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Associations between Empathy Development and Collective Music Making with Free Improvisation and Music Notation for Adolescent Musicians

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Casey Schmidt

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Abstract

The purpose of this study was (1) to examine the impact that small ensemble free improvisation experiences had on dispositional empathy development when compared with other forms of collective music making; and (2) to examine the relationship between co-performing musicians' empathy levels and their performance achievement in small ensembles using free improvisation and notated repertoire.

I used an experimental pre-and-posttest design to examine the effect of small ensemble free improvisation experiences on dispositional empathy development. High school instrumental music students (N = 185) were randomly assigned to one of three music making conditions: freely improvising dyads (n = 64), notated duets (n = 62), and traditional performance ensemble rehearsals (n = 59). Participants completed musical interventions related to their respective condition assignments for 20 minutes a week for a period of eight weeks. I utilized the *Basic Empathy Scale* (BES; Jolliffe & Farrington, 2006) to measure dispositional empathy. I compared pre-and-posttest BES scores from participants in the three music-making conditions using a difference-in-differences regression estimator while controlling for gender identity, instrumental playing experience, and affective valence toward the music-making experiences. Findings showed that there were no statistically significant differences in empathy development within or between groups resulting from the music experience interventions.

In addition to determining the effect of the musical interventions on empathy development, I examined the relationship between co-performer empathy levels and the performance achievement of improvising dyads (n = 32) and notated duets (n = 31). Performance achievement was rated with a researcher designed *Collaborative Improvisation Measure* (CIM;

Schmidt, 2018) for the improvising dyads and the *Small Ensemble Adjudication Form* (SEAF) for notated duets, which was adapted from a high school level small ensemble rating form for solo and ensemble contest ("Illinois High School Association," 2013). Group empathy level for each ensemble was the aggregate of individual responses on the BES. Continuous scores on the BES and ensemble categorizations of High-High, High-Low, and Low-Low empathy pairs were used as independent variables for performance outcomes in a series of regression models and ANOVAs.

Findings showed that co-performer empathy levels were positively associated with performance achievement but not performance change over time for both improvising dyads and notated duets. Co-performer empathy may support a baseline for collaboration that enables musicians, regardless of the type of collective performance, to maximize their collective abilities as they generate performance outcomes.

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CHAPTER 1: INTRODUCTION AND RATIONALE

Introduction

The role music education plays in the lives and development of students is embedded within the broader educative experience. Despite the incessant application of standardized testing and accountability standards in school learning environments, education has made a progressive, although slow, shift away from the myopic focus on advancing content knowledge and skill development over the last two decades. The educational landscape is being reshaped to include 21st century skills such as cooperation, critical thinking, and creativity (Noddings, 2013). Changes in policy and the reformation of learning environments suggest that the scope of student growth and development is beginning to broaden beyond the bounds of what students know and can do to include the modes through which students engage in learning and the ways they demonstrate and express their growth (Griffin & Care, 2015). A better understanding about approaches music educators facilitate to implement 21st Century skills and the ways those approaches shape both social and musical development is critical to maintaining the relevancy and efficacy of school music learning within the broader educational community.

The purpose of this chapter is to outline a theoretical framework and provide a rationale for examining how music improvisation experiences may shape the way students interact and connect with each other during the learning process and how those interactions influence musical achievement. I will begin the chapter by orientating music learning within a broader social and emotional learning framework where empathy is a critical facet for fostering collective and supportive learning environments. After outlining this orientation, I will examine the construct of

empathy and support an argument that links the response systems used during empathic action to those exercised during collective music making. Evidence from existing empirical work will provide support for the link between musical engagement and empathy development. Despite the existence of an emerging body of empirical evidence linking music and empathy, I will argue that there is still much to learn about how different forms of music making may exercise empathic skills and support the development of empathic dispositions. Finally, I will conclude the chapter with a discussion about the research problem and articulate the purpose and questions for the investigation.

Social and Emotional Learning (SEL)

The broad aims in education are expanding to include student wellbeing as well as academic achievement, and this is best demonstrated through the creation, application, and proliferation of *social and emotional learning* programs in PreK-12 classrooms ("Collaborative for Academic, Social, and Emotional Learning," 2019; Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011). The primary goals of social and emotional learning (SEL) are to support students in their development of self- and social awareness, emotional regulation, responsible decision-making, problem-solving, and relationship management (Elbertson, Brackett, & Weissberg, 2010). SEL programs are designed to help children attain and maintain the skills to manage personal wellbeing and positive relationships. The development and implementation of SEL programs are guided by the theory that learning is a social experience and that students learn best in the context of healthy social interactions and cooperative development.

Research shows that the infusion of SEL in school environments not only enhances students' emotional self-awareness, self-management, empathic response, relationship skills, and

responsible decision-making, but that it also has a positive impact on academic achievement (Durlak et al., 2011). Since the first inception of SEL standards by the state of Illinois in 2002, all 50 states now included SEL in their preschool standards, 18 states have implemented SEL competency standards for grades K-12, and 25 states provide support materials to offer SEL at district levels ("Collaborative for Academic, Social, and Emotional Learning," 2019). Supporting the social and emotional development of students in schools has gained traction and the empirical support for the effectiveness of SEL programs at enhancing student learning and social development suggests that it is a trend that will continue to expand (Elbertson et al., 2010; Taylor, Oberle, Durlak, & Weissberg, 2017).

As an increasing number of schools embrace the responsibility of fostering not only the cognitive abilities of students, but also their social and emotional development, it is worth exploring how musical learning fits within this evolving landscape. Musical engagement is an inherently social affair (Small, 1998), and as Hargreaves and North (1999) note, “we contend that many of the psychological functions of music are primarily social” (p. 82). Music is critical in the formation of self-identity, interpersonal relationships, and mood. Music and social interaction are inextricably linked in school music classrooms, where the predominant musical learning experience is coordinated with groups of students in the traditional performance ensemble or general music classroom. These contexts are ripe with opportunities for students to make interdependent musical decisions and participate in affective engagement or the exchange of emotional states through shared musical expression and perception.

In addition to being a social action, music stimulates the perception, response, and expression of emotions (Gabrielsson & Juslin, 2003; Schubert, 2013). Opportunities for students

to engage with the emotional elements of music and with the generation of emotional content during music-making processes create openings for recognizing and labeling the internal emotions experienced and the emotions expressed by others. The ability to attune to and recognize the emotions of others while maintaining self-other differentiation is one of the core tenets of the SEL framework and is grounded in the construct of empathy (Batson, 2009; Coplan, 2011). It seems that the social and emotional mechanisms activated in collective music-making environments align with the goals of SEL, which include social awareness, emotional understanding and regulation, problem solving, and interpersonal management.

The intent of this study was to examine music's relationship with one of the core constructs of the SEL framework: empathy. Focusing in on this construct provides insight into how music shapes social and emotional connections and supports a basis for musical learning within the scope of a student's SEL experience. The social and emotional qualities of musical engagement make music learning environments unique spaces for shaping and reacting to empathic dispositions.

Empathy and Music

Empathy

Empathy represents the ability and inclination of an observer to understand the feelings or state of mind of another person while recognizing and maintaining self and other differentiation (Batson, 2009; Coplan, 2011; Hoffman, 2000). As the theoretical framing of empathy in the following section will demonstrate, empathy is a complex construct with a wide variance of philosophical and psychological interpretations. One of the challenges to investigating empathy, like most psychological constructs, is articulating what it is and

determining how it is developed and enacted. Empathy is both an innate trait and a learned ability that is developed throughout the course of a person's life (Barnett, 1987; Norma Deitch Feshbach & Feshbach, 2009; Thompson, 1987). Empathy has been investigated as an automatic mechanism of affective or emotional resonance and as a volitional response that utilizes cognitive processing to observe and interpret social cues to understand the intentions, thoughts, and feelings of others. Current definitions assert that empathy is an interaction of both affective and cognitive mechanisms (Singer & Lamm, 2009; Stueber, 2017; Thompson, 1987; Yu & Chou, 2018). Felicity Laurence (2008) provides a comprehensive definition of the empathic process and one that is used to frame empathy in this investigation:

> In empathizing, we, while retaining fully the sense of our own distinct consciousness, enter actively and imaginatively into others' inner states and understand how they experience their world and how they are feeling, reaching out to what we perceive as similar while accepting difference, and experiencing upon reflection our own resulting feelings, appropriate to our own situation as empathic observer, which may be virtually the same feelings or different but sympathetic to theirs, within a context in which we care to respect and acknowledge their human dignity and our shared humanity. (p. 24)

Laurence's definition of empathic action highlights the interaction between cognitive and affective systems and the preservation of self-consciousness.

The capacity to empathize is reliant on the observer's ability to coordinate both cognitive and affective systems to understand and experience the inner states and feelings of others while maintaining a full sense of self-awareness (Batson, 2009; Coplan, 2011; Livingstone & Thompson, 2009; Stueber, 2017). Social actors leverage their empathic connection with others to

facilitate appropriate social interactions (Batson, 2009; Bowles & Gintis, 2011; Eisenberg, Eggum, & Spinrad, 2015; Hoffman, 2000). The ability to empathize does not suggest a perfect emotional match between the empathizer and the observed, but rather, an emotional congruence that facilitates shared understanding and coordinated action.

Empathy and Music Making

The capacity to empathize with others and the mechanisms that support interpersonal understanding and social interaction also form the foundation for coordinated music making and the exchanges that occur between co-performers when they attune to each other and make musical decisions (D'Ausilio, Novembre, Fadiga, & Keller, 2015; Pesquita, Corlis, & Enns, 2014; Sawyer & Dezutter, 2009). Collaborating musicians coordinate musical actions and construct a shared sense of musical meaning through both cognitive and affective systems, which is reflective of the empathic process. Keller (2014) argues that empathy is an important feature for coordinating musical and emotional development between musicians during ensemble performance.

Despite theoretical underpinnings that music and empathy may be developmentally related, it is important to highlight that the inherent value in music learning is rooted in musical engagement, and that the goal of music education is to help students engage with music so that it brings their lives more meaning and provides them with a better understanding of what it means to be human (Reimer, 2003). Therefore, my goal in examining the relationships between different forms of musical engagement and empathy development is not to suggest that the principal purpose of music education is to foster empathy, rather, this study may provide educators with knowledge about how music and empathy interact so they can utilize and foster

the capacities of both phenomena to provide more meaningful learning experiences that enhance the musicianship and humanity of their students. Bennet Reimer (2003) asserts:

> To understand music is to understand its intimate connections to all of human experience. To experience music is to experience how we as individuals are connected to all other humans in our communities and all other communities in the world and in history. (p. 60)

Perhaps, then, an argument can be made that the converse of this relationship is also true: The ability to experience a connection with others, socially and emotionally, impacts our understanding of music and influences the musical experience. If providing meaningful learning experiences that foster musical understanding is the central aim of music education, then it is worthy to understand how the shape of those experiences may impact the way students connect with others both socially and emotionally and how those connections influence musical understanding.

Empathy and Collective Music Making

Collective music making is a culturally ubiquitous experience that supports communicative and emotional connections between participants through shared intentionality and musical understanding (Cross, 2009; Krueger, 2013; Meyer, 1961; Reimer, 1989). Theorists argue that music may be an evolutionary adaptation for supporting social cohesion by fostering group level communication, emotional congruence, and collective action (Brown, 2000; Cross, 2009; Huron, 2001). Brown (2000) asserts:

> It is telling to consider that music and dance are among the very few cultural mechanisms available for channeling group emotional expression, functioning as vehicles for generalized catharsis and conflict resolution, but most importantly, as bonding

> mechanisms that generate spiritual solidarity and cooperation through shared, temporally-synchronized experience. (p. 262)

The enaction of cognitive sensitivity and emotional resonance during group musical interactions are reflective of the conditions that enhance empathic connections (Barnett, 1987).

Hoffman (2000) asserts that empathy is a fundamental evolutionary feature that has enhanced human species survival by promoting altruistic and cooperative behaviors that foster and capitalize on the adaptive advantage of social cohesion (Bowles & Gintis, 2011). Empathy is an important evolutionary trait that has enabled humans to coexist and work together as social beings. In accordance with theory (Brown, 2000; Cross, 2009; Cross, Laurence, & Rabinowitch, 2012; Hoffman, 2000; Huron, 2001), music and empathy are evolutionary and concurrently functioning mechanisms that support social bonding and may have interdependent relationships. One of the aims of this study was to examine how empathy and group music making intersect and shape mutual development.

If music making, most generally, is a mechanism for social cohesion, then perhaps different forms of music making, more specifically, have varying socially connective and empathic properties (Rabinowitch, 2015a). Collaborative music making in a performance ensemble, as one example, may incite states of shared intentionality where individuals respond to each other in an effort to attain mutual goals and coordinate actions (Keller, 2014). As Cross, Laurence, and Rabinowitch (2012) articulate:

> Active participation in music-making helps make possible the alignment of our own emotional states with those of our collaborators and may give rise to a sense of empathic

> community. Its effects might even outlive the activity itself; music may act as a scaffold that can help us to acquire the habit of empathizing. (p. 340)

Although music-making environments may scaffold the development and formation of social intelligence and empathic connections (Krueger, 2013, 2015), these connections may be more robust within individuals that have strong predispositions for empathic response (Clarke, DeNora, & Vuoskoski, 2015; Vuoskoski, Clarke, & DeNora, 2017; Wallmark, Deblieck, & Iacoboni, 2018). Empathic dispositions seem to enhance attunement or the cycle of processes that support empathic action in music-making contexts and bolster the social scaffolding music invokes (Babiloni et al., 2012; Babiloni, Percio, Bruni, & Perani, 2017; Good & Russo, 2016; Schellenberg, Corrigall, Dys, & Malti, 2015; Seddon, 2005; Seddon & Biasutti, 2009; Wallmark et al., 2018). In other words, the conduit between empathic dispositions and musical interactions flows both directions with each social mechanism shaping the other.

If collective musical engagement serves as social scaffolding by facilitating interactive experiences and the development of shared meaning between participants (Krueger, 2013), then different forms of collective music making may shape the relationship between music and empathy in different ways (Rabinowitch, 2015a). Although there is body of research that has examined the connections between empathy and music perception while listening (Clarke et al., 2015; Kawakami & Katahira, 2015; Vuoskoski et al., 2017; Wallmark et al., 2018; Wöllner, 2012), empathic behavioral response through music performance interactions (Babiloni et al., 2017; Cirelli, Einarson, & Trainor, 2014; Kirschner & Tomasello, 2010; Trainor & Cirelli, 2015; Tunçgenç & Cohen, 2018), empathy levels and music participation (Cho, 2019; Hietolahti-Ansten & Kalliopuska, 1990; Kawase, 2016), and a broad base of group musical interactions and

empathy development (Kalliopuska & Ruókonen, 1986, 1993; Rabinowitch, Cross, & Burnard, 2012), there is a paucity of research that has examined different forms of collective musical engagements, the interactions involved, and the ways those interactions may shape or be shaped by empathy development. The lack of research examining the relationships between different forms of music making and empathy development supports the need for this study and its questions.

Empathy and Music in Adolescents

Although there is a growing body of research that has examined the relationship between music and empathic response, most of the existing literature focuses on children at early and middle developmental stages (Cirelli et al., 2014; Hietolahti-Ansten & Kalliopuska, 1990; Kalliopuska & Ruókonen, 1986, 1993; Kirschner & Tomasello, 2010; Rabinowitch et al., 2012; Trainor & Cirelli, 2015; Tunçgenç & Cohen, 2018). Empathic resonance, understanding, and response are informed by and become more acute with the development of cognitive abilities, which enhance the abilities of children to perceive and decode emotional and contextual cues (Barnett, 1987; Brownell, 2013; Eisenberg, Murphy, & Shepard, 1997; Hoffman, 2000). The influence of cognitive capacities on empathic response suggests that empathic dispositions are malleable, and that social experiences and developmental progress shape dispositional empathy. Research that extends the study of empathy and music into middle and late childhood might provide music educators and researchers with a better understanding about how interactions between the two phenomena change as children develop and become more socially independent. In this study, I address the relationship between collective music making and empathy

development in adolescent music students, advancing empirical understanding about these relationships in late childhood.

In the next section, I will provide a conceptual of empathy development. Following this conceptual outline, I will discuss the theoretical link between collective music making and empathy response in what Rabinowitch (2015a) articulates as the music empathy theory. I will conclude this chapter with final comments about the need for this study and an outline of the remaining chapters.

Empathy Development

For the purposes of this study, dispositional empathy is conceptualized as an individual's current capacity to engage in the imaginative or reactive process of understanding or resonating with another person's emotional or psychological condition while maintaining their own emotional and psychological identity (Batson, 2009; Coplan, 2011; Singer & Lamm, 2009). This capacity to empathize with others is a disposition rather than a trait because it is influenced by the development of social skills along with the progression of other capacities associated with human cognitive development (Eisenberg & Strayer, 1987; Norma Deitch Feshbach & Feshbach, 2009). In this study, dispositional empathy or the capacity to engage in the empathic process was measured with both cognitive and affective responses on the Basic Empathy Scale (BES; Jolliffe & Farrington, 2006) . In chapter 3, I provide more details about the BES and its validity and reliability.

Given that empathic dispositions are malleable and shaped by cognitive development and social experiences, the capacity to empathize can be supported through a greater awareness of other people and their emotional and situational cues (Hoffman, 2000). As Feshbach and

Feshbach (2009) assert, “although the ontogenetic pattern of empathic development is unresolved, it is now generally accepted that empathy can be learned and therefore that empathy can be taught and trained” (p. 85). But what are the conditions that support empathic learning? Empathy development is enhanced by frequent and diverse emotional interactions with other people, and empathic socialization starts early in life (Eisenberg & Strayer, 1987). Children with secure parental attachments, that experience empathic modeling, and that participate in social encounters that promote perspective taking are likely to build onto inherent empathic response systems (Eisenberg et al., 2015).

Barnett (1987) outlines several social antecedents to empathic development that may be facilitated in learning environments and empathy inducing interventions. Conditions that satisfy the emotional needs of children while discouraging excessive self-concern is an important antecedent. Positive music-making environments that encourage musical expression while simultaneously attending to the expressive features of others may fulfill this condition. Barnett proposes that numerous opportunities to observe and interact with others provide empathic insights. Once again, the activity of collaborating with others in music-making contexts supports the conditions for a variety of social interactions and observations. Barnett suggests that empathically supportive social conditions foster reduced interpersonal competition, encourage balanced self-concern, promote emotional perception through verbal, visual, and contextual cues, and support experiences with a broad range of emotional expression. These examples of empathic support mechanisms characterize the conditions that are often found in successful collaborative music-making environments.

Music Making and Empathy Interdependence

Music engagement is a social process that inspires empathic response through interpersonal interaction and emotional interpretation (Davies, 2011; Krueger, 2013, 2015). As Krueger (2015) notes:

> Long-term exposure to music appears to scaffold the acquisition of rudimentary embodied skills at the heart of our empathic engagements: e.g., the ability to attend to and interpret the sonic shape of emotionally-coloured sounds; auditory-tactile-kinesthetic sensitivity to the flexible rhythmic parameters of interactive turn-taking; and the coordination of bodily movement with affective expression and shared feeling. (p. 93)

Davies (2011) argues that the simple perception of music provides recurrent opportunities for responding to emotional cues. Although music perception may initiate empathic resonance, collective music *making* may augment empathic associations and empathic response in a social context (Cross et al., 2012). After all, successful music making includes aspects of both perceiving and expressing musical ideas through the generation of emotionally meaningful sound.

The shared behavioral mechanisms of mimicry, synchronization, and affectively motivated movements and interactions during collective music making support processes of cooperation and shared understanding (Cross et al., 2012; Rabinowitch et al., 2012). Of course, different forms of musical experiences may scaffold for these behaviors with more effectiveness than others. Thus, different forms of music making are likely to have different effects on fostering empathic connections. Rabinowitch (2015a) theorizes that participating in the process of collective music making or musical group interactions leads to enhanced interpersonal

sensitivity and empathic development. Rabinowitch further argues that the modes or processes used during different types of music making likely support different types of social interactions and may have different effects on or demonstrate different responses to empathy development.

