join in, you will work with a group and create music using iPads. At the end of class, you will answer some questions about working in your group. One of the groups will be videotaped while working on the assignment.

You will not be in danger if you choose to join in.

If you help out in this study, teachers may be able to understand how you work together in groups and with iPads.

No one will be able to see what you are doing, but I may share some things with others that are helping me with the study. If your parents say yes, I would like to show your work at meetings with people that want to know what you are doing.

You do not have to join. You can say no, even after we start. Your parents can't force you to do this project. This project is not part of your class music grade.

If you would like to be a part of this project, please say YES or NO when I come around and ask.