Seddon (2005) argues that the formation of unified musical structures through improvisation is enhanced by empathic attunement, which supports the ability of musicians to successfully communicate nonverbally, listen and respond to the music being generated more deeply, take risks, and stretch creativity. Collective free improvisation may be an especially effective form of group musical interaction for activating and exercising empathic abilities or for leveraging empathic dispositions to engage in intersubjective decision making (MacDonald & Wilson, 2020; Ng, 2018; Seddon, 2005). Nachmanovitch (1990) describes collective free improvisation "as a direct relationship between people, unmediated by anything other than their imaginations, group improvisation can be a catalyst to powerful and unique [relationships] (p. 99). Free improvisers enter collaborative relationships and engage in the creative process to generate unified musical structures.

For the purposes of this study, collaborative free improvisation is defined as the spontaneous and collective creation of music between co-performers using pitch, rhythm, and sound effects through the generation of and response to musical ideas, communication, and shared understanding (Nachmanovitch, 1990; Ng, 2018; Wilson & MacDonald, 2016, 2017). In free improvisation environments, performers utilize the musical skills and understanding that each member brings to the experience as they craft and respond to musical ideas in-the-moment of creation without preconceived frameworks for interaction (Canonne & Garnier, 2011; van der Schyff, 2013; Wilson & MacDonald, 2017). Ng argues, "collective free music improvisation

requires perpetual interactions and negotiations among ensemble members to establish, develop, and sustain conversations on an unstable, fluctuating sociomusical platform" (2018, p. 2). There is no intermediary barrier such as a referential framework (i.e., preconceived musical structures or song forms to guide musical expectations) in free improvisation to limit the musical choices of co-performers as they construct shared improvisations. This form of music making necessitates enhanced social interaction between co-performers to successfully blend and adapt spontaneous musical ideas into unified structures.

MacDonald and Wilson (2020) assert that improvisational processes are foundational to all aspects of human interaction and that the processes engaged during collective music improvisation are as dependent on interacting musicians' social skills as they are on musical, technical, and creative abilities. Given the socially embedded and cognitively and affectively enacted nature of collective free improvisation, it stands to reason that the empathic dispositions of improvisers may demonstrate a particularly strong relationship with collective improvisation experiences. The aim of this research was to examine the relationship between dispositional empathy development and collective free improvisation when compared with other forms of musical group interactions.

Statement of the Problem

As the review of literature in the following chapter will demonstrate, there have been few randomized and controlled studies utilized to establish a causal relationship between music making in educational settings and empathy development, and none that have examined the relationships of different forms of music making on empathy development. In addition to a lack of experimental designs, many of the current studies position musical engagement as the

independent variable or the influencing factor on empathy differences in study participants (e.g., (Hietolahti-Ansten & Kalliopuska, 1990; Ilari, Fesjian, & Habibi, 2018; Kalliopuska & Ruókonen, 1986, 1993; Kirschner & Tomasello, 2010; Rabinowitch et al., 2012). While this could well be the case, it is also possible that levels of empathy development influence levels of musical achievement, especially in highly social and expressive forms of music making such as collective free improvisation. Therefore, this study examined the relationship between music making and empathy development from both of these perspectives.

Purpose and Research Questions

The purpose of this study was to examine the effect of small group music improvisation experiences on dispositional empathy development in adolescent instrumental music students when compared with collective music-making experiences using traditional notation in small and large performance ensembles. In addition, the relationship between group empathy dispositions and ratings of performance achievement were examined to determine if empathy levels predicted performance achievement during interactive music experiences and to determine if different types of musical experiences (improvisation or notation) were more susceptible to the influence of empathy levels on interactive achievement.

Research Questions:

- Do adolescent instrumental music students that participate in small group improvisation experiences demonstrate different levels of change in dispositional empathy when compared with participants that engaged in music-making experiences in small groups and large performance ensembles using traditional notation?

- Is there a relationship at pre-and-posttest between the dispositional empathy levels of co-performers and achievement ratings of group improvisation and notated duet performance tasks? Is this relationship different based on performance condition?
- Is there a relationship between the empathy scores of co-performers at baseline and changes in performance ratings between pre-and-posttest performances of freely improvised dyads and notated duets? Are these changes affected by performance condition?
- Is there a relationship between changes in empathy scores and changes in performance achievement for improvisation groups and notated duet groups? Are these associations affected by performance condition?

Adolescent instrumental music students, an underrepresented population in the existing literature on music and empathy, were randomly assigned to one of three different music-making conditions to examine the effects of different musical interactions on dispositional empathy development while also examining the predictive relationship between co-performer empathy levels on performance achievement in different music-making contexts. The relationship between collaborative free improvisation and dispositional empathy was the primary interest of this study with the notated duet and traditional large ensemble experiences operating as comparison conditions.

Chapter Organization

The literature review in the next chapter will outline and synthesize the empirical research connecting empathy to musical engagement and the socio-communicative function of collective improvisation. In addition to reviewing this extant literature, chapter 2 will provide more details about the need for the current study and offer a basis for study hypotheses.

Chapter 3 details the measures and procedures used in the experimental and concurrent correlational research designs. Adolescent instrumental music students ($N = 185$) were randomly assigned to three music-making conditions (improvising dyads, notated duets, traditional large ensembles). Participants completed a demographic questionnaire to indicate their age, gender identity, racial/ethnic identity, the number of years they had been playing their instrument, and the instrument they played. Dispositional empathy levels were measured with the Basic Empathy Scale (BES; Jolliffe & Farrington, 2006), collective improvisation achievement was measured with the Collaborative Improvisation Measure (CIM; Schmidt, 2018), performance achievement for the notated duets was measured with the Small Ensemble Adjudication Form (SEAF; "Illinois High School Association," 2013), and affective valence associated with the collective music-making experiences was measured with the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988).

Participants completed the BES and performance tasks at pre-and-posttest collection periods. The musical interventions were implemented once a week for 20 minutes for a period of eight weeks. Participants completed music-making tasks associated with condition assignments during the intervention period. Data were analyzed to examine the effect of musical interventions

on dispositional empathy development and the relationship between dispositional empathy levels and performance outcomes for improvising dyads and notated duets.

In chapter 4, I provide an analysis of the data and illuminate findings about the effect the different music-making experiences had on gains in empathy levels using a difference-in-differences regression estimator. This analysis enabled me to compare changes in dispositional empathy between conditions from pre-to-posttest while controlling for gender identity, affective valence, and instrumental playing experience. In addition to analyzing the between music-making condition differences in empathy gains, I examined within participant variation in dispositional empathy levels using the control variables as predictors and present findings about the predictive relationship of gender identity, instrumental playing experience, and affective valence on participant empathy levels.

I present the analysis and related findings about the relationship between co-performer empathy levels and performance achievement in chapter 5. Using a series of regression analyses, I examined the predictive relationship between co-performer empathy levels and performance outcomes with pretest, posttest, and gain scores while controlling for the within group averages of instrumental playing experience and affective valence. In addition to using co-performer empathy levels as a continuous predictor of performance outcomes, I categorized improvising dyads and notated duets as high-high, high-low, and low-low empathy pairs using gender weighted medians. Analyses of variance were utilized to examine the between empathy group and performance group differences in performance outcomes with pretest, posttest, and gain scores. I present findings about the predictive relationship of co-performer empathy levels and

performance outcomes to support a comprehensive discussion about the influences between empathy and music making in chapter 6.

Finally, in chapter 6, I synthesize the findings from the analyses to offer a discussion, implications, and conclusions about the relationship between collective free improvisation and empathy development. I frame the discussion of findings within the context of previous research related to empathy and musical engagement. I discuss findings about performance outcomes as they relate to the collective improvisation literature and hypotheses derived from theories about the socially generative nature of unmediated free improvisation experiences. The discussion of results supports implications for fostering music learning environments that enhance both interpersonal connections and musical development.

CHAPTER 2: REVIEW OF LITERATURE

Purpose of the Literature Review

The aim of this study was to examine the effect of small group music improvisation experiences on dispositional empathy development in adolescent instrumental music students when compared with engaging in musical experiences that use traditional notation in small and large ensemble settings. In addition, I examined and compared the relationships between group level empathy dispositions and performance achievement for dyads performing free improvisations and notated duets.

The purpose of this literature review is to provide the reader with background about the historical conceptualization of empathy and review the literature that has made empirical connections between empathy development and musical engagement. In addition to reviewing the literature on empathy and its relationship to musical engagement, I will also examine the literature on collective music improvisation and the social, affective, and cognitive interactions enacted during collective improvisation processes. In the last section, I will discuss variables that may influence the interaction of musical engagement and empathy development and demonstrate a need to control for these factors when analyzing data from experimental interventions.

This review provides empirical support for assertions that group musical interactions encourage empathic attunement and may induce contexts that influence dispositional empathy development (Cross et al., 2012; Rabinowitch et al., 2012). I also argue that the relationship between musical engagement and dispositional empathy may be dependent upon the forms and types of musical engagement enacted (Rabinowitch, 2015a, 2015b). In addition to providing

empirical support for the connections between musical engagement and empathy development, I will show that there is a need for research that provides a more focused examination of how different forms of musical enaction are connected to empathy development.

Definitions

Prior to discussing the epistemology of empathy and reviewing the relevant empirical work linking empathy to music, I'm providing broad definitions for a few terms that are frequently cited in the literature and used to shape my conceptual framework about the relationship between empathy development and musical achievement. For the purposes of this study, intersubjective exchanges are the processes through which understandings and responses to shared experiences are influenced by the interactions of individuals (Rowe & Isaac, 1991). Empathic attunement refers to the process whereby people purposefully observe and understand the psychological states of others such that both observers and the observed can take collective action that attends to the understandings and feelings of others. Intersubjective exchanges are subsumed within the attunement process but applied deliberately with the intent of shaping experiences that respond to the needs and understandings of others.

For the purposes of this study, collective music making broadly refers to synchronous music making between more than one individual. Different forms of collective music making can be characterized on a continuum of collaborative music making, which refers to the level individual musicians interact and generate musical ideas and form congruent musical understandings. Collaborative musicians respond to the social and musical cues of co-performers as they produce intersubjectively informed musical outcomes. Empathic attunement forms the

basis of collaborative musical actions between musicians and shapes the capacity of interacting musicians to respond to one another and generate mutually creative ideas (Seddon, 2004, 2005).

The levels through which musicians attune to one another and mutually generate musical ideas determines where upon the collaborative music-making continuum the musical experience falls. For example, musicians in performance ensembles that fixate on performing their individual parts and only respond to the directives from conductors to make musical decisions fall on a lower end of the collaborative music-making continuum when compared with music-making experiences in group improvisation or chamber ensembles. Although it is unlikely that any form of collective music making is completely void of attunement and collaboration, some musical experiences are much more conducive to interactive musical decision-making than others and are ultimately more collaborative. In the next section, I will provide a philosophical orientation for the construct of empathy and frame empathic attunement as a process of shared cognitive and affective understanding and collaborative response.

Epistemological Foundations of Empathy

The construct of empathy emerged out of the nineteenth-century German aesthetic movement (King & Waddington, 2017). *Einfühlung* (feeling into) was originally used to describe the projection of human observers into works of art for a better understanding of, appreciation for, and emotional connection with artistic content. Empathy eventually entered the domain of psychology as a construct for the capacity of humans to understand the thoughts and feelings of others. Philosophers and psychologists initially debated the source of empathy and suggested that it is enacted from one of two different processing domains: affective resonance or cognitive response (Wispé, 1987).

Philosopher Theodor Lipps shifted *Einfühlung* from the domain of aesthetic philosophy and redefined empathy as a psychological process through which people understand the mental states of others (Clarke et al., 2015; Wispé, 1987). This early characterization of empathy was considered a reflexive and internal process wherein humans resonate with the emotional cues of others through a system of innate perceptual and response abilities. In other words, humans are hardwired to perceive and generate an affective response to the observed emotional states of others. Hoffman (2000) argues that the capacity to affectively resonate with others is an evolutionary adaptation that is essential for human social cohesion. empathy, from the aforementioned perspective, is consider an automatic process of knowing the thoughts and feelings of others through emotional contagion, social intuition, and matched neural representation.

Stein provided an alternative description of empathy and suggested that it is a *cognitive* capacity to perceive the internal states of others and develop an understanding about their thoughts and feelings through perspective taking (Batson, 2009; Laurence, 2017; Stein, 1964). Empathy, from the perspective of Stein and others, is a cognitive process of understanding another person's condition or state of mind by recognizing and reflecting on their emotional cues and personal circumstances rather than simply producing an automatic affective response (Bamford & Davidson, 2019; Stueber, 2017; Thompson, 1987). Cognitive empathy is engaged and enhanced through the capacity to see oneself through the perspectives of others and their circumstances. This capacity is developed as people experience a larger range of social and emotional interactions. Cognitive empathy is not considered a fixed trait, but a disposition that can be learned as people develop the ability to decode emotional cues and perceive the

situational circumstances of others in order to make accurate inferences about what they are experiencing and feeling (Eisenberg et al., 1997).

Dual Process

The modern conception of empathy in both psychological and philosophical traditions suggests that it is enacted through the complicated interplay of both affective resonance and cognitive response (Singer & Lamm, 2009; Stueber, 2017). Affective resonance is an inherent and automatic capacity of empathic observers to resonate with the emotional states of others through emotional contagion and matched neural representations, which emerge from the emotional cues and social reactions of others (Batson, 2009; Stueber, 2017). The second of the dual processes, cognitive response, is the capacity of empathizers to volitionally observe others' social cues and contextual circumstances in an effort to project themselves into the experiences of others or generate an inferential understanding about the emotional states and circumstances of others (Batson, 2009; Eisenberg et al., 1997; Ickes, 2009).

Dispositional empathy represents the combined inherent and learned capacity of observers to resonate with and understand the internal states of mind and emotions of others (Coplan, 2011; Jolliffe & Farrington, 2006). Cognitive development enhances affective resonance by increasing the emotional content observers have learned from their lived experiences and interpersonal interactions that can be mapped onto affective resonance (Hoffman, 2000). Affective resonance is a catalyst for engaging inferential understanding and cognitive response to the perceived conditions of others (Singer & Lamm, 2009; Stueber, 2017).

The activation and development of one empathic system creates more efficient and accurate activations in the other (Eisenberg et al., 1997; Singer & Lamm, 2009). Figure 2.1

shows a model of the interaction between affective resonance and cognitive response. The empathizer is at the center of the model and engages with the empathic process using a pallet of previous emotional and social encounters and understandings. Empathizers with a greater range of interpersonal experiences and emotional understandings will enter the empathic process with an enhanced capacity to empathize with others (Barnett, 1987; Brownell, 2013; Eisenberg et al., 1997). It stands to reason that an empathizer that has experienced an emotion such as joy and has witnessed others that have experienced joy will more efficiently and accurately identify and understand joyous emotional states in others. Empathizers utilize the emotional cues, social reactions, social cues, and contextual circumstances perceived from others in a dual process of affective resonance and cognitive response to map the cues and circumstances of others onto their pallet of social and emotional understanding (Eisenberg et al., 1997).

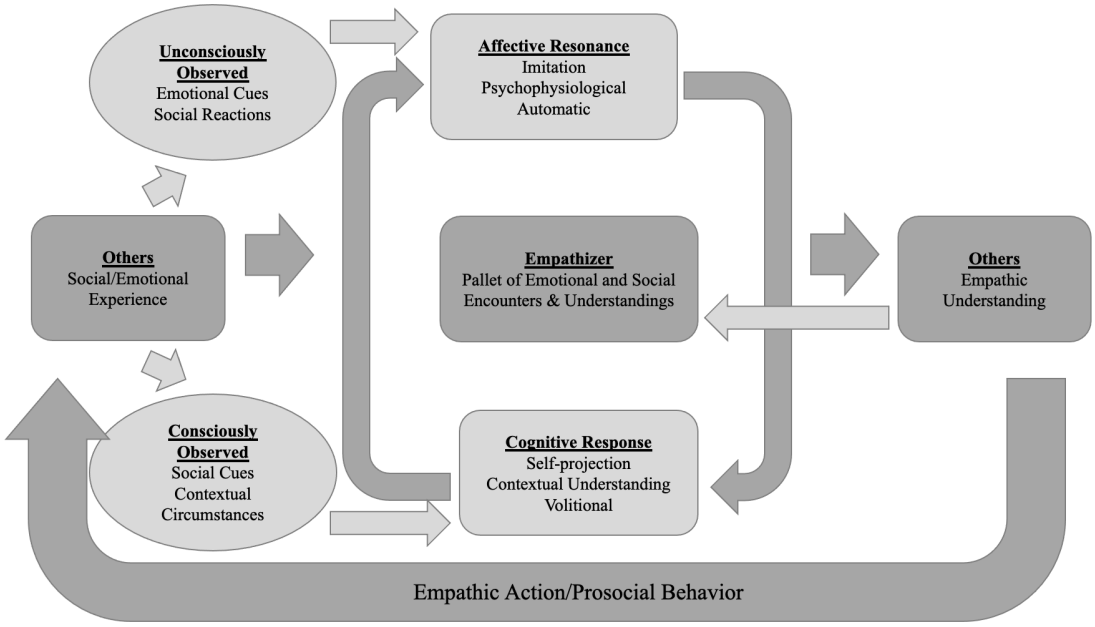
Affective resonance and cognitive response interact to provide empathizers with a multifaceted source of information to support their empathic understanding (Singer & Lamm, 2009). For example, affective resonance may facilitate inferential understanding or the projection of the self into the circumstances of others during cognitive response by engaging emotional contagion or the felt emotions of the observed (Ickes, 2009). Cognitive response may support more nuanced responses and a broader pallet of emotional understanding that can be triggered during affective resonance (Hoffman, 2000). These two systems of empathic processing pull in the social and emotional cues of others and cycle around previous social and emotional understandings to form an empathic understanding of others.

Empathic understanding is utilized to inform empathic actions or prosocial behaviors toward the observed whereby the cycle continues under the influence of this new social

interaction and empathic response (Batson, 2009). Empathic understandings of others that result from the empathic process feedback to the empathizer to enhance their pallet of social and emotional encounters and understandings to facilitate more efficient and accurate empathic processing during successive interpersonal interactions (Eisenberg et al., 2015; Eisenberg et al., 1997; Ickes, 2009). This is why Barnett (1987) asserts that empathic development is enhanced by numerous opportunities to observe and interact with others. Barnett further argues that peer interactions may be the most critical and effective antecedents for empathy development. The center of the empathic process model becomes more robust, and the pallet of emotional and social understandings becomes more adaptable to a greater variety of social and emotional expressions with increased opportunities to interact with others and engage in the empathic process.

Figure 2.1

Empathic Dual Process Model



Empathic Attunement

The construct of empathic attunement is described by theoretical frameworks in the field of psychotherapy as a process that generates accurate interpersonal connections and effective collaborative action between therapists and clients for therapeutic decision-making (Barrett-Lennard, 1981; Vanaerschot & Lietaer, 2007). Empathic attunement has also been applied to the development of empathic intelligence to support active listening, observation, and affective resonance between teachers and learners in educational settings and between supervisors and subordinates in workplace settings (Arnold, 2005, 2010). Attunement engages the empathic dispositions of observers in a three-cycle decision-making process which includes observational resonance, shared communication of resonant understanding, and collaborative information processing and decision-making (Barrett-Lennard, 1981).

In their review of psychologist Heinz Kohut's influential work on and application of empathic attunement as a process of enacting psychoanalytic self-psychology, Rowe and Isaac (1991) outline the intersubjective process:

> Each of us has an ongoing, continuous flow of inner experiences. These may include our experience of a certain event or situation, such as a rainy day or a difficult task. They may include our experience of another person's experiencing an event or situation. Our experiences also include our own experience of ourselves. And finally, they may also include our experience of others experiencing us as we experience them. This intersubjective process is one that occurs whenever human beings interact. (p. 17)

The intersubjective process, in this context, refers to the interactions between two people and how perception, meaning, and action are shaped through those interactions. Although dynamic

and multifaceted, the intersubjective process is a commonly occurring phenomenon that drives individual and collective action during social and cooperative experiences.

Attunement is reliant on both affective and cognitive faculties to inform intersubjective processes and advance empathy from a state of passive observational resonance to a process of empathic action (Vanaerschot & Lietaer, 2007). In therapeutic settings, the first stage of attunement consists of the therapist using their inner personal associations as referents to activate meanings and feelings that correspond with their client's inner phenomenological world. The first phase of the attunement cycle is primarily observational and does not necessarily require interpersonal interactions. Attunement leverages the intersubjective process in the second stage where therapists and clients share their understanding of inner meanings and feelings through empathic response mechanisms, such as the therapist verbally articulating what they have inferred to be the emotional state of the client. A shared understanding of meanings and feelings between therapists and clients informs the third stage of the attunement process, where they work collaboratively to process phenomenological information to make meaningful and healthy decisions and take appropriate actions in light of those decisions.

Engaging in empathic attunement both exercises and relies upon empathic intelligence, which emerges from a system of psychic, cognitive, affective, social, and ethical skills and understandings (Arnold, 2005, 2010). Arnold outlines five facets of empathic intelligence as the capacity to differentiate self-states from others' states, engage with the dynamic between thinking and feeling in self and others, attune to the connection and disconnection between thinking and feeling in social contexts, model the emotional experiences of others, and care and respond to the well-being and development of self and others. Empathic intelligence involves the

interplay between inter/intra-subjective processes and enables two or more people to effectively communicate and work collectively to generate a range of approaches and strategies for learning, solving problems, and generating creative products together. Arnold (2005) asserts that the recurrent enaction of the facets of empathic intelligence builds the capacity of people to engage and empathize with others and supports dispositional empathy development.

Empathic Attunement and Music Collaboration

Seddon (2004) argues that collaborative creativity during group music making results from an empathic attunement process. In other words, successful music collaborators process more than their own feelings and understandings during music making in an effort to perceive the musical ideas generated by those they collaborate with while being committed to sustaining their own musical contributions. Empathic attunement during music making is enacted as musicians listen and respond to one another during collaborative and intersubjective performances. The attunement process of attentive listening, communicative interaction, and musical response facilitates collaborative action between musicians, which allows them to take musical risks and stretch their creativity (Seddon, 2005; Seddon & Biasutti, 2009). Because of the interplay between intra- and interpersonal cognitive and affective systems during musical engagements, Arnold (2005) asserts that music and its associated experiences are among the sources that contribute to the development of empathic intelligence. As Hart (2016) articulates in a review of how children acquire the ability to empathize with and demonstrate compassion toward others, “music, rhythms, and play are crucial factors in our personal development” (p. 60). The following section examines literature on the interplay between music experiences and

interpersonal development and the empirical evidence that supports a link between music making and empathy.

Literature for Music and Empathy

Much of the growing body of research examining the connection between empathy and musical experience has been conducted in the fields of music psychology, music cognition, and neuroscience. Most of this literature focuses on the relationships between empathy and aural perception, musical meaning, neural activation, and co-performer interactions. This review synthesizes results from these investigations along with the relatively few studies conducted in educational settings. After reviewing the empirical connections between empathy and music, I outline studies examining the socio-communicative aspects of collective improvisation. Using a synthesis of findings from these studies, I will argue that collaborative improvisation facilitates empathic attunement processes and may also support antecedents for dispositional empathy development.

Music Perception

Aural perception is crucial to listening to and performing music, and empathy seems to influence and be stimulated by music listening experiences. Krueger (2013) asserts that listeners "have a great deal of perceptual autonomy in what they do with music: how they listen, what sort of meanings they choose to enact, and how they actively engage with music to forge relationships and shared experiences" (p. 3). Davies (2011) argues that humans are reliant on the ability of social cohorts to understand and respond to the outward show of emotional cues. Davies goes on to suggest that although it is a more sophisticated process than reacting to the raw emotional cues expressed during human contact, music is an outward presentation of

emotional content and provides listeners with recurrent opportunities for emotional reactions. “In particular, music appears to leverage empathy in the elicitation of emotion in listeners” (Livingstone & Thompson, 2009, p. 97). As the research will show, empathy development seems to function as a support mechanism for listeners as they perceive and respond to the expressive content within music.

Affective Processing

To examine the relationships between empathy, emotional response, and musical preference, Kawakami and Katahira (2015) tasked grade-6 Japanese students ($N = 84$) with listening to two compositions that were categorized as expressing sad emotions. After listening to the two sad musical selections, participants indicated the emotions they experienced during the listening process by rating whether they experienced any of the emotions presented on a list of 50 descriptive words or phrases using a scale of 1 (*not at all*) to 5 (*very much*). In addition to rating their emotional experiences, participants completed preference ratings for the musical examples by rating how much they liked each of the two selection on a scale of 1 (*not at all*) to 5 (*very much*).

Empathy was measured prior to the listening task through an adapted version of the Interpersonal Reactivity Index (IRI; Davis, 1983) . The IRI measures dispositions of both affective and cognitive empathy on subscales of empathic concern (EC), personal distress (PD), perspective taking (PT), and fantasy (FS), with EC and PD representing dimensions of affective empathy and PT and FS signifying dimensions of cognitive empathy. Participants in this study completed a version of the IRI that was modified for children and translated into Japanese. The

children responded to the 30 items on the IRI by indicating their agreement with statements on a scale of 1 (*not at all*) to 5 (*very much*).

A correlation analysis showed that IRI subscales of empathic concern (EC), perspective taking (PT), and fantasy (FS) had significant (though low to moderate) correlations with preferences for sad music. Although three out of the four subscales from the IRI demonstrated correlations with preferring sad music, when filtered through emotional response categories, only the affective subscale of fantasy showed a direct link to preferences for sad music. The authors suggest that these results indicate that empathy increases preferences for sad music. Moreover, sub-traits of empathy may foster different preferences for music depending on the expressive content of the music and an individual's emotional response to the music.

Wöllner (2012) investigated the perception of emotional expression in music and its relationship to cognitive and affective empathy. A string quartet of advanced students at a collegiate music conservatory performed and then rated their expressive intentions as they reviewed their performance through visual, audio, and audiovisual conditions. Audience participants ($N = 22$) also reviewed and rated the expressiveness of the performance under the same conditions as the performers. Audience participants were adults with a mean age of 22.32 years and had varying levels of musical training (3-19 years).

Ratings of expressiveness by both string quartet and audience members were gathered continuously while reviewing the performances under all three conditions (audio, visual, visual-audio). As participants reviewed the performances, they moved a computer cursor with a mouse to either the right or left to continuously document their ratings of high and low levels of musical expressiveness. After rating the expressiveness of the performances, audience participants

completed the Questionnaire of Cognitive and Affective Empathy (QCAE; Reniers, Corcoran, Drake, Shryane, & Völlm, 2011), an inventory validated to measure components of both cognitive and affective empathy response. The results showed a correlation between participants' levels of affective empathy and their accuracy at identifying expressive levels in the music performances that closely matched to the expressive intentions of the performers. There were no significant correlations between accurate interpretations of expressive performance and levels of cognitive empathy.

Using a pair of experiments, Pesquita, Corlis, and Enns (2014) examined the relationships between the accurate perception of collaborative jazz performances, affective social response systems, and musical training. Listeners were tested to determine whether they could detect real-time, collaborative jazz improvisations from overdubbed jazz performances. Jazz musicians were recorded performing jazz standards as a live duet, as a solo dubbed over a recorded performer, and two recorded performances dubbed together. Fifty-five adult participants (mean age 20.3) were asked to indicate "Yes" or "No" about whether the recorded performance, selected and presented at random from the three recorded conditions, was the live condition. They were also asked to indicate their confidence in their selection on a 6-point Likert-type scale.

In addition to testing participants' ability to identify live performance conditions, they completed the 50-item Autism Quotient (AQ; Baron-Cohen et al., 2001) that was used to measure affective social response systems on five subscales: social skill, attention switching, attention to detail, communication, and imagination. Higher scores on the AQ correspond with higher levels of autistic traits. The AQ generates scores with a range of 0 to 50 points. Listener

differences in musical expertise were also measured using the Musical Expertise Questionnaire (MEQ; Pesquita et al., 2014), which consists of 15 items of open response questions about the amount of time and quantity participants engage in music. Higher scores on the MEQ signify higher levels of musical experience.

Listeners with low levels of social aptitude and low musical training were less accurate at deciphering collaborative performances than participants with either high social aptitude or high levels of musical training. This result suggests that automatic affective response systems may enhance one's sensitivity to identifying collaborative actions between performing musicians even when observers do not have high levels of musical training.

In a second experiment, the authors examined whether cooperative live performances would influence the listener's subjective experience toward the performance. Using the same stimulus and measures of affective social response (AQ) and musical expertise (MEQ), a new sample of adult participants ($N = 111$) listened to the performances and ranked their agreement with descriptive phrases using a 6-point Likert-type scale about whether they experienced emotion, engagement, synergy, and creativity during their listening experience. Using median scores on the MEQ and AQ, participants were categorized as musical novices or experts and as having high or low levels of affective social response. The results indicated that participants with high social aptitude rated their listening experiences higher for all performances, but musical novices were particularly sensitive to collaborative performances and rated cooperative performances higher if they had high levels of social aptitude. Findings from both experiments showed that affective social response influenced perceptual understanding of musical

performances. Musical novices with high levels of affective social response demonstrated a strong subjective affinity for collaborative improvisations.

Cognitive Processing

Given the impact that dispositional empathy, especially affective resonance, seems to have on the inclinations of listeners to perceive the emotional content (Kawakami & Katahira, 2015; Wöllner, 2012) and collaborative development (Pesquita et al., 2014) of musical performances, it is worth considering how the explicit guidance of cognitive empathic systems toward musical perception may influence emotional responses. Cognitive response can be guided by imaginative perspective taking and perceiving the self through the situated states of others. Therefore, cognitive response can be made explicit by directing empathic observers to image how they would feel and respond if they projected themselves into the experiences of others. This projection supports the ability of observers to overtly develop an understanding about the experiences and feelings of others through volitional processing.

The purpose of a study by Miu and Balteş (2012) was to determine if there is a relationship between cognitive empathic awareness and music-induced emotions. In their study, 56 adult participants (M_{age} = 22.4) with no formal music education observed scenes from two operas that were characterized as representing happy (*Rataplan* by Marial Malibran) and sad (*Gelido in ogni vena* by Antonio Vivaldi) content. Participants were divided into high and low cognitive empathy conditions to observe the video performances of the opera scenes. For the purposes of this study, the high cognitive empathy condition was contextually situated to support overt perspective taking and emotional understanding while observing the opera scenes. The low

cognitive empathy condition avoided overt projection of participants into the emotional content of the scene by direction observations toward musical descriptions.

Participants in the high cognitive empathy condition were instructed to imagine how the performer in the opera scene felt about the music they were performing and to try and feel those emotions themselves. Participants in the low cognitive empathy condition were instructed to describe the music and the scene as objectively as possible. Participants were measured for dispositional empathy with the Toronto Empathy Questionnaire (TEQ; Spreng et al., 2009) and psychological response parameters (heart rate, skin conductance level, respiration rate). Participants also completed the Geneva Emotional Music Scales (GEMS; Zentner, Grandjean, & Scherer, 2008) to assess their emotional reactions of wonder, transcendence, tenderness, nostalgia, peacefulness, power, joyful activation, tension, and sadness as they observed the opera scenes.

Results indicate that participants in the high cognitive empathic awareness condition demonstrated a greater emotional connection to the music regardless of the musical content. Participants with high dispositional empathy experienced sadness, wonder, and transcendence when listening to sad musical content whereas participants with low dispositional empathy demonstrated little emotional connection to the music unless they were directed to think about the emotional content of the music and imagine themselves experiencing the emotions of the performer in the opera scene in the high cognitive empathy condition. This research demonstrates that listeners can detect emotional connections to musical content through both empathic systems: automatic affective resonance and volitionally attuned cognitive response, but automatic resonance is conditional on empathic dispositions.

Neural Activation

With both affective and cognitive empathic systems demonstrating an influence over the expressive connections to musical performances (Kawakami & Katahira, 2015; Miu & Balteş, 2012; Wöllner, 2012), Wallmark, Deblieck, and Iacoboni (2018) examined how regions of the brain associated with empathic response were activated during the perception of sound and music. The purpose of their two experiments was to determine if empathy levels changed neural responses to musical sounds. Trait empathy was measured using the IRI. In the first experiment, 15 undergraduate student participants (M_{age} = 19.1) listened to 12 musical timbres produced from a computerized sound generator in a normal and two noisy conditions while undergoing an fMRI scan. The 12 musical timbres were recorded samples of electric guitar (n = 4), tenor saxophone (n = 4), and bamboo flute (n = 4). The 12 musical samples were randomized and played for the participants in a regular tone and in noisy conditions, which consisted of the tone being altered at different levels of distortion. Results from the first experiment indicate that dispositional empathy levels were correlated with increased activation in brain regions associated with emotional contagion (affective resonance) while listening to isolated musical timbres.

In the second experiment, Wallmark et al. (2018) sought to determine if empathic dispositions influenced brain activation while listening to full musical samples rather than just timbres generated from musical instruments. Participants (20 undergraduate students, M_{age} = 19.1) listened to 16 musical excerpts that were categorized as familiar with and liked, familiar with and disliked, unfamiliar with and liked, and unfamiliar with and disliked while undergoing an fMRI scan. The participants selected the 8 examples of music they were familiar with and liked (n = 4) and disliked (n = 4). The researchers selected the eight examples of music that the

participants were unfamiliar with. The musical examples were trimmed to 16s excerpts. The results showed neurophysiological differences in music processing based on dispositional empathy levels. Regions of the brain associated with cognitive empathy activation showed more differences based on empathy traits while listening to unfamiliar music. The authors suggest that these results indicate that low-empathy participants may have tuned out aversive and unfamiliar music while those with high empathy dispositions demonstrated neural reactivity to unfamiliar and even unpleasant sounds. Empathy levels may have stimulated a more acute or attuned awareness of the sounds produced by others, even to those that seemed unfamiliar and distasteful.

Empathic Responsiveness

The activation of empathic neural substrates through music listening may foster empathic connections to not only the music heard, but also to the sources that generate the music. Clarke, DeNora, and Vuoskoski (2015; 2017) examined whether exposure to music from an unfamiliar culture through listening would evoke empathy and generate affiliation to the cultural source of the music. Participants ($N = 61$) between the ages of 18 and 45 ($M = 24.07$) were randomly assigned to two conditions in which they either listened to music from Indian popular music or West African popular music.

The Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998) was used to measure participants' affiliative attitudes toward Indian and West African people. The IAT measures implicit positive and negative associations to the categories and concepts related to a specific ethnic group or culture. The measure has been frequently used to reveal racial bias, but for the purposes of this study, it was used to show participants' positive or negative affiliations

toward Indian and West African people. Participants also completed the IRI to measure their levels of dispositional empathy.

The results showed a significant interaction between dispositional empathy and the type of music participants were exposed to (Indian or West African popular music). Participants with high dispositional empathy levels demonstrated higher levels of positive associations toward Indian people than toward West African people on the IAT after listening to Indian music. The same effect was observed in participants that listened to West African popular music; they demonstrated stronger levels of affiliation toward West African people than toward Indian people. Although music listening seems to invoke affiliative response, "empathic individuals appeared to be more susceptible to the affiliation-inducing effects of music listening" (p. 76). The authors suggest that music listening may inspire an empathic response, but this response is more likely to be triggered in people with high empathic capacities to begin with.

With evidence suggesting that aural perception and empathy interact during music listening to facilitate listener connections to the expressive features and cultural properties of music, one might wonder if musical training might also bolster empathic perception during other social interactions. Parsons et al. (2014) sought to examine the relationships between parental status, empathy, and musical training on the perception of infant cries. Study participants (N = 109) were between the ages of 21 and 39 years (M = 28.76). A portion of the participants were mothers (n = 29) and fathers (n = 25) with infants less than 18 months old (M = 8.1 months). Approximately half of the participants had musical training (4 or more years) in their backgrounds.

Participants listened to 15 digital recordings of infant cry bursts that were digitally altered to increase or decrease in pitch level to simulate variable levels of distress. Paired recordings of the same cry burst offset by 0.5-4 semitones were successively played for participants. Participants listened to the paired cry bursts and selected the option that sounded the most distressed. In addition to completing the cry burst comparison task, listeners also completed the Empathy Quotient (EQ; Baron-Cohen & Wheelwright, 2004) questionnaire and the Beck Depression Inventory-Second Edition (BDI-II; Beck, Steer, & Brown, 1996).

The only significant result from the analysis was the interaction of parental status and musical training. Parents with musical training demonstrated significantly higher achievement at detecting distressed infant cry bursts than their nonparental and non-musically trained counterparts. Empathy scores were significant predictors of accurate distress detection for participants that were not parents. Parental status seems to moderate the effect of dispositional empathy and the ability of detect infant distress cries. This result suggests that dispositional empathy is a critical factor in empathic response if there are no interacting variables (e.g., parental status, musical training). The authors conclude that music, dispositional empathy, and social conditions seem to shape empathic responsiveness through complex interactions.

Summary

The compendium of evidence presented by the preceding research suggests a complex relationship between both affective and cognitive empathic response systems and music perception. It appears that affective resonance enhances the emotional accuracy of listeners as they listen to the expressive features from musical performances (Kawakami & Katahira, 2015; Miu & Balteş, 2012; Wöllner, 2012). Although the automatic responses activated during

affective resonance stimulate accurate expressive understanding of musical content, it also appears that cognitive systems become active during the listening process and can be attuned so that listeners make emotional connections to the music they hear (Miu & Balteş, 2012; Wallmark et al., 2018). Finally, music perception and empathy development seem to be interacting factors that foster interpersonal understanding and affiliative reactions (Clarke et al., 2015; Parsons et al., 2014; Vuoskoski et al., 2017).

Although the scope of the research examining the relationship between music listening and empathy is still rather small, the evidence suggests that music listening is an agent of social scaffolding and leverages both cognitive and affective systems to foster empathic responses (Davies, 2011; Krueger, 2013, 2015; Livingstone & Thompson, 2009). If music listening incites empathic response systems and serves as social scaffolding, then perhaps the interpersonal actions facilitated during collective music making will demonstrate similar effects. In the next section, I describe the literature examining the relationship between empathy and interpersonal interactions during collective music making.

Performer Interactions and Interpersonal Response

As the preceding studies have demonstrated, music listening is connected with empathy through understanding and appreciating the emotional content within its sounds, and it may incite empathic brain activity, social affiliation, and hone the perceptual skills that foster empathic reactions in broader social contexts. Music listening is one facet in a network of interactions during the socio-communicative activity of music making (Keller, 2014). Human interaction during music making also includes the perception and monitoring of motor, cognitive, emotional, and social states and actions (Rabinowitch, 2015a). If music listening is linked to

empathic associations, then collective music making—which subsumes music listening—may have even stronger connections to empathic development through the activation of synchronous, imitative, and responsive movement between co-performers. Empathic action may also be closely related to the cognitive awareness of musical, emotional, and social cues executed during musical collaborations. As D'Ausilio, Novembre, Fadiga, and Keller (2015) assert, "Musical ensemble performance is a universal means of non-verbal communication that is achieved through specialized and codified forms of social interaction" (p. 111). This section examines the relationship between musical interactions during collective music making and empathic response.

Synchronous Movement

Performers utilize more than just the generation and perception of sound to interact and communicate during music-making processes. For instance, movement provides opportunities for visual communication, embodied alignment, and expressive representations as performers coordinate musical actions (Keller, 2014; Keller & Appel, 2010). Researchers have found that the use of movement between co-performers during music making experiences may trigger empathic attunement and foster embodied affiliations (Seddon, 2004; Seddon & Biasutti, 2009). It seems that movement and empathic social interactions are connected to processes of moving in out and out of synchrony with others, which supports both interpersonal affiliations and self-other differentiation (Behrends, Müller, & Dziobek, 2012).

In an investigation of the effects of synchrony on pro-sociality (a related construct to empathy), Tunçgenç and Cohen (2018) examined the differences in helping behavior, mutual smiles, eye contact, and empathy between children (ages 4-6, $M = 5.1$) that were engaged in

synchronous play (n = 38) and those that engaged in non-synchronous play (n = 38). Participants in both the synchronous and non-synchronous conditions learned to play a clap and tap game and performed the tasks with another child. They listened to a click track with headphones as they completed the task and were instructed to complete the steps of the game with the click of the track. In the synchronous condition, paired participants heard clicks that were aligned while children in the non-synchronous condition heard clicks at different tempi.

After completing the click and play game, participants were instructed to complete a fish feeding task that induced a spill by one of the participants. Raters observed the other child's behavior and coded their behavior as absolute help, moderate help, and zero help to measure prosocial response. The results showed that children were more likely to display helping behaviors after completing a synchronous play task than the children that completed the nonsynchronous task.

Cirelli, Einarson, and Trainor (2014) examined whether the experience of interpersonal synchrony in a musical context led to increased prosocial behaviors in 14-month-old walking infants (n = 48). Infants were bounced to music while facing an experimenter who either bounced to the music in-synchrony or out-of-synchrony with the infant. In addition to the variation of synchronous movement, the musical beat was either evenly spaced or unevenly spaced using an unpredictable beat pattern to examine the role of movement predictability on prosocial response. Following the infant/researcher musical interaction through listening and bouncing, infants were tested to see if they would hand an object back to the researcher that they had "accidentally" dropped.

Results showed that infants helped significantly more often when they bounced in synchrony than out of synchrony but that beat predictability and the interaction between beat predictability and synchrony and were not significant factors in prosocial response. A second experiment showed that anti-phase bouncing induced similar helping behavioral responses in infants (n = 20) to synchronous movement. The second experiment used the same procedures as the first experiment with the exception that anti-phase infants were bounced in opposite direction of the researcher. Although the movements of the researcher didn't mirror infant movements, when infants moved at the same tempo as the researcher, they demonstrated significantly more helping behaviors during the helping response task than those in the asynchronous condition. The researchers assert that these results demonstrate a link between music, movement, and prosocial response.

Although the preceding studies demonstrate a relationship between synchronous movement and prosocial response, research has also shown that the capacity to move in synchrony is related to dispositional empathy as demonstrated by the ability of undergraduate students (n = 21) to physically entrain to a musical beat (Bamford & Davidson, 2019). Participants completed the Empathy Quotient (EQ; Baron-Cohen & Wheelwright, 2004) and the Big Five Aspect Scale (BFAS; DeYoung et al., 2010) of personality traits. Participants were video recorded listening to a series of musical excerpts and observed as they freely responded to the music. The video was coded by raters to determine the duration between a change in musical stimulus and the onset of movement that aligned with the rhythmic pulse of the music. Findings showed that the constructs of agreeableness on the BFAS and dispositional empathy on the EQ were significantly related. These two constructs also demonstrated a positive correlation with the

ability to rhythmically entrain to music. Results showed that "people with high empathy are quicker to spontaneously move to music" (p. 16). The authors assert that the relationship between rhythmic entrainment and empathy indicates that similar neural mechanisms are activated when engaging in either rhythmic entrainment or empathic response, and that empathy may be an embodied experience that is exercised during synchronous musical engagements.

Collective Musical Action

Kirschner and Tomasello (2010) examined whether collective music making among 4-year-old children increased cooperative and helpful behavior when compared to a matched control condition with the same level of social and linguistic interaction but without music (N = 96). Pairs of children were told a story at the start of an experimental intervention about a group of frogs sleeping in a pond. The children collectively engaged in a task to wake the frogs with a morning song (musical task) or a morning exercise (non-musical task). Following the collective activities (musical or non-musical), the children completed a spontaneous helping test. Children were required to move 24 marbles (6 at a time) with a tube as part of a story about grinding food to feed some fish. The tube of one child in each pair was manipulated to drop marbles on the floor during the movement task.

The behavioral response of the child with the fully functional tube toward the child with the broken tube was coded on a continuum between being actively helpful toward the victim to disregarding the victim and continuing the marble moving task on their own. The results showed that children in the collective music-making condition were more likely to help the victim and cooperate during the helping task test than participants in the non-musical analog, suggesting that

collective music making enhances prosocial behavior and empathic response in 4-year-old children.

Neural Processes and Ensemble Performance

Empathic processing seems to support related mental states between co-performers such as feelings, emotions, needs, and intentions during music-making experiences (Babiloni et al., 2017). Babiloni et al. suggest:

> Playing in an ensemble is expected to induce substantial empathic feelings in musicians due to several indicators including musical sounds and observations of our own and other bodies in action, as well as a need for the realization of a common representation and interpretation of the musical piece performed. (p. 212)

To examine the activity of the empathic brain, the researchers developed a system of recording simultaneous EEG data from four professional musicians ($N = 12$; $M_{age} = 35.9$ years) performing in three different saxophone quartets. Researchers collected EEG data while the saxophonists were performing, while they were in resting states, as they observed audio-visual recordings of their performances, and while they turned pages on a lectern as they observed the audio-visual recordings of their performances. They compared EEG data generated by the professional saxophonists with 10 age-matched non-musicians.

Results from the EEG scans showed that the musicians demonstrated significant correlations between empathy trait scores as measured by the Empathy Quotient (Baron-Cohen & Wheelwright, 2004) questionnaire and increased activity in areas of the brain closely associated with empathic response while performing and observing their performances. Similar correlations were not found in the non-musicians as they engaged in the observation of musical

performances. The results indicate that the neurophysiological mechanisms underlying general empathic reactions are activated as a part of musical engagement during ensemble performance experiences.

Musical Empathy

Although musical engagement seems to incite empathic reactions and brain activity, Waddington (2017) sought to develop a definition for musical empathy in the context of ensemble performance and to determine how empathic responsiveness is actuated. Waddington examined co-performer empathy through a series of three empirical studies about the interactions of professional musicians performing in various ensembles. Data for the first study included focus group interviews with 19 musicians that explored their experiences of co-performer empathy. The participants' ensembles included a wind quintet, a vocal duo, a woodwind trio, a mixed piano trio, a brass ensemble, and a string quartet. Follow up studies with a string quartet and a string duet using observational video recall were conducted to examine and illuminate musical empathy during ensemble rehearsals and a performance.

After using qualitative approaches to code and analyze data from interviews and observational video recall sessions, Waddington found a strong connection between spontaneous interpretive flexibility while performing music and empathic connections between performers that was grounded in themes of shared approaches, special connections, intentional awareness, flexibility, and familiarity and trust. Waddington defined musical empathy as a cyclical process of working together toward shared interpretations, special connections between performers that facilitated mutual responding, and performance flexibility that enabled spontaneous responses between co-performers to produce novel and unexpected outcomes. Musical empathy in

ensemble performance, as characterized by Waddington, suggests that musicians don't just perform pieces or preset operations, rather, they use frameworks of shared understanding to perform with each other in unique and unexpected ways: they become empathically attuned to each other.

Collective Participation and Empathy

Music making seems to facilitate social interaction and empathic response while simultaneously benefiting from the highly empathic dispositions of performers. The relationship between empathy and musical response may impact the types of music-making experiences musicians elect to engage with. Cho (2019) examined the relationship between small ensemble participation and empathy levels in college music students (n = 165). Participants completed a survey that consisted of questions related to demographic information, musical experiences before college, small ensemble experiences during college, and self-report psychological evaluations. Empathy was measured using the EQ questionnaire. In addition to the empathy measure, participants completed the Ten-Item Personality Inventory (Gosling, Rentfrow, & Swann, 2003). Multiple linear regression analysis was used to examine the relationship between empathic capacity and small ensemble performance engagement.

Results from Cho's study showed that there was an association between participation in small ensembles and empathy skills in college music students. Cho suggests that one possible explanation for this association is that co-performers are involved with complex social interactions in which interpersonal awareness and mutual sensitivity are reinforced during small ensemble music-making experiences. In other words, it is possible the small ensemble participation may cultivate habits of empathy. However, as Cho goes on to explain, it is also

possible that those with higher empathic dispositions seek out small ensemble experiences resulting in higher levels of participation from those with higher levels of empathy. Although no causal assertions can be made based on these findings, it appears that there is a link between college musicians' empathy levels and their engagement with small ensemble music-making experiences.

Empathy may not be a critical factor in all collective music-making endeavors. An examination of the relationships between personality traits, empathy dispositions, and aptitudes for solo and large ensemble performance in Japanese collegiate music majors ($N = 68$) suggests that large group musical interactions are not reliant on empathy (Kawase, 2016). Kawase completed correlation analyses on responses to a survey that included the Big Five Personality Trait Scale (BFS), an empathy scale (IRI), and a self-report scale of ensemble and solo performance aptitudes. Ensemble and solo performance aptitudes were measured by the level of agreement participants rated statements on a 7-point Likert-type scale about evaluations of their ensemble and solo performance abilities.

The results showed that there were significant positive correlations between ensemble aptitude and traits of extraversion, agreeableness, and openness on the personality scale; however, there were no significant correlations between individual empathy levels and ensemble aptitude. Kawase suggests that the personality traits associated with large performance ensemble aptitude are critical for the group interactions during large ensemble rehearsals. Kawase goes on to suggest that the lack of relationship between dispositional empathy and large ensemble performance aptitude contradicts other studies examining ensemble performance and empathic connections. The author asserts that the conditions in large ensemble performance environments

may be less dependent on the empathic connections between co-performers than the more intimate conditions in small ensemble performance environments. The results from this study lend credence to Rabinowitch's (2015a) argument that *how* people engage with music is a critical factor to predicting the degree of empathic connections activated and used during the experience.

Summary

As the preceding studies have shown, empathic systems seem to be important mechanisms for coordinating performance interactions during collaborative music-making experiences. Synchrony between musicians is an essential facet for coordinating co-performer actions and demonstrates a connection to empathic attunement (Keller, 2014; Keller & Appel, 2010; Seddon, 2005; Seddon & Biasutti, 2009). There is a growing body of evidence that suggests that synchronous movement during music making exercises and enhances empathic response mechanisms (Cirelli et al., 2014; Kirschner & Tomasello, 2010; Trainor & Cirelli, 2015; Tunçgenç & Cohen, 2018). It also appears that musicians activate and leverage their empathic capacities to enhance interpersonal coordination and creativity during music-making experiences (Babiloni et al., 2017; Waddington, 2017). Those with a higher capacity for empathy seem to gravitate toward small ensemble music-making experiences that are more dependent upon interpersonal coordination and communication (Cho, 2019). However, research findings also showed a null relationship between empathy development and musical achievement in large ensemble settings (Kawase, 2016). This contrast in findings may be attributed to the reduction of interpersonal interactions and opportunities for co-performer musical decision making in conductor led large ensembles. These disparate results suggest important avenues for new research that examines how different forms of music making affect empathic response. The

following section reviews the interventional effect of musical interactions on empathy and will show that a broad base of collective music experiences demonstrates a positive influence on empathy development.

Musical Interventions and Empathy Development

Research shows that areas of the brain associated with empathy are responsive during musical experiences (Babiloni et al., 2017; Wallmark et al., 2018). These neurophysiological responses are not surprising given that musical experiences are typically socially interactive activities and that empathic responsiveness is a fundamental mechanism for facilitating social connectedness (Batson, 2009; Hoffman, 2000). Collective music experiences that synchronize action between participants seem to inspire and sustain empathic responsiveness in the form of prosocial and helping behaviors after engaging in musical events (Cirelli et al., 2014; Kirschner & Tomasello, 2010; Trainor & Cirelli, 2015; Tunçgenç & Cohen, 2018; Vuoskoski et al., 2017). Despite the evidence connecting music to empathic response, there has been little empirical research examining how musical experiences may shape the development of empathic dispositions. The following section will review the studies that have examined the effects of musical interventions on empathy development.

Music Participation and Empathy

The purpose of a study by Hietolahti-Ansten and Kalliopuska (1990) was to compare the levels of empathy and self-esteem for 12-year-old students studying instrumental music (n = 25) with students that were not involved in an instrumental music program (n = 30). Empathy was measured using the a modified version of the Mehrabian and Epstein Empathy Scale (Mehrabian & Epstein, 1972) and self-esteem was measured with the Battle Self-Esteem Scale (Battle, 1981).

The scales were administered to both groups of participants (instrumental music students and students not involved with music) as self-report questionnaires. The Mehrabian and Epstein Empathy scale is a 33-item measure that asks participants to agree with a series of statements on a 9-point Likert-type scale. The Battle Self-Esteem Scale is a 30-item measure that asks for yes or no responses to a series of questions.

The results showed that students in the instrumental music group had significantly higher levels of self-esteem and empathy scores than students in the non-music group. The researchers assert that "an active interest in music naturally evokes empathy and well-being" (p. 1365). This may be a spurious assertion given the sampling procedures, which likely resulted in selection bias because of the omitted variables attributed to the underlying differences between students that elect and don't elect to participate in school music programs (Elpus, 2013).

Collective Music-Making Interventions

In an effort to show causation between musical engagement and empathy development, Kalliopuska and Ruókenon (1986) examined differences in empathy scores between 6-year-old children participating in an empathy inducing music program (n = 15) with children that did not participate in the program (n = 15). Children were assigned to the experimental conditions by order of enrollment in a suburban day-care center. Empathy development was measured using the Feshbach and Roe Empathy Scale (Feshbach & Roe, 1968), the unpublished Ikonon-Nylund Sociability Scale (1981), and two scales of pro-sociability (Kalliopuska, 1981; Weir & Duveen, 1981). The empathy inducing music intervention was administered once a week for three months for a total of 12 hours. The researcher designed music program consisted of a collection of musical activities where students engaged in singing, playing instruments, listening to music,

musical exercise, music painting, dramatizing musical fairytales, and discussions of feelings evoked by the musical experiences. Cooperation and interpersonal awareness were emphasized during the activities.

The results showed that students in the music condition had significantly more positive change in empathy scores when compared with the control group. In a follow-up study, Kalliopuska and Ruókenon (1993) examined the effects of the empathy inducing music program 9-months after implementation. The results showed that the control group also made significant gains in empathy scores. The music group did not show any significant changes after 9-months and any differences between the control and music group in the original study were no longer significant in the follow-up study. The authors suggest that empathy development is a naturally occurring phenomenon in 6-year-old children that may be accelerated by musical interventions. The small sample, lack of random assignment to treatment and control conditions, and an absence of commensurate non-music activities in the control condition suggest that causal association between musical experiences and empathy development should be made with caution when reviewing results from these studies.

An experimental study by Rabinowitch, Cross, and Burnard (2012) examined the effect of long term musical group interactions (MGI) on empathy development. Fifty-two Children (ages 8-11) were randomly assigned to one of three conditions: the MGI program, a parallel program that included similar social activities without music, and a control condition with no music or interactive activities. Children in all three conditions participated in their assigned programs for one hour a week for a period of nine months. MGIs included musical games designed to encourage interaction through entrainment, imitation, and flexibility, and to foster

the awareness of self-other exchanges during improvisation and composition activities. The parallel social activities supported similar interactions to the MGIs but without the use of music. The children in the control condition did not participate in a formal social interaction program as part of their academic experience.

Participants in all groups completed a battery of pre-and-posttest measures to evaluate their capacity to empathize and verbal ability. The empathy measures included two researcher designed instruments (Matched Faces and Emotional Memory Task; Rabinowitch et al., 2012) and the Index of Empathy (Bryant, 1982). Verbal ability was measured with two items from the Wechsler Intelligence Scale for Children (Wechsler, 1974). The music group showed significant gains on the Index of Empathy and generated higher scores on the emotional memory task. These results suggest that the inclusion of musical group interactions in school contexts supported empathic capacities more effectively than academic experiences that did not utilize MGIs.

Music Making and Empathic Response

Other researchers have examined the effects of collective music participation on school aged children's empathic responses through prosocial behavior and cooperation when compared with other socially interactive activities (Cook, Ogden, & Winstone, 2019; Good & Russo, 2016; Ilari et al., 2018; Schellenberg et al., 2015). Studies comparing children with similar backgrounds that participate in music ensembles with other collective activities (i.e., sports) have shown that music participation has a stronger positive impact on prosocial behavior than other forms of collective action (Ilari et al., 2018; Schellenberg et al., 2015).

In a study examining whether group singing experiences generated more cooperation between participants than art-making and competitive games (Good & Russo, 2016), researchers

found that group singing participants (n = 16; M_{age} = 7.13) showed the highest levels of cooperation and the greatest amount of gains while completing 20 trials of the children's version of the prisoner's dilemma game (Matsumoto, Haan, Yabrove, Theodorou, & Carney, 1986) when compared with art (n = 16; M_{age} = 8.06) and competitive game (n = 18; M_{age} = 8.44) participants. The prisoner's dilemma game allows participants to strategize about whether they would like to work together to earn prizes or work independently to earn more prizes while prohibiting the other player in their dyad from earning prizes. Participants in the art and competitive game conditions did not show any growth or differences from each other. The authors concluded that group singing is more effective at positively influencing cooperative behaviors than other collective activities such as art and competitive games.

An intervention study examining the effects of music-based programs that initiated contact between neurotypical children and autistic peers found that neurotypical children demonstrated increased prosocial emotions toward autistic children as a result of their musical interactions (Cook et al., 2019). All participants (ages 10-11) in this study participated in group singing activities with other neurotypical participants either interacting with autistic children (n = 24) or engaging in group singing activities without interacting with autistic children (n = 25). The groups were formed from previously established classes. The program was designed to be age appropriate, be inclusive to all ability levels, be positive, and provide ample opportunities for students to interact and work in small groups over the course of a school term (11 weeks). Participants completed a pre-and-posttest questionnaire that contained several scales concerning prosocial behavior and bullying response.

Although these studies examined the impact of musical interventions on prosocial behavior and cooperation rather than making direct comparisons of empathy development, the constructs of prosocial behavior and cooperation are often motivated by empathic dispositions and are generated through attunement processes (Batson, 2009; Eisenberg et al., 2015; Hoffman, 2000). These studies suggest a causal link between collective music-making experiences and empathy response behaviors in school children.

Summary

The reviewed studies on the application of musical interventions show strong relationships and even suggest causation between music-making experiences and empathy development. However, there is a need for new studies that avoid issues of music participation selection bias and for additional studies that make direct examinations between different forms of music making and dispositional empathy development. In addition to needing more and better designed studies to examine the relationship between music-making experiences and empathy development, the existing research focuses on preschool (Kalliopuska & Ruókonen, 1986, 1993) and elementary school students (Rabinowitch et al., 2012). If the capacity for empathic response increases with higher levels of cognitive development (Barnett, 1987; Eisenberg et al., 2015; Eisenberg et al., 1997; Hoffman, 2000), then examinations of musical interventions at later developmental stages may yield important results. As Rabinowitch (2015b) articulates, "a complete and general picture in any area in the social sciences should consist also of a developmental perspective. This is especially true for the case of music and empathy" (p. 102). There is simply not enough research examining the connections between music and empathy spanning the breadth of human development to draw meaningful conclusions.

Although the extant research has examined the effects of musical group interactions using a variety of empathy promoting musical activities on empathy development, there is a paucity of research examining how different forms of musical engagement promote empathy development. If the aims in music education include supporting both musical and interpersonal development, a better understanding about the nature of different musical interactions and empathy development will be informative for music educators as they design curricular experiences for their students.

I would argue that group improvisation is a particularly interactive form of music making that activates processes that both leverage and enhance empathy development. The research reviewed in the next section examines group improvisation and the interpersonal processes enacted between co-performing musicians.

Literature for Collaborative Improvisation

Collaborative improvisations are successfully executed when co-performing musicians share a sense of intention for the musical development of improvisations, and when musicians are cognizant of the musical contributions generated by their co-performers so that they can collaboratively respond to one another during the improvisation process. Shared intention and collaborative awareness enable improvising musicians to attend to their own spontaneous sound production while attuning to the musical qualities, expressions, and gestures of co-performers. As Wilson and MacDonald (2017) assert, "improvisation is an essentially collaborative and therefore distributed form of creativity…one improviser's musical output can only be fully understood in relation to the context of its production" (p. 136). Collaborative development and distributed creativity during improvisation processes emerge out of the social interactions and communicative cues between co-performers. The following review will highlight the socio-

communicative interactions discussed in the collective improvisation research and suggest that these interactions exercise both cognitive and affective empathic connections with others.

Social Interaction

Communication and social cooperation are essential facets to supporting co-performer interactions during improvisation processes for both beginning and professional improvisers. Burnard's (2002) ethnography examined the interactions and musical productions of a group of 12-year-old children participating in an after school free improvisation club. The students used focus mechanisms to generate musical ideas. These mechanisms included "gaining entry" into improvised musical ideas through group-beat alignment when responding to or generating new musical ideas, "carrying on" by interacting musically with other musicians to sustain musical ideas, and by providing conscious cues "to stop" an idea. In addition to their interactions through focus mechanisms, the students interacted through improvisatory roles. Leaders and followers during improvisation were continually negotiated through communicative gestures. Shifts in leadership roles often prompted shifts in musical foci. Shifting roles and focus mechanisms enabled participants to produce musical content that was socially generated and constantly evolving through various forms of verbal and musical communication.

A study by Beegle (2010) demonstrated that group improvisation at the elementary level was enacted through processes of exploration and social planning. Children (5^{th} graders) were observed planning their improvisations using a four-part process of exploration, run-throughs, discussion, and negotiation. Discussion and negotiation allowed children to verbally communicate their ideas to the group, reflect on and evaluate their music, and make musical choices. The students also communicated musical ideas through performance demonstrations and

listening while experimenting with musical ideas. The children that emerged as group leaders were often facilitators of role assignments, discussions, and run-throughs. Social roles and communication between student improvisers were integral features to planning and developing the ideas the students used in their culminating improvisations.

Berliner's (1994) ethnography of professional jazz musicians showed that jazz improvisation in group contexts is not defined by the creative expression of an individual, but by the combined features of all the participants that emerge from the group. The jazz artists in Berliner's study articulated the importance of interacting with others and noted that successful improvisations are predicated on "keen aural skills and the ability to grasp instantly the other's musical ideas" (p. 362). Improvisation, perhaps more so than any other musical experience, demands an awareness of others to engage in cooperative and creative development (Sawyer, 2006; Sawyer & Dezutter, 2009).

Performers in free improvisation environments often arrange themselves in circular, nonhierarchical formations to foster equal performance rights and to allow for the orderly and collaborative exchange of musical ideas (Healey, Leach, & Bryan-Kinns, 2005; Hickey, 2015). Performers have been noted to break this formation during periods of conversation and to test musical ideas in subgroups, but then return to the circular formations to execute musical exchanges through a system of equitable turn-taking (Healey et al., 2005). Hickey (2015) noted similar performance configurations during observations of free improvisation ensembles in university settings. Open and intimate learning/rehearsal spaces allowed students to collaborate and communicate musically, visually, and verbally in the round. These studies show that

improvisers situate themselves during their collaborative efforts to enhance social interaction and the exchange of musical ideas between co-performers.

Communication

Improvising musicians create musical ideas and generate cohesive performances using a variety of communicative modes. Different modes shape co-performer interactions and musical outcomes. Seddon's (2005) examination of the communicative processes used by collegiate musicians (n = 6) rehearsing and performing in a jazz combo revealed six different modes of communication: verbal instruction, non-verbal instruction, verbal cooperation, non-verbal cooperation, verbal collaboration, and non-verbal collaboration. These modes of communication emerged out of a grounded theory approach of inductive reasoning. The author observed, transcribed, coded, categorized, verified, and interpreted video data of interactions between jazz musicians during six rehearsals and a performance. Seddon noted that improvising musicians arrived at a state of empathic attunement when they were able to communicate musically and develop a shared sense of trust and understanding to challenge each other and take risks. Empathic attunement enabled improvisers to enact a deeper sense of collaborative communication using non-verbal modes and to stretch their creativity.

Physiological and Expressive Attunement

Empathic attunement between musicians is activated as individuals decenter from their own musical contributions and focus on their collaborative efforts with others by processing both musical and social cues within collaborative music-making environments (Seddon, 2005; Seddon & Biasutti, 2009). In addition to exchanging musical ideas, improvisers also rely on physical cues or the embodied reactions of co-performers during the improvisation sessions to share their

collaborative intentions (Biasutti & Frezza, 2009; Gratier, 2008; Morgan, Gunes, & Bryan-Kinns, 2015). In collaborative improvisation environments, musicians acknowledged using visual, gestural, verbal, and musical feedback to monitor their creative processes (Biasutti & Frezza, 2009). Gratier (2008) observed musicians communicating their intentions and coordinating their actions during the improvisation process with physical phrasing, eye contact during moments of change and development, and musical motives, punctuations, completion, and synchronization. Morgan et al. (2015) noted several physiological and behavioral changes in collaborative improvisers throughout the improvisation process (e.g., body motion, eye gaze, heart rate, and brainwave activity). Physiological and behavioral activity correlated with changes in musical content. The results from this body of research suggest that collaborative improvisers emit subtle and automatic cues that facilitate communication and coordination during the improvisation process. These cues are reflective of the social cues observed and perceived by empathizers as they respond with empathic accuracy and engage in attunement processes (Barnett, 1987; Eisenberg et al., 1997; Ickes, 2009).

Summary

Collaborative improvisation activates diverse socio-communicative and musical exchanges between co-performing musicians. This activation seems to make collaborative improvisation fertile ground for leveraging and perhaps fostering empathy development and the underlying processes of affective resonance and cognitive response. As noted earlier in the review of music and empathy, musical interactions may act as social scaffolding by enhancing the concurrent activation of cognitive and affective empathic response mechanisms (Cross et al., 2012; Krueger, 2013). Music *making* supports empathic connections as co-performers interact

with and attune to each other during cooperative development. Although improvisation may not be the only musical process that activates empathic attunement (Seddon & Biasutti, 2009; Waddington, 2017), improvisers' reliance on social, communicative, cognitive, and affective processing for cooperative musical development may make improvisation particularly responsive to and supportive of empathic development.

Related Factors for Empathic and Musical Development

Despite the congruence of affective and cognitive processing during empathic attunement and improvisation, there has been no research examining whether music improvisation differs from other forms of music making in its support of or response to empathy development. Although the research outlined in the previous sections suggests that collaborative improvisation and empathy may mutually develop, other variables including gender, instrumental playing ability, and affective associations have all been shown to either influence music performance achievement, empathy development, or both. Controlling for these factors is critical to minimize omitted variable bias to show causal associations between musical engagement and dispositional empathy development.

Instrumental Learning Experience

One factor that influences improvisation achievement and perhaps the impact of improvisation experiences on interpersonal and musical development is instrumental performance ability (McPherson, 1995b, 2005). Instrumental performance ability and experience shapes the possibilities that interacting musicians have available when they respond to each other during improvisational exchanges (Berliner, 1994; Biasutti & Frezza, 2009; Monson, 1996; Sawyer, 2006; Sawyer & Dezutter, 2009; van der Schyff, 2013). McPherson (1995b) found

strong correlations between instrumental music students' abilities to perform a range of tasks on their instruments (e.g., perform by ear, play rehearsed music, play by memory) and their abilities to improvise. Findings from this study and from McPherson's (1993) development of the Test of Ability to Improvise demonstrate a strong link between instrumental fluency and improvisation achievement.

In their examination of the improvisation processes used by musicians across a wide range of instruments and genres, Biasutti and Frezza (2009) found that, among other factors, improvising musicians noted that high levels of instrumental performance skills enabled them to improvise across a wide range of musical structures and interact with other improvising musicians. In their ethnographies of jazz improvisers, both Monson (1996) and Berliner (1994) found that instrumental fluency was an important factor in enabling jazz musicians to perform expected instrumental roles and attend to stylistic conventions. Having the skills and understanding to perform expected roles and conventions provides improvising jazz musicians with the framework to interact with others and stretch expectations through creative development.

Although more open and less conventional than jazz and other genre specific forms of improvisation, van der Schyff (2013) found that in the context of free improvisation, performers from various musical backgrounds deployed their instrumental skills and diverse performance experiences toward the generation of meaningful and interactive improvisations. It seems that instrumental performance experience not only shapes achievement outcomes, but also the meaningfulness of the experiences in collective free improvisation contexts. This finding indicates that the socio-communicative connections between co-performers and their ability to

attune to each other, in part, depends on each improviser's instrumental performance ability and their ability to decenter from the process of generating their own sound so they can focus on the sounds produced by others (Sawyer, 2006; Seddon, 2005). Prior instrumental performance experience is among the variables that needs to be considered when examining the effects of improvisation experiences on empathy development and performance outcomes.

Gender

Research shows that gender is a mediating factor when examining empathy levels using self-report standardized measures (Davis, 1983; Jolliffe & Farrington, 2006; Singer & Lamm, 2009; Stueber, 2017; Wallmark et al., 2018). In the development, validation, and standardization of self-report empathy measures (e.g., IRI and BES), researchers have found a recurrent pattern of female participants responding with higher empathy scores than male participants (Davis, 1983; Jolliffe & Farrington, 2006). Although there is some debate about whether these differences actually reflect differences in empathic capacities or social expectations priming different genders to respond differently on self-report measures (Singer & Lamm, 2009), Wallmark et al. (2018) found that female participants responded with significantly higher emotional concern scores on the IRI and showed increased levels of activation in the brain stem when compared with male participants while listening to musical sounds. Additional testing showed, however, that gender was not a significant neurophysiological factor in music processing. Although neurophysiological processing may not demonstrate significant differences based on gender while processing music, the results from several studies demonstrate that gender is a factor that needs to be controlled for when using self-report empathy measures such as the IRI or the BES to examine the variance in dispositional empathy (Ang & Goh, 2010; Davis,

1983; Garaigordobil, 2009; Jolliffe & Farrington, 2006, 2011; Schulte-Rüther, Markowitsch, Shah, Fink, & Piefke, 2008; Schwenck et al., 2014).

Positive and Negative Affect

Secure attachment, interpersonal affection, reduced interpersonal conflict, and a positive self-concept are among the conditions that enhance empathy development in children (Barnett, 1987). Barnett asserts that empathy is likely to be influenced positively in conditions that satisfy a child's emotional needs while discouraging excessive self-concern. These antecedents suggest and research demonstrates that positive and negative affect may be important factors in either supporting or hindering empathy development (Eisenberg et al., 2015; Stueber, 2017).

In addition to influencing empathic development, affective valence has been shown to impact learning and musical achievement (Austin & Vispoel, 1998; Chen et al., 2018; Hedden, 1982; Charles Schmidt, 2005). Positive attitudes about learning mathematics are related to the activation neurocognitive structures that stimulate engagement and learning, which predicted academic achievement in mathematics even while controlling for other cognitive and social factors (Chen et al., 2018). In studies examining music learning, levels of music self-concept, and attitudes about learning music have been linked to music achievement outcomes (Austin & Vispoel, 1998; Hedden, 1982; Charles Schmidt, 2005). Research shows that affective response toward music learning shapes developmental progress and should be included as a control variable when modeling the relationship between music performance achievement and other variables such as empathy to avoid omitted variable bias.

Summary

Previous instrumental learning experience, gender, and affective valence are all factors that may mediate the impact of musical interventions on changes in empathy or the relationship between dispositional empathy and performance achievement. As Good and Russo (2016) acknowledged in the limitations section of their study that investigated the effects of group singing on cooperative behavior:

> …the study does not provide a means of deciphering the extent to which hedonic factors may have been responsible for the social benefits of group singing. Future research should consider taking a measure of enjoyment or mood that would allow for the statistical control over the influence of hedonic factors. (p. 343)

The literature suggests that affective valence impacts cognitive, musical, and empathic development (Austin & Vispoel, 1998; Chen et al., 2018; Eisenberg et al., 2015; Schmidt, 2005; Stueber, 2017). Although gender is not related to musical achievement and improvisational ability, gender does account for some of the variation in how participants respond to dispositional empathy measures, which should be controlled for in statistical analyses of empathic response (Davis, 1983; Jolliffe & Farrington, 2006). Finally, instrumental learning experience has a direct impact on musicians' abilities to interact cooperatively and creatively during improvisation and other instrumental performance tasks (Biasutti & Frezza, 2009; McPherson, 1993, 1995a, 1995b, 2005; Seddon, 2005; Seddon & Biasutti, 2009). When examining the predictive and relational properties between dispositional empathy and music performance experiences, these factors need to be measured and controlled for to generate accurate analytical models of these relationships.

Chapter Summary

The aim of this research review was to delineate how small group improvisation experiences may demonstrate a relationship with empathy development that is different from other forms of group music-making experiences. If musical experiences, even at the listening level of engagement, are a form of social scaffolding that supports the activation of empathic response systems (Krueger, 2013), then perhaps more interactive forms of musical engagement that rely on intersubjective exchanges, shared meanings, and attunement between co-performers will demonstrate stronger connections to empathy development levels (Cross et al., 2012; Rabinowitch et al., 2012).

The existing literature shows a positive relationship between empathy and music perception. Increased empathy facilitates higher levels of emotional and performance understanding while listening to music and increases the listener's appreciation for a broader range of emotional content heard in musical performances (Bamford & Davidson, 2019; Miu & Balteş, 2012; Pesquita et al., 2014; Wallmark et al., 2018; Wöllner, 2012). Research demonstrates that the relationship between empathy development and music perception is not unidirectional. It appears that listening to music and musical training may enhance empathic response mechanisms that influence the capacity of observers to perceive social cues and generate affiliative responses with others (Clarke et al., 2015; Parsons et al., 2014; Vuoskoski et al., 2017). Although music listening may stimulate an embodied response (Davies, 2011; Krueger, 2013), it is primarily an observational process that does not require the same level of attunement or intersubjective processing that is activated between social actors that engage in group musical interactions.

Empathy appears to be a critical social mechanism in ensemble music making that enables individual musicians to decenter from their own experiences and attend to the experiences of others in an effort to create cooperative performances with a shared sense of meaning (Keller, 2014). Waddington (2017) articulates empathy in the context of ensemble performance as the ability of co-performing musicians to work together and develop shared interpretations, to develop an affective awareness of co-performers' internal musical understanding, and to develop special connections between co-performers to support conditions of spontaneous interpretive flexibility. Brainwave activity during musical performances shows that the musical brain may be a feature of the broader empathic brain (Babiloni et al., 2012; Babiloni et al., 2017). Studies showing correlations between ensemble performance and empathic activity are bolstered by studies examining empathy development and musical group interactions.

It appears that participating in musical group interactions may be related to the development of cooperative action, prosocial behavior, and empathy development. Synchrony is an important feature in musical coordination and demonstrates a positive relationship with empathic response (Cirelli et al., 2014; Kirschner & Tomasello, 2010; Rabinowitch & Meltzoff, 2017; Trainor & Cirelli, 2015; Tunçgenç & Cohen, 2018). Group music-making experiences support affiliative, cooperative, and prosocial responses (Cook et al., 2019; Good & Russo, 2016; Ilari et al., 2018; Schellenberg et al., 2015). In addition to being a catalyst for empathic response, there is a small body of research that suggests that long-term group musical interactions may support the development of dispositional empathy (Hietolahti-Ansten & Kalliopuska, 1990; Kalliopuska & Ruókonen, 1986, 1993; Rabinowitch et al., 2012).

The purpose of this study was to build on this existing research that shows a connection between empathy and musical engagement to determine if collective free improvisation and its reliance on social interaction and intersubjective development demonstrates a stronger relationship with dispositional empathy than other forms of collective music making in adolescent instrumental music students. As the review has shown, there has been little attention to the variability of the relationship between music and empathy based on *how* music is engaged. And as Rabinowitch (2015a) argues, how people engage with music and each other during the music-making process may be more important to its relationship with empathy than the types of music they engage with. Free improvisation and the processing involved may exercise and be more reliant on the attunement process and the capacity to empathize with others. In addition to delineating the relationship between different types of collective musical interactions and empathy development, this research examined the association between empathy and music making in adolescent music students, a population largely absent in the extant research.

In the following chapter, I will articulate the procedures used to examine the relationship between dispositional empathy development and collaborative improvisation.

CHAPTER 3: RESEARCH DESIGN AND METHOD

Introduction

The purpose of this study was to determine if: (a) adolescent instrumental music students that participate in small group improvisation, small group traditional notation, and large group traditional notation conditions demonstrated different levels of change in dispositional empathy as a result of their musical experiences, (b) there is a relationship between pre-and-posttest group empathy scores and group performance achievement for freely improving dyads and notated duets, (c) there is a relationship between the co-performer empathy scores at pretest and changes in performance achievement between pre-and-posttest performances, and (d) there is a relationship between changes in empathy scores and changes in performance achievement for improvisation and notated duet groups from pre- to posttest and if these changes are affected by performance condition.

As the review of literature in the previous chapter showed, many of the extant studies connecting music to empathy involved analyses between empathic response mechanisms and musical engagement (Babiloni et al., 2017; Clarke et al., 2015; Kawase, 2016; Parsons et al., 2014; Seddon, 2005; Seddon & Biasutti, 2009; Vuoskoski et al., 2017; Vuoskoski & Eerola, 2011) or comparisons between levels of empathy development and music perception (Pesquita et al., 2014; Wallmark et al., 2018; Wöllner, 2012). While these studies demonstrate interactive relationships between music and empathy, they do not show causal links between the two phenomena, nor do they address how performance achievement during different types of music making is impacted by empathy levels.

The few intervention studies that have examined the effects of music making on empathy have utilized a variety of musical experiences to support group musical interactions, leaving questions about how specific forms of interactive music making shape dispositional empathy (Cook et al., 2019; Hietolahti-Ansten & Kalliopuska, 1990; Ilari et al., 2018; Kalliopuska & Ruókonen, 1986, 1993; Kirschner & Tomasello, 2010; Rabinowitch et al., 2012). One of the other detractors to the existing intervention literature is the lack of randomized control research designs. This lack of random assignment generates concerns about participant selection bias and the prevalence of omitted variables accounting for changes in empathy rather than the music-making interventions.

I utilized an experimental design to understand how different forms of music making caused changes in dispositional empathy. I also employed a correlational approach to examine how baseline and changing empathy levels predicted music-making achievement between interacting co-performers and to determine if there were any differences in this predictive relationship between the performance conditions.

In an effort to minimize selection bias, I recruited participants from instrumental music programs and randomly assigned them to different music-making conditions during intervention periods. Recruiting from this population enabled me to examine dispositional empathy at baseline for students that were already actively engaged in their school music programs. As previous research has demonstrated, making comparisons between music and non-music students creates the conditions for selection bias and a lack of accountability for confounding variables related to music participation (Elpus, 2013). This study alters the musical activities of students

that have all elected to participate in their school's instrumental music program and evades omitted variable biases attributed to school music participation.

I randomly assigned participants to three different forms of music-making experiences during intervention periods, thereby minimizing condition level selection bias. Since all participants were members in their school's instrumental music program, participants, regardless of condition assignment, were actively engaged in traditional large ensemble rehearsals during their instrumental music class experiences when they were not participating in study interventions. Therefore, traditional large ensemble rehearsals were the baseline musical experience for all study participants and served as the control condition. The application of random assignment from this musically homogenous population established a causal association with changes in dispositional empathy as a result of different music-making experiences.

Northwestern University's Institutional Review Board (IRB) examined and approved the recruitment, intervention, and data collection procedures utilized in this study based on the social and behavioral science protocol for human-subjects research. Students under the age of 18 provided written assent and parent consent to participate. Students that were18-years-old completed and submitted adult consent forms. Both of these forms were approved by the IRB and are available in the appendix section of this document. Students from the instrumental music programs selected for this study were not required to participate and were provided with the option of discontinuing participation at any point during the study. In the remainder of this chapter, I will discuss the administration of a pilot study to test intervention and data collection procedures. I will provide a detailed description of the full study protocol including participant

selection, data collection instruments, the research design, administration procedures, and the steps used in data preparation and analysis.

Pilot Study

I conducted a pilot study to test the administration of data collection instruments and to determine if the intervention protocol could be applied with high fidelity by teachers and student participants. The pilot study procedures followed the same procedural sequencing as the full study but consisted of four 20-minute interventions rather than the prescribed eight 20-minute interventions used during the full study. Participants in the pilot consisted of 18 band students that were randomly assigned to one of three music-making conditions: three improvising dyads ($n = 6$), three notated duets ($n = 6$), and large ensemble rehearsal ($n = 6$). I acquired teacher and administrative approval to conduct the study at the pilot site and all participants completed and returned assent/consent documents.

One week prior to starting the intervention, I met with participants ($N = 18$) to administer the demographic survey and *Basic Empathy Scale* (BES). Students assigned to the improvising dyad condition were audio recorded completing the performance task for the *Collaborative Improvisation Measure* (CIM) with their randomly assigned partners. Participants assigned to the notated duet condition were audio recorded sight reading two excerpts from a notated duet as the performance task for the *Small Ensemble Adjudication Form* (SEAF). In the full study, recordings from the CIM and SEAF pre-and-posttest tasks were randomized and distributed to a panel of four judges to provide performance ratings for the tasks using the CIM and SEAF rating scales. Since the pilot study used a small sample for the purpose of testing administrative procedures and since the CIM and SEAF have either undergone previous reliability testing or

have had a record of frequent use, these recordings were not rated during the pilot phase and were preserved as examples for rater training sessions during the full study.

After completing pretesting, pilot study participants engaged in four intervention treatments. The interventions were administered once a week for a period of 20 minutes. The improvising dyads completed four improvisation warm-ups along with free improvisation rehearsals throughout the course of the intervention. Notated duets rehearsed a series of instrumental duets during each 20-minute treatment period. The large ensemble participants remained in their regularly scheduled ensemble rehearsal class during each treatment period. Participants in all conditions completed the *Positive and Negative Affect Schedule* (PANAS) at the conclusion of each intervention period and submitted PANAS surveys to a secured survey collection envelop.

After each participant completed four music-making treatments, I administered posttests for the BES, CIM, SEAF that mirrored the administration of the pretests. Some small adjustments were made to clarify the language in the instructions on the CIM and SEAF performance tasks. Aside from adding clarity to the language and providing an additional instruction on the SEAF so that participants divided their parts on the duet prior to their sight-reading performance, the performance tasks remained unaltered and there were no changes made to the demographic survey or the BES. Students were encouraged to ask questions for clarity if they were confused by questions on the surveys or instructions for the performance tasks. The participants completed the BES in less than 5 minutes and were able to complete the CIM and SEAF tasks without needing additional clarification.

Pilot testing revealed that completing the performance tasks on the CIM and SEAF takes slightly more time than originally anticipated (~ 5 minutes), suggesting the need to extend pre-and-posttest collection times during the administration of measures for the full study. Results from the pilot study showed that the administration of measures and intervention protocols could be conducted with accuracy and efficiency during performance ensemble class meeting times. In the following sections, I will provide detailed descriptions of the procedures used in the full study and data collection measures.

Research Design

Participants

Instrumental music students ($N = 192$) from seven different high school music programs (5 string orchestras and 5 concert bands)[1] were recruited and randomly assigned to either freely improvising dyad, notated duet, or large performance ensemble music-making conditions. Seven participants were unable to complete the full protocol and their data were removed from the dataset. The sample used for data analysis consisted of 185 band ($n = 100$) and orchestra ($n = 85$) students. Only students receiving guardian consent and providing written assent were included in the pool of participants. The following questions were administered with Basic Empathy Scale during pretesting to generate a demographic profile of the participants in the study and to control for variables such as gender identity and instrumental playing experience.

1. Age: _____
2. Pronoun (e.g., He/She/They): _____

[1] Although the research was conducted at seven different school locations, one school had two string orchestra classes participate and two schools had two concert band classes participate in the research study. This resulted in seven school locations with 10 different ensembles serving as student participant sources.

3. Racial/Ethnic Identity (circle the most appropriate choice)

    White/Caucasian
    Hispanic or Latinx
    Black or African American
    Native American or American Indian
    Asian/Pacific Islander
    Other_____

4. How many years have you been playing your instrument? _____

5. What instrument do you play? _____

Participants' ages ranged from 13-18 (M = 15.52, SD = 1.14) years. Table 3.1 provides demographic details about the sample including the racial/ethnic identities and pronoun selections represented in the sample. Participants wrote in the pronoun they identified with on the demographic survey. This option was provided with the recognition that gender is not a binary construct. All the participants in this sample, however, wrote either "she" or "he" for their pronouns. Pronoun selection was used as a proxy for gender identity. Participants that wrote "she" on the survey were categorized as female identifying participants (F.I.P.) and participants that wrote "he" on the survey were categorized as male identifying participants (M.I.P.). Participants performed on a variety of instruments found in traditional concert bands and string orchestras. A cross tabulation of participants' performance instruments, years of experience playing their instruments, and condition assignments is provided in table 3.2.

Table 3.1

Racial/Ethnic and Gender Identities

Race/Ethnicity	*n*	(%)
White/Caucasian	129	(67.2)
Hispanic/Latino	17	(8.9)
Black/African American	6	(3.1)
Native American/American Indian	1	(0.5)
Asian/Pacific Islander	31	(16.1)
Other	8	(4.2)
Pronoun		
She	127	(68.6)
He	58	(31.4)
Other	0	(0.0)

Note. Pronoun selection was an open response question on the survey. All participants in this study chose to write either "He" or "She" as their selected pronoun. Pronoun selection was used as a proxy for gender identity and respondents were categorized as male identifying participants (M.I.P.) or female identifying participants (F.I.P.) based on the pronoun they wrote on the survey.

Table 3.2

Instruments, Condition, and Years of Instrumental Playing Experience

Instrument	Condition Assignments			Total	Mean Experience
	Improvising Dyad	Notated Duet	Large Ensemble		
Violin	18	17	15	50	8.02 (*SD* = 2.52)
Viola	5	9	5	19	6.26 (*SD* = 1.82)
Cello	7	2	6	15	6.60 (*SD* = 2.10)
Bass	0	0	1	1	6.00 (*SD* = 0.00)
Flute	10	6	5	21	6.05 (*SD* = 1.28)
Oboe	0	0	2	2	2.00 (*SD* = 0.00)
Clarinet	4	3	8	15	5.80 (*SD* = 1.27)
Saxophone	8	5	2	15	5.40 (*SD* = 1.12)
Trumpet	2	7	4	13	5.85 (*SD* = 1.28)
French Horn	1	2	3	6	5.83 (*SD* = 2.40)
Trombone	2	3	3	8	6.38 (*SD* = 1.60)
Euphonium	1	1	2	4	5.25 (*SD* = 0.96)
Tuba	1	2	0	3	5.33 (*SD* = 3.06)
Percussion	5	5	3	13	4.85 (*SD* = 1.28)
Total	64	62	59	185	6.41 (*SD* = 2.15)

Times and Locations of Participation

All data collection and treatment interventions were conducted during regularly scheduled class/rehearsal meetings of participants' respective instrumental music programs. Given that all study participants were active members in their school's instrumental music program, the baseline or control music-making condition experienced by all participants was the traditional large ensemble rehearsal. Large ensemble rehearsals served as the control for interventions of small group musical interactions (freely improvising dyads and notated duets).

Method and Variables

This study utilized an experimental pretest-posttest control group and concurrent correlational design. Empathy scores on the Basic Empathy Scale and composite and affective subscales (BES; Jolliffe & Farrington, 2006) were used as outcome variables for pre-and-posttest comparisons to determine if a significant level of variation in individual empathy change was caused by the music making participants experienced during intervention periods. In addition to using gains from the BES as the dependent variable for experimental treatment effects, pretest scores from the BES were used to establish a baseline of empathic dispositions and operated as predictor variables to analyze the relationships between empathy levels and group improvisation achievement measured by the Collaborative Improvisation Measure (CIM; Schmidt, 2018) and notated duet performance achievement measured by the Small Ensemble Adjudication Form (SEAF; "Illinois High School Association," 2013). Changes in pretest to posttest scores on the BES were also used to examine the relationship between changes in empathy and changes in performance achievement in the small ensemble performance conditions.

Participants were randomly assigned to the three music-making conditions with the large ensemble operating as the comparison group for music-making experiences in small ensembles using notation and free improvisation. Although I employed random assignment for the experiment, there were threats to causal attribution in this design that should be considered when reviewing the results from this study. Participants were aware that they could've been assigned to any of the three music-making conditions, and they were informed about the music-making tasks they would experience in each condition while undergoing treatment. This information was disseminated so that guardians and participants could make informed consent/assent to participate. Participant awareness about the different condition assignments and experiences may have resulted in compensatory rivalry between conditions or resentful demoralization from those assigned to the control condition (Creswell, 2015). In addition to these threats, the same measures were utilized for both pre- and posttests, which may have enabled participants to apply posttest responses that were commensurate with or falsely divergent from their pretest responses rather than responding honestly to the prompts or measurement tasks on the posttests.

An overt threat to external validity was based on the fact that all participants were enrolled in school instrumental music ensembles. Although the effects of selection bias were minimized by recruiting participants from this musically homogenous population, the generalizability of results beyond students participating in school instrumental music programs in not applicable. Additional research examining the relationships between empathy development and the three music-making conditions experienced by the participants in this study will have to be replicated with more musically diverse populations to establish a broader base of generalizability. It is important to note that the sample was drawn from urban, suburban, and

rural high school band and orchestra programs. This sampling frame bolsters the validity of results and the generalizability of findings to students in a variety of instrumental learning environments.

Procedures

Research Locations and Teacher Recruitment

The seven instrumental music programs involved with this study were selected by convenience based on the music teachers' willingness to participate in the research and having practice facilities capable of supporting the intervention protocols used in this study. Teachers and school administrators were contacted by phone and e-mail to request approval to include their music programs as research locations. Teachers and school administrators were provided with a written explanation about the rationale, purpose for the study, and procedures involved. These recruitment letters are included in the appendix section of this document. Both teachers and administrators issued written approvals for research treatment and data collection to be conducted at their locations.

Once permission was obtained from teachers and administrative gatekeepers, I met with the teachers at each location for 30-45 minutes to discuss the details of the participant recruitment, assignment, intervention, and data collection procedures. Teachers had an opportunity to ask as many questions about the study procedures as they needed to implement the plan, and they were provided with a written document to explain the procedures and the sequence of the administration protocol.

Assent/Consent and Random Assignment

After completing one-on-one meetings with program teachers, an information letter and assent/consent forms were distributed to students and student guardians enrolled in the participating teachers' instrumental music programs. In addition to distributing assent and consent documents, I administered a short informational meeting with the students to discuss details about the study and answer student questions. I used the meeting as an opportunity to request student participation while clearly articulating that they were not required to participate in the research study and that participation was contingent on their returned assent and consent documents. Students were also informed that if they elected to participate in the research study, they could withdraw at any time for any reason. The purpose of the study and the nature of the measures and intervention protocols were also clearly presented. Students knew that they had an equal opportunity to be placed in any intervention condition. Those that chose not to participate in the study were informed that they would continue their participation in large performance ensemble rehearsals as normal.

Students were provided with approximately one week to complete and return assent/consent forms to a document deposit envelop stored in a secure location in their music classrooms. Students that submitted documents were included in the participant pool for random assignment. I collected assent/consent documents after the 1-week collection period, documented each participant's assent/consent submission, and issued each participant with a study ID number that was utilized for all subsequent data collection purposes.

Once students at each research location were issued study ID numbers, their numbers were entered into the dataset and randomly assigned to the three music-making conditions using

a computerized random assignment generator. In addition to randomly assigning participants to the three different music-making conditions, students within the freely improvising dyad and notated duet conditions were randomly assigned to complete testing and intervention tasks with another participant assigned to the same music-making condition. The distribution of students assigned to each music-making condition are provided in table 3.2.

Sequence of Data Collection and Intervention Procedures

After establishing research locations, completing consent and assent procedures, and randomly assigning student participants to study conditions and ensemble partners, I distributed study packets to student participants based on their condition assignments and administered pretests at each research location. An example of the letter detailing treatment condition and partner assignments is included in the appendix of this document. Table 3.5 shows the complete sequence of pretest, treatment, and posttest tasks for each condition.

Table 3.3

Sequence of Data Collection and Treatment by Condition

	Control Condition	Group Improvisation	Notated Duet
Pretreatment	Pretest BES	Pretest BES + CIM	Pretest BES+SEAF
Intervention 1	Ensemble Rehearsal PANAS(1)	*Warm-Up Long Tones/*Free Play PANAS(1)	Duet Rehearsal PANAS(1)
Intervention 2	Ensemble Rehearsal PANAS(2)	*Ostinato/*Free Play PANAS(2)	Duet Rehearsal PANAS(2)
Intervention 3	Ensemble Rehearsal PANAS(3)	*Mirror, Mirror/*Free Play PANAS(3)	Duet Rehearsal PANAS(3)
Intervention 4	Ensemble Rehearsal PANAS(4)	*Double Your Pleasure/*Free Play PANAS(4)	Duet Rehearsal PANAS(4)

(continued)

Table 3.3 (continued)

Intervention 5	Ensemble Rehearsal PANAS(5)	*Drone/*Free Play PANAS(5)	Duet Rehearsal PANAS(5)
Intervention 6	Ensemble Rehearsal PANAS(6)	*Matching/*Free Play PANAS(6)	Duet Rehearsal PANAS(6)
Intervention 7	Ensemble Rehearsal PANAS(7)	*KISS Music/*Free Play PANAS(7)	Duet Rehearsal PANAS(7)
Intervention 8	Ensemble Rehearsal PANAS(8)	*Descending Scale/*Free Play PANAS(8)	Duet Rehearsal PANAS(8)
Post-treatment	Posttest BES	Posttest BES + CIM	Posttest BES+SEAF

Pretest Data Collection. Approximately one week prior to the start of the treatment period[2], all student participants completed the BES and accompanying demographic questionnaire to establish baseline empathy scores and gather background information. Students assigned to the freely improvising dyad and notated duet conditions completed the performance tasks for the CIM and SEAF in their randomly assigned dyads. Details about the performance tasks on both measures are provided in the description of the measures section. Pretesting on the CIM and SEAF established a baseline of performance achievement prior to intervention experiences. I audio recorded performance tasks using a Zoom H2n Handy Recorder. Pretest performance recordings were stored on a secure external hard drive so that they could be randomized with posttest recordings and assessed by a panel of four raters using the rating scales for the CIM and SEAF.

[2] One research location completed the first intervention within the same week as the pretest to accommodate the ensemble's performance schedule.

Interventions. Participants completed condition specific music-making tasks over a period of 7-9 weeks for eight 20-minute intervention sessions[3]. On a designated day during each week of the intervention period, participants assigned to the improvising dyads and notated duets would leave their large ensemble rehearsal to engage in their assigned intervention. Each dyad would complete their intervention task in a practice space assigned by the music teacher at each location. The participants assigned to the large ensemble condition would remain in the large ensemble rehearsal under the direction of their instrumental music teacher while the improvising dyads and notated duets completed their intervention tasks. While pre-and-posttest performance tasks (one week before and one week following interventions) were audio recorded for performance ratings, the eight interventions were not audio recorded or monitored for fidelity. Teachers at each research location simply recorded when the assigned dyads completed their 20-minutes of work together and submitted a Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) in response to their interactions. If assigned pairs were unable to complete an intervention during the designated intervention time, they completed the intervention during the earliest class period that both partners were available following the missed intervention. Once improvising dyads and notated duets completed their interventions during each period, they resumed participating in the large ensemble rehearsal.

The improvising dyads completed a different improvisatory warm-up task each week during their intervention times. These warm-up tasks were selected from *Improv Duets for Classical Musicians: A Concise Collection of Musical Games for Two Players* by Jeffery Agrell

[3] To accommodate school calendars and performance schedules, three research locations took a one-week gap in treatment and extended the treatment period by an extra week to administer 8, 20-minute interventions. One research location completed 8, 20-minute interventions over a period of 7 weeks rather than the prescribed 8 weeks.

(2013) and were designed to support different types of musical interactions and forms of communication between improvising musicians. Table 3.5 shows the titles of the improvisation games selected as warm-up tasks during each week of the intervention. During the first week, improvisors worked on generating collaborative improvisations using long tones. During the second week, improvisers created ostinatos and melodic ideas that were accompanied by partner ostinatos. The third week consisted of partners matching melodic styles and inverting the melodic motion of their partners. During the fourth week, improvisors practiced developing accompanying material for the free playing of their partners. In the fifth week, improvisers practiced generating melodic ideas over drones that were produced by their partners. During week six, improvisers concentrated on listening to and matching the musical ideas of their partners. In the seventh week, co-performing improvisers worked together to develop musical ideas with simple concepts such as major scales and arpeggios. In the final week, improvisers created melodic ideas over descending scales performed in different keys performed by their partners. The improvising dyads were instructed to complete the warm-up task and then use the remaining 20 minutes of their intervention time each week to freely improvise together. The intervention instructions distributed to the improvising dyads are included in the appendix.

The notated duet participants used the 20-minute intervention sessions each week to rehearse a series of seven traditionally notated instrumental duets from *Recital Duets* by Sy Brandon (1981). This series of duets was selected because it was unfamiliar to all participants prior to starting the interventions, it was written atonally to minimize interacting musicians' reliance on tonal conventions to master the repertoire, and the duets were written for any instrumental combination to support the random assignment of notated duet pairs. The notated

duet participants were instructed to start with the first duet and not proceed to any of the successive duets until they felt that they had mastered each preceding duet. They were instructed to work together to try and master both technical and expressive elements of the music. Excerpts from the repertoire were selected as pre-and-posttest performance tasks to assess performance achievement. Notated duet intervention instructions are included in the appendix section of this document.

At the end of each intervention session, participants in all conditions completed the PANAS to control for positive and negative associations with the music-making experiences. I was onsite at each research location during the first two to three intervention sessions to assist students and teachers with the intervention protocols and to answer any questions that emerged. Once the instrumental music teachers at each location and I were confident that they could administer the intervention with high fidelity, I extracted myself from the research locations to minimize my influence on the learning environments and enhance the external validity of the results. Although I was onsite for the first two to three interventions to provide guidance and answer questions at each location, I was unable to monitor each ensemble pair to ensure that they were accurately completing the intervention tasks.

Posttest Data Collection. One week after treatment ended[4], I returned to each research location to administer and record posttests. Participants in all conditions completed the BES as a posttest measure of dispositional empathy. Students in the freely improvising dyads and notated duets completed the CIM and SEAF performance tasks as posttest measures of collaborative

[4] Three research locations completed the posttest within the same week as the final 20-minute intervention to accommodate school calendars and performance schedules at those locations.

improvisation and notated duet performance achievement. I collected the PANAS questionnaires that had been deposited in secure collection envelops at each location. After posttests were administered, I prepared the data for assessment and analysis.

Measures

Basic Empathy Scale (BES)

In order to measure baseline levels and changes in dispositional empathy, I utilized the Basic Empathy Scale (BES), a 20-item, self-report questionnaire that measures both affective and cognitive empathy (Jolliffe & Farrington, 2006). Empathy scores are generated by summing responses to 11 items on the affective empathy scale and 9 items on the cognitive empathy scale. An example of an item from the affective scale would be "*I usually feel calm when other people are scared,"* and an example of a cognitive item would be "*It is hard for me to understand when my friends are sad*." Respondents ranked their agreement to statements for each item using five-point Likert scales (1 – *Strongly Disagree* to 5 – *Strongly Agree*). The measure has undergone two trials of testing by Jolliffe and Farrington with adolescent participants (trial 1, $N = 363$; trial 2, $N = 357$). The measure was tested for construct, convergent, and discriminant validity. Results showed that the measure is aligned with theoretical expectations and previous empathy research. The internal consistency coefficients for cognitive and affective empathy scales were $\alpha = .79$ and $\alpha = .85$ respectively when reliability was calculated during the measure development study. Internal consistency coefficients for the current study were $\alpha = .75$ on the cognitive scale and $\alpha = .84$ on the affective scale. Internal consistency for the full measure was $\alpha = .83$.

The BES was selected as the measure of empathy for the current study because it is one of the few empathy measures that provides a scale for both affective and cognitive empathy that

was also designed to be used with adolescents. The measure underwent rigorous validity and reliability testing during its development (Jolliffe & Farrington, 2006). The developers stipulate in their terms of use that the BES must remain confidential and not be shared through the distribution of publication or research documents. For this reason, a copy of the BES is not included in the appendix section of this document. Interested readers should contact the first author of the study that outlines the development of the BES to procure a copy of the measure for their research interests (Jolliffe & Farrington, 2006).

Collaborative Improvisation Measure (CIM)

The CIM (Schmidt, 2018) is an author designed 6-item measure that was highly influenced by task-7 of McPherson's (1993) Test of Ability to Improvise (TAI). The TAI was developed by McPherson to assess individual improvisation achievement. The CIM expands on the musical content items measured with the TAI to include items that rate the musical interactions of co-performing improvisers. The CIM aggregates musical generativity and interaction to assess co-performer collaborative improvisation achievement. The performance task on the CIM is designed to facilitate collaborative musical generativity and processes of interaction through free improvisation. The free improvisation task enables participants, regardless of improvisational or idiomatic experience, to participate in the performance task.

The CIM generates a composite score for collaborative improvisation achievement based on the sum of subscales from musical generation and collaborative interaction. Musical generation is scored with a composite of instrumental fluency, musical syntax, creativity, and musical quality (from McPhersons TAI). Collaborative interaction scores are based on a composite of shared intentionality and affective congruence. Shared intentionality is rated on a

continuum from *nonreciprocal* to *interactive* musical generation between co-performers using a 5-point Likert-type scale. Affective congruence measures the relationship of emotional content improvised between co-performers using a 5-pont Likert-type scale (1 – *no emotional connection*, 5 – *emotionally connected*).

I pilot tested the measure with a sample of collegiate musicians completing the performance tasks and had a panel of three raters assess the recorded performances. The measure demonstrated an interrater consistency of α = .90 for the full scale with alpha coefficients of internal consistency for each judge ranging from .85 to .92. The CIM demonstrated an interrater consistency of α = .80 for the current study. The alpha coefficients of interrater consistency for each item on the scale are shown in the table 3.3. The alpha coefficients of internal consistency for each rater were quite high and ranged from .90 to .95. The sum of composite scores from each panel member generated the total improvisation achievement score for each freely improvising dyad.

Table 3.4

Interrater Reliability Coefficients (CIM)

Assessment items	α coefficients
Full measure	.80
Instrumental fluency	.83
Musical syntax	.81
Creativity	.78
Musical quality	.82

(continued)

Table 3.4 (continued)

Shared intentionality	.80
Affective congruence	.83

Note. Cronbach's alpha

The CIM was administered as a pre-and-posttest measure of collaborative free improvisation achievement. Improvising dyads were audio recorded completing the performance task. Pre-and-posttest recordings were randomized and distributed to a panel of raters for scoring. Instructions for the CIM performance task reflect those used by McPherson's (1993) measure of individual improvisation achievement on Task-7 from the TAI, but the instructions were adapted to be applicable for improvising dyads rather than individual improvisers. Improvising dyads completed two warm up tasks and a primary improvisation task. The performance task instructions are provided below.

CIM Performance Task Instructions for Improvising Dyads

Warmup Task (1): Perform a one octave scale in a mutually determined key, tempo, and rhythmic value (e.g., b-flat major, 100 bpm, quarter notes).

Warmup Task (2): Perform a short improvisation together using the scale or mode that you just played. Generate your ideas freely but try and play your ideas together.

Primary performance task: This task will be audio recorded and used for data analysis.

For this task you and your partner are free to play anything you like, so let your imaginations roam free. Your improvisation doesn't have to be in any particular key or conform to any set criteria. Just play your most interesting musical ideas by working with each other.

Remember, you are completely free to do whatever you like musically, you may play for as long as want. When you and your partner complete your improvisation, I will turn off the audio recorder.

CIM scoring procedures. Pre-and-posttest recordings of improvising dyads were randomized and distributed to a panel of raters so that they could be scored on the musical parameters of fluency, syntax, creativity, and quality and on collaborative processes of shared intentionality and affective congruence. The scores for each item were generated from raters' (*N* = 4) assessments of the freely improvised duets based on the descriptive characteristics outlined below using five-point Likert-type scales. The ratings on each item were summed to generate a composite score and the scores from the four raters were summed to generate a total score of collaborative improvisation achievement. An example of the electronic rater response form is provided in the appendix section of this document.

> **Instrumental fluency** – reflects the performers' skills to confidently generate spontaneous and expressive musical ideas.
>
> **Musical syntax** – reflects the performers' skills at generating musical ideas that lead to a logical form with a coherent beginning, middle, and ending.
>
> **Creativity** – reflects the novelty and variety of musical ideas, and the manipulation or elaboration of musical ideas.
>
> **Musical quality** – reflects the overall musical appeal of the improvised performance.
>
> **Shared Intentionality** – reflects the combined ability of performers to interact with each other to mutually generate and respond to musical ideas.
>
> **Affective congruence** – reflects the combined ability of performers to align their musical expressions with their co-performers to produce an emotionally coherent improvisation.

The panel of raters consisted of four instrumental music teachers that were purposefully selected because of their extensive experience as performing improvisers and teachers of adolescent instrumentalists. They were issued a scoring guide that provided detailed descriptions of each

scale when they participated in a rater training session. The descriptive scoring guide is provided in the appendix section of this document.

The panel of raters and I met for a one-hour training session where we examined and discussed scale descriptions and practiced scoring the freely improvising dyad recordings collected during the pilot study. The raters listened to each recorded example three times and provided a rating for each item of the CIM. Judges discussed their ratings and worked together to resolve major differences in how they scored each example based on scale descriptions. These resolutions provided a basis for using the scales and scale descriptors during individualized rating tasks. After we completed the training session, I provided each rater with a digital rater response form and randomized pre-and-posttest CIM recordings through *Qualtrics XM* to complete the scoring process individually.

The CIM was selected as the measure of collaborative improvisation achievement for this study because it demonstrated strong levels of reliability during pilot testing and because its open-ended task reflected the intervention tasks. The measure also facilitated the pairing of any two instrumental music students, which was essential for the random assignment procedures used in this study. The performance task on the CIM focuses on musical generativity and processes of interaction rather than on conventional rules or expectations found in idiomatic specific measures of improvisation. The open performance task enabled students, regardless of improvisational or idiomatic experience, to participate in the task. CIM scores were used to examine the relationship between group empathy scores and collaborative improvisation achievement.

Small Ensemble Adjudication Form (SEAF)

The SEAF is a measure of small ensemble performance achievement that was adapted from the *Illinois High School Association Small Ensemble Adjudication Form* ("Illinois High School Association," 2013) and used to examine the relationship between group level empathy scores and performance achievement on notated duets. In addition to examining the relationship between notated duet performance achievement and group empathy levels, SEAF and CIM scores were used to examine the interaction of performance condition and empathy levels on performance achievement to determine if the two performance conditions (improvising dyads and notated duets) reacted differently to the influence of group empathy levels.

The SEAF is frequently used as an evaluative tool in the state of Illinois for assessing the performance achievement of small ensembles at state solo and ensemble contests performing notated repertoire. The SEAF generates a composite score for performance achievement based on how raters rank the quality of performance on six items using five-point Likert-type scales (1 - *poor*, 5 - *superior*). The six items on the SEAF assess the performance concepts of intonation, rhythm, balance and blend, instrumental technique, interpretation and musicianship, and articulation and/or bowing. The SEAF demonstrated a global interrater consistency of $\alpha = .85$. The alpha coefficients of interrater consistency for each item on the scale are shown in the table 3.4. The alpha coefficients of internal consistency for each rater were quite high and ranged from .92 to .97. The total score for each duet was the sum of composite scores issued by four raters.

Table 3.5

Interrater Reliability Coefficients (SEAF)

Assessment items	α coefficients
Full measure	.85
Intonation	.85
Rhythm	.87
Balance and blend	.82
Technique	.86
Interpretation and musicianship	.86
Articulation and or bowing	.86

Note. Cronbach's alpha

Randomly assigned duet groups were audio recorded performing "Movements I and III" from *Recital Duets* by Sy Brandon for pre-and-posttests. The performance task instructions for the SEAF are provided below.

SEAF Performance Task Instructions

Introduction: For this task you will perform excerpts from Sy Brandon's Recital Duets. I'll tell you which portions of the duet you will play in a moment. Take as much time as you need to warmup and tune. Let me know when you are ready, and I will continue with the instructions.

Pause for participants to tune and warmup.

Performance task: Please perform movements I and III from the recital duets in your packet with your partner to the best of your ability. Do not feel bad about making mistakes or if you cannot finish the movements. Try your best and perform as much of movements I and III as possible with as much accuracy as possible.

- Be sure that one of you plays the top part while the other plays the bottom part.

- Do not play the repeat in Mvt. III and skip to the 2nd ending.
- Let me know when you're ready to begin and I'll start the recorder.

SEAF scoring procedures. The recordings of pre-and-posttest duet performances were randomized and distributed to the same panel of raters that evaluated the CIM performance tasks. Raters assessed the pre-and-posttest performance achievement of each notated duet group by ranking the recordings on six items. Item descriptions are provided below, and an example of the electronic rater response form is provided in the appendix section of this document.

Intonation – accuracy of printed pitches

Rhythm – accuracy of note and rest values, duration, pulse, steadiness, correct meters

Balance and blend – likeness of qualities, awareness of ensemble

Technique – artistry, attacks, releases, control of ranges, musical and/or mechanical skill

Interpretation and musicianship – style, phrasing, tempo, dynamics, musical expression

Articulation and or bowing - accuracy of performing articulation figures and/or bowing patterns

Rater training for the SEAF was concurrent with CIM training. The panel and I met to examine and discuss item descriptions and practiced scoring the noted duet recordings collected during the pilot study. The raters listened to each recorded example three times and provided a rating for each item on the SEAF. Raters discussed their ratings and worked together to resolve major differences in how they scored each example based on item descriptions. These resolutions provided a basis for using the scale and item descriptors during individualized rating tasks. After we completed the training session, I provided each rater with a digital rater response form and

randomized pre-and-posttest SEAF recordings through *Qualtrics XM* to complete the scoring process individually.

I selected the SEAF as the measure of duet performance achievement because panel members were familiar with the scale and because of its common use as an assessment tool for small ensemble performances. *Recital Duets* by Sy Brandon (1981) was selected as the intervention and SEAF performance task stimulus because it provided the flexibility to randomly assign any combination of instrumentalists to notated duet groups and it provided an adequate amount of notated material for participants to rehearse for eight 20-minute intervention sessions.

Positive and Negative Affect Schedule (PANAS)

The PANAS was used as a measure of positive and negative reactions to the musical experiences during interventions (Watson et al., 1988). Research suggests that both learning and empathy development are influenced by attributions of positive or negative attitudes (Chen et al., 2018; Stueber, 2017) and a lack of control for these influences may subjugate outcome variance to omitted variable bias (Good & Russo, 2016). To control for the variance of attitudes related to the interventions, participants completed the PANAS after each intervention session. The PANAS is a 20-item measure that asks respondents to rate how their feelings match descriptive words on 5-point Likert-type scales (1 - *Very slightly or not at all*, 5 - *Extremely*). Scores from both positive and negative attitude scales were aggregated and divided by the number of interventions to generate a global average of negative and positive attitudes during the full treatment period. The difference between global positive and negative responses on the PANAS was used to represent affective valence to the music-making experiences. The PANAS has been validated with adolescents, demonstrating internal consistencies of $\alpha = .84$ for negative attitudes

and α = .85 for positive attitudes (Huebner & Dew, 1995). Internal consistency for the current study was α = .83 on the negative scale and α = .93 on the positive scale.

Demographic and Background Survey

To generate accurate descriptive statistics for the sample and to control for variables of gender and years of instrumental playing experience, participants completed a short background questionnaire during the pretest collection period. The background questionnaire asked participants to indicate their pronoun, ethnic/racial identity, performance instrument, and years playing their instrument. Gender has been shown to impact empathic dispositions and was an important control variable to include in general linear models for this study (Davis, 1983; Dereli & Aypay, 2012; Jolliffe & Farrington, 2006, 2011; Singer & Lamm, 2009; Stueber, 2017; Wallmark et al., 2018). Instrumental playing experience impacts the capacity of co-performers to attune to each other and engage in generative musical interactions (Keller, 2014; McPherson, 1993, 1995a, 1995b, 2005; Seddon, 2005; Seddon & Biasutti, 2009). Therefore, it was important to control for levels of instrumental playing experience to determine if this characteristic contributed to variations in empathy development and performance achievement. Controlling for gender identity and instrumental playing experience enhanced the internal validity and accuracy of the analytic models.

Data Preparation and Analysis

Individual Panel Data

I configured the individual participant dataset into long format panel data with two observations of dispositional empathy and time invariant characteristics of participant number, condition assignment, gender identity, affective valence, and instrumental playing experience. In

addition to arranging the variables for use in analytic modeling, I tabulated descriptive characteristics of age, race, and instrument to provide background and demographic information about the sample. Descriptive statistic for sample backgrounds and demographics are shown in tables 3.1 and 3.2. Table 3.6 shows the coding schema for variables in the individual participant dataset.

Although data from PANAS questionnaires were collected after each intervention over the 8-week treatment period, for the purposes of this study, these data were aggregated into global positive and negative ratings by averaging the scores from each intervention. This approach treated positive and negative affect as each individual's time invariant response to the music-making experiences. Affective valance (AFF_VAL_i) was calculated from the difference in average positive and negative response on the PANAS scale. Affective valence represents the overall affective response to music-making experiences throughout the study protocol. The difference between positive and negative response generated a centered variable with a range of -40 to 40. Positive numbers represented a positive response, negative numbers represented a negative response, and zero represented a neutral response.

Table 3.6

Data Coding Schema for Individuals

Variable	Code	Variable Description
Participant Number	$PART\_NUM_i$	Participant ID number to facilitate anonymous data collection
Empathy Level		
	BES_{it}_CMP	Composite score on the *Basic Empathy Scale*, Range: 20–100

(continued)

Table 3.6 (continued)

	BES_{it}_AFF	Affective score on the *Basic Empathy Scale*, Range: 11–55
	BES_{it}_COG	Cognitive score on the *Basic Empathy Scale*, Range: 9–45
Participant Age	AGE_c	Range: 13 – 18
Gender ID	GEN_ID_i	F.I.P. = 0, M.I.P. = 1
Race/Ethnicity	$RACE_c$	White = 1, Hispanic or Latinx = 2, Black or African American = 3, Native American or American Indian = 4, Asian or Pacific Islander = 5, Other = 6
Instrumental Experience	$INST\_YRS_i$	Number of years participant has been playing their instrument – continuous range
Instrument	$INST_c$	Instrument participant played during the study – categorical
Affect		
	AFF_VAL_i	Affective valence which represents the difference between positive and negative ratings on the PANAS, Range: -40–40
Condition		
	FID_i	Freely Improvising Dyad: No = 0, Yes = 1
	ND_i	Notated Duet: No = 0, Yes = 1
	CG_i	Large Ensemble Control: No = 0, Yes = 1
Observation	$OBSRV_t$	Pretest = 0, Posttest = 1

Note. Subscript $_i$ represents time invariant characteristics. Subscript $_t$ denotes variables that changed over time. Subscript $_c$ represents variables of individual characteristics that were used to generate descriptive statistics for the sample.

Analysis of Individual Panel Data

Two observations (pre-and-posttest) of dispositional empathy were used as the outcome variable in a differences-in-differences (DID) regression model (Stock & Watson, 2011). This

model was used to calculate differences in and significance of change in dispositional empathy between the three music-making conditions after participants had completed the music-making interventions. The traditional large ensemble was the control condition and the comparison group in the model. The DID model regressed dispositional empathy on condition assignment, observation, the interaction of condition and observation period, and controlled for gender identity, instrumental playing experience, and affective valence. The DID theoretical model used in the analysis is shown in equation 3.1.

Equation 3.1

$$Y_{it} = \beta_0 + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 G_{1i} + \beta_4 G_{2i} + \beta_5 D_t + \beta_6 W_{1it} + \cdots + \beta_r W_{rit} + u_{it}$$

The model represented by equation 3.1 generated coefficients for each factor in the estimator, which explained each factor's related variation with dispositional empathy outcomes while holding all other factors constant (Stock & Watson, 2011). The coefficient for β_0 represents the *Y* intercept or the mean of BES scores while controlling for condition assignment, time of observation, the interaction of condition and time of observation, and mediating variables. X_{1it} and X_{2it} were based on the interaction of music-making conditions with observation and generated coefficients for β_{1it} and β_{2it} which represent the effects of the music-making interventions (freely improvising dyads and notated duets) on changes in dispositional empathy when compared with the control condition (Large Ensemble Performance).

I used the DID estimator to examine the effects of music-making interventions on changes in composite, affective, and cognitive empathy scores. This resulted in three levels of analysis which examined how sensitive different types of empathic response were to different

forms of music-making experiences. Results from these three levels of analysis using stepwise DID modeling are presented in chapter 4.

In addition to modeling empathic outcomes as a result of musical interventions, I used pretest dispositional empathy levels as an outcome of an ordinary least squares (OLS) multiple regression model to determine how the preexisting characteristics of participants may have predicted the dispositional empathy outcomes prior to study interventions. I used the OLS theoretical model shown in equation 3.2 to regress pretest empathy levels on the preexisting characteristics of gender, instrumental playing experience, and age in a post-hoc analysis.

Equation 3.2

$$Y_i = \beta_0 + \beta_1 D_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + u_i$$

The purpose of using the estimator represented by equation 3.2 in post-hoc analyses was to determine if instrumental playing experience was a significant predictor of empathy levels within the sample prior to the implementation of experimental interventions. Y_i represents the outcome of pretest dispositional empathy. β_0 represents the Y intercept and the coefficient for the pretest mean on the Basic Empathy Scale for the full sample while holding all other factors constant. D_{1i} represents the dichotomous variable for whether individuals responded using a female identifying pronoun (0) or a male identifying pronoun (1) and generated coefficient β_1, which was the average difference in pretest empathy levels between genders while holding all other factors constant. X_{2i} was a continuous variable for instrumental playing experience and generated coefficient β_2, which represented the associated variation in pretest empathy levels with previous playing experience while holding all other factors constant. X_{3i} represents the continuous variable for age and was added to the model under the assumption that age and

instrumental playing experience were correlated and that both of these variables shared some of the variation with empathy outcomes. The variation of age generated coefficient β_3, which explained the variation of pretest empathy outcomes related to age while holding all other factors constant. Results from the post-hoc analysis and a deeper explanation for its inclusion are presented in chapter 4.

Group Level Data

In addition to my interest in examining the effect of different forms of music making on changes in dispositional empathy at the individual level, I wanted to understand how group empathy levels impacted the performance achievement or changes in performance achievement for interacting musicians. In addition, I wanted to determine whether performance achievement is more susceptible to empathy levels based on the type of performance modality. I arranged the dataset into group level variables to examine the relationship between empathy levels and performance achievement for the notated duet and freely improvising dyad groups and to determine if there were differences in that relationship between the performance groups.

I configured group level data into both wide and long formats. The datasets included group ID numbers to signify each group of interacting individuals. Group level data from the BES, instrumental playing experience, and affective valence were calculated by averaging the data from individuals within the groups. Pre-and-posttest performance achievement scores and performance gains on the CIM and SEAF were collected for each group in the freely improvising dyads and notated duets. A dichotomous marker of condition was included in the dataset with the notated duet condition representing the constant (Notated Duet = 0, Improvising Dyad = 1). Since both the CIM and SEAF had identical scoring ranges, I used raw data from these measures

in the analysis rather than standardized scores. Changes in group level empathy and performance achievement were calculated from the differences of posttest and pretest results. The long format dataset included a dichotomous marker for observation level (Pretest = 0, Posttest = 1) and did not include variables for changes in empathy or performance achievement scores. In a final level of analysis, comparisons in performance achievement between empathy pairs were made by categorizing ensemble pairs as high-high, high-low, and low-low empathy pairs using gender weighted medians. The dataset includes a categorical variable for these three levels of empathy pairs. Table 3.7 presents the coding schema used for group level variables.

Table 3.7

Data Coding Schema for Groups

Variable	Code	Variable Description
Group ID	GRP_ID_g	Group ID numbers
Pretest Group Empathy Levels		
	$PRE\_BES_g\_CMP$	Aggregated by averaging each performer's individual composite scores on the *Basic Empathy Scale* pretest, range 20-100
	$PRE\_BES_g\_AFF$	Aggregated by averaging each performer's individual affective scores on the *Basic Empathy Scale* pretest, range 11-55
	$PRE\_BES_g\_COG$	Aggregated by averaging each performer's individual cognitive scores on the *Basic Empathy Scale* pretest, range 9-45

(continued)

Table 3.7 (continued)

Posttest Group Empathy Levels		
	POST_BES$_g$_CMP	Aggregated from the average of individual composite scores on the *Basic Empathy Scale* posttest, range 20-100
	POST_BES$_g$_AFF	Aggregated from the average of individual affective scores on the *Basic Empathy Scale* posttest, range 11-55
	POST_BES$_g$_COG	Aggregated from the average of individual cognitive scores on the *Basic Empathy Scale* posttest, range 9-45
Changes in Group Empathy Levels		
	Δ_BES$_g$_CMP	Difference between pre-and-posttest composite scores on the *BES*.
	Δ_BES$_g$_AFF	Difference between pre-and-posttest affective scores on the *BES*.
	Δ_BES$_g$_COG	Difference between pre-and-posttest cognitive scores on the *BES*.
Pretest Performance Achievement	PRE_PERF_ACH	Pretest performance achievement scores on the CIM or SEAF depending on performance condition. Range: 24-120
Posttest Performance Achievement	POST_PERF_ACH	Posttest performance achievement scores on the CIM or SEAF depending on performance condition. Range: 24-120
Changes in Performance Achievement	Δ_PEFF_ACH	Gains in performance achievement based on the difference of pre-and-posttest performance scores on either the CIM of SEAF.
Instrumental Experience	INST_YRS$_g$	Avg. number of years participants had played their instruments

(continued)

Table 3.7 (continued)

Affect		
	AFF_VAL$_g$	Affective valence which represents the difference between positive and negative ratings on group PANAS averages, Range: -40 to 40
Condition	COND$_g$	Notated Duet (SEAF) = 0 Freely Improvising Dyads (CIM) = 1
Observation	OBSRV$_t$	Pretest = 0, Posttest = 1
Empathy Pairs	GRP_EMP_CAT	Each participant was categorized with high or low empathy based on gender weighted medians. Each ensemble pair was then categorized as a High-High = 3, High-Low = 2, or Low-Low = 1 empathy pair based on each ensemble member's empathy categorization.

Note. Subscript $_g$ denotes group level data that were either aggregated by summing the scores of participants within groups or by averaging the data between participants.

Audio recordings (N = 126) of both pre-and-posttests from the CIM (Pretest, n = 32; Posttest n = 32) and SEAF (Pretest, n = 31; Posttest, n = 31) performance tasks were randomized and rated by a panel of four judges with extensive experience as teachers of adolescent musicians and performers of instrumental music and music improvisation. Judges rated the recordings of collaborative improvisations with the online CIM response form. Judges rated notated duet performance recordings using the SEAF online response form. Both scales consisted of six items with a scoring range of 6-30. Ratings from the four judges were combined to generate composite scores with a range of 24-120 on each measure.

Analysis of Group Level Data

To examine the relationship between pre-and-posttest group empathy scores and concurrent performance ratings for the improvising dyads and notated duets, I regressed the

performance outcomes at each collection period on empathy response from the corresponding collection period while controlling for the mediating variables of instrumental playing experience and affective valence. To determine whether there were differences in performance achievement based on the music-making condition, I included a dichotomous variable in the model to account for the two different forms of music-making interventions with the notated duet operating as the comparison group. Equation 3.3 shows the ordinary least squares (OLS) multiple regression model I used to estimate the relationship between baseline empathy scores and performance achievement at pre-and-posttest (Stock & Watson, 2011).

Equation 3.3

$$Y_g = \beta_0 + \beta_1 X_{1g} + \beta_2 X_{2g} + \beta_3 D_{3g} + \beta_4 W_{4g} + \cdots + \beta_r W_{rg} + u_g$$

The OLS model in equation 3.3 generated an estimate of the relationship between group empathy levels and performance outcomes and was utilized when examining the relationship between empathy and performance outcomes at concurrent collection periods. Coefficient β_0 represents the constant, which was the average performance outcome while controlling for condition assignment, empathy response, instrumental playing experience, and affective valence. The interaction between empathy level and performance condition is represented by variable X_{1g} and generated coefficient β_1, which showed the predictive relationship between the interaction of empathy level and performance condition on performance outcomes while holding all other factors constant. Variable X_{2g} represents group empathy response and generated coefficient β_2, which showed the predictive relationship between empathy scores and performance achievement. Variable D_{3g} indicates assignment to either the notated duet (ND = 0) or freely improvising dyad (IMP = 1) conditions and generated coefficient β_2, which showed the

difference in performance achievement between the two music-making groups. The relationship between group empathy levels and performance achievement and the interaction of these factors were examined while controlling for group averages of instrumental playing experience and affective valence (W_{4G} and W_{5G}). Detailed results about the estimated relationships between empathy levels on composite, affective, and cognitive scales and performance achievement using the estimator in equation 3.3 are presented in chapter 5.

My third research question was concerned with whether changes in performance achievement using pre- to posttest performance gains was attributed to baseline (pretest) levels of dispositional empathy and if performance gains were more susceptible to empathy levels based on performance modality. To address this question, I regressed gains in performance achievement on pretest group empathy levels, condition assignment, the interaction of condition and empathy, and mediating variables. The OLS model expressed in equation 3.4 was used to estimate these relationships.

Equation 3.4

$$\Delta Y_g = \beta_0 + \beta_1 X_{1g} + \beta_2 X_{2g} + \beta_3 D_{3g} + \beta_4 W_{4g} + \cdots + \beta_r W_{rg} + u_g$$

The model notated in equation 3.4 examined the relationship between changes in performance achievement from pretest to posttest (ΔY_g) and pretest empathy levels (X_{2g}). Coefficient β_2 provided the coefficient for the predictive relationship between pretest empathy levels and changes in performance achievement. X_{1g} represents the interaction of empathy and performance condition where coefficient β_1 showed whether freely improvising dyads demonstrated a statistically significant difference in performance change as a result of empathy levels when compared with the notated duet condition. Condition assignment is notated by D_{3g}

and coefficient β_3 shows the predictive differences between condition assignment on changes in performance achievement (ΔY_g). In addition to examining the relationships between changes in performance achievement based on empathy levels and condition assignment, the theoretical model in equation 3.4 also controls for affective valence and instrumental playing experience within each group (W_{4g} and W_{5g}). I provide a detailed analysis of the relationships between changes in performance achievement and group composite, affective, and cognitive dispositional empathy in chapter 5.

The fourth question addressed in this research examined the relationship between changes in performance achievement and changes in dispositional empathy during the intervention process and whether those relationships were influenced by type of performance modality (notated duets or freely improvising dyads). For this analysis, I utilized the data in long format with two observations and completed a DID regression analysis. The DID model is notated in equation 3.5 and regressed pre-and-posttest performance outcomes on observation, condition assignment, empathy response, the interactions of these main effects along with the variables controlling for the average amount of group instrumental playing experience and average amount of group affective valence.

Equation 3.5

$$Y_{gt} = \beta_0 + \beta_1 X_{1gt} + \beta_2 X_{2t} + \beta_3 X_{3g} + \beta_4 X_{4gt} + \beta_5 X_{5gt} + \beta_6 D_{6t} + \beta_7 D_{7g} + \beta_8 W_{8gt} + \cdots + \beta_r W_{rgt} + u_{gt}$$

The outcome of the regression model (Y_{gt}) includes both pre-and-posttest performance achievement observations. The coefficient β_0 represents the average or constant level of performance achievement while holding the main effects of observation, condition assignment, empathy response, the interaction of main effects, and the control variables constant. Variable

X_{1gt} represents a three-way interaction between observation, condition, and group empathy response and generated coefficient β_1, which showed whether there were any significant differences in performance outcomes from pre- to posttest between conditions as a result of changes group empathy response. Variable X_{2t} represents the interaction of observation and empathy response within groups and generates coefficient β_2 which showed the predictive relationship between changes in empathy response and performance outcomes for all participating groups. Variable X_{3g} represents the interaction of performance condition and empathy response and produces coefficient β_3, which showed the between group differences in performance outcomes related the variation in empathy response at both observation periods. Variable X_{4gt} represents the interaction of performance condition and observation and generates coefficient β_4 which showed whether there were any significant differences in performance outcomes from pre- to posttest.

In addition to the aforementioned interactions, the model also includes the main effects from empathy response, condition, and observation as independent predictors of performance outcomes. Variable X_{5gt} represents the continuous variable of empathy response for all group participants at both pre-and-posttest observation and generated coefficient β_5, which showed the relationship between empathy response and performance outcomes across both conditions and observations. Variable D_{6t} is a dichotomous factor for observation level (Pretest = 0, Posttest = 1) and produced coefficient β_6, which showed the within group relationship of performance outcomes between observations. Variable D_{7g} is a dichotomous factor for group assignment (Notated Duet = 0, Freely Improvising Dyads = 1) and generated the coefficient for β_6, which showed the between group differences in performance outcomes across both observations. In

addition to regressing the main effects on performance outcomes, the estimator also controlled for affective valence and instrumental playing experience across groups (W_{8g} and W_{9g}). The predictive relationship of the interactions, main effects, and control variables were determined by holding all other factors in the model constant. A detailed analysis using this model as an estimate of the relationship between changes in empathy and performance achievement is provided in chapter 5.

Group Empathy Pairs

After completing an analysis of the relationships between performance outcomes and group empathy response while treating empathy response as a continuous variable for each group, I completed a second level of analysis which categorized performance groups into different empathy pairs. This analysis was completed to determine if there were different performance outcomes based on between group empathy pair categorizations (i.e., different empathy levels between co-performers). Using the gender weighted medians from responses on the BES at pretest collection, I categorized each participant as having high or low dispositional empathy. After categorizing each participant with either high or low dispositional empathy, ensemble pairs were categorized as High-High, High-Low, or Low-Low empathy pairs. Group empathy pair categories along with performance conditions were used as factors in a series of 3x2 ANOVAs to determine if there were any differences in performance outcomes between empathy pairs and if there were any interactions with condition assignments.

Replicating the progression used in regression analyses to answer the overarching research questions, I started by examining whether there were any differences between groups in performance outcomes at corresponding observation periods (pre-and-posttest). I used 3x2

ANOVAS with empathy pairs (High-High, High-Low, Low-Low) and performance condition (Notated Duets and Freely Improvising Dyads) as the between-subjects factors with performance achievement at pre-and-posttests as separate dependent outcomes.

After examining if there were differences in performance outcomes between groups at pre-and-posttest collection periods, I examined whether there were differences in empathy gains from pre- to posttest between groups. In this analysis, the difference in performance achievement from pre- to posttest was the dependent outcome in a 3x2 ANOVA with empathy pairs (High-High, High-Low, Low-Low) and performance condition (Improvising Dyads, Notated Duets) operating as the between-subject factors.

Since empathy pair categorizations were nominal rather than continuous, I did not analyze empathy and performance change between groups as I did in regression analysis, but I completed another level of analysis looking at differences in performance outcomes between groups at both pre-and-posttest collection periods to determine if there were any interactions between observation levels and performance condition. Using pre-and-posttest performance achievement as the dependent variable, I completed a 3x2 repeated-measures ANOVA with empathy pairs (High-High, High-Low, Low-Low) and performance condition (Improvising Dyads, Notated Duets) operating as the between-subjects factors and observation (Pretest, Posttest) operating as the within-subjects factor. Detailed results from both regression and ANOVA analyses are provided at the end of chapter 5.

Chapter Summary

The purpose of this chapter was to describe the research method and designs used to answer the stated research questions. As the methods section stipulated, this research examined

the connection between dispositional empathy and music engagement on both experimental and correlational levels. I was interested in understanding the effect that different forms of musical interaction had on changes in dispositional empathy. I was also interested in the relationship between empathy levels and interactive musical achievement. That is why I used random assignment to examine the effects of interactive music-making conditions using traditional notation and free improvisation on changes in dispositional empathy in individual participants. I provide a detailed analysis about the effects of the interventions in chapter 4.

I was also interested in examining the relationship between group empathy levels and group musical achievement. To examine these relationships, interacting participants in the two intervention groups also completed pre-and-posttest performance tasks to generate performance achievement outcomes at both collection periods. The outcome variable of interest in questions 2-4 is group performance achievement with empathy serving as a group level predictor. Analyses and results pertaining to empathy's association with interactive musical achievement under both notated and improvisatory conditions are presented in chapter 5. Chapter 6 follows the two chapters of analysis with a synthesis of the findings and a discussion about how this research informs approaches to supporting both musical achievement and social interaction in instrumental music classrooms.

CHAPTER 4: IMPROVISATION AND EMPATHY DEVELOPMENT

Music Improvisation and Dispositional Empathy Development

This chapter presents the results from analyses that addressed the first facet of the purpose, which was concerned with the effect of small group free improvisation experiences on dispositional empathy development when compared with musical experiences using traditional notation. In addition, I report the results from a post-hoc analysis related to the preexisting characteristics of participants to provide some possible explanations for intervention responses.

I begin this chapter by describing the variables used in the primary analysis. Following the descriptive statistics, I will provide results from analyses using the difference-in-differences (DID) regression models that were outlined with the formulas at the end of chapter 3. The DID analyses regressed composite, affective, and cognitive empathic response at pre-and-posttest observations on observation level, condition assignment, years of instrumental experience, gender, and affective valence. After results from the DID analyses are described, I will explain the post-hoc analysis procedures that isolated variables of significance from the DID models and describe how the post-hoc results informed speculative explanations for DID results.

Descriptive Statistics

Outcome Variable: Empathy

Dispositional empathy levels were drawn from pre-and-posttest administrations of the Basic Empathy Scale (BES; Jolliffe & Farrington, 2006). The pretest was administered one week prior to the intervention protocol and the posttest was administered one week following treatment. Participants either engaged in improvising dyads, notated duets, or traditional large

ensemble rehearsals during intervention periods. Responses on the BES composite and subscales served as outcome variables to examine the effects of musical interventions on changes in dispositional empathy while controlling for differences in affective valence, gender, and years of instrumental experience. Composite and subscale means from pre-and-posttest administrations of the BES by condition are presented in table 4.1. These means show there was very little movement in dispositional empathy levels in any of the empathic processing domains or in any of the music-making conditions from pre- to posttest.

Table 4.1

Group Empathy Means by Condition and Observation

		Improvising Dyads (n = 64)	Notated Duets (n = 62)	Large Ensembles (n = 59)
BES Scale	Observation	*M (SD)*	*M (SD)*	*M (SD)*
Composite	Pretest	74.70 (8.56)	74.97 (7.14)	74.83 (6.32)
	Posttest	75.64 (7.81)	75.66 (7.42)	75.90 (8.05)
	Change	0.94 (6.44)	0.69 (5.72)	1.07 (5.54)
Affective	Pretest	38.05 (6.73)	38.34 (4.93)	38.17 (4.92)
	Posttest	38.81 (6.07)	38.85 (5.22)	38.83 (5.48)
	Change	0.77 (4.43)	0.52 (3.48)	0.66 (3.72)
Cognitive	Pretest	36.66 (3.88)	36.63 (4.00)	36.66 (3.58)
	Posttest	36.83 (3.24)	36.81 (4.11)	37.07 (4.09)
	Change	0.17 (3.48)	0.18 (3.51)	0.41 (3.47)

Note. The BES was administered to all participants (N = 185) at pre-and-posttest resulting in 370 observations. The scale generates a composite score of dispositional empathy on subscales of affective (11 items) and cognitive (9 items) empathy using 5-point Likert-type scales.

Independent Variables: Condition and Observation

Despite the apparent lack of differences between groups by condition and within groups by observation, I utilized a DID regression estimator to determine if there was any statistically significant variation between and within groups at pre-and-posttest administrations and to examine the variation in empathy levels between participants with additional regressors (Stock & Watson, 2011). Responses on the BES were utilized as outcome variables in regression modeling. Condition assignment was the critical independent variable to examine if different musical interventions shaped changes in dispositional empathy.[5] In addition to condition assignment, observation level (pre-and-posttest) was an essential factor to determine if there were significant differences in dispositional empathy following the 8-week treatment period.

Control Variables

Although participants were randomly assigned to music-making conditions, stratified assignment procedures were not employed to evenly match participants on factors of instrumental playing experience and gender identity across conditions. Previous research has shown that gender identity influences empathy response (Dereli & Aypay, 2012; Garaigordobil, 2009; Jolliffe & Farrington, 2006; Schulte-Rüther et al., 2008; Schwenck et al., 2014; Van der Graaff, Carlo, Crocetti, Koot, & Branje, 2018). Therefore, it was important to control for gender identity when examining the impact of musical treatments on dispositional empathy change. Previous instrumental playing experience likely influenced participants' music-making experiences during the musical interventions and the impact of the interventions on dispositional

[5] Participants were randomly assigned to one of three music-making conditions during intervention periods: improvising dyads (n = 64), notated duets (n = 62), and large ensemble rehearsals (n = 59).

empathy change. Controlling for instrumental playing experience isolated the variation in empathy related to this preexisting characteristic and generated a less biased link between the music-making conditions and changes in dispositional empathy. Table 4.2 shows the distribution of participants' preexisting characteristics across conditions including age, gender identity, and average years of instrumental playing experience.

Table 4.2

Condition, Age, Gender ID, and Instrumental Playing Experience

	Age	Gender		Instrumental Exp.
Condition	Avg. Years (*SD*)	F.I.P. (*n*)	M.I.P. (*n*)	Avg. Years (*SD*)
Improving Dyads	15.48 (1.07)	43	21	6.42 (2.18)
Notated Duets	15.55 (1.21)	45	17	6.45 (2.09)
Large Ensemble Rehearsal	15.54 (1.15)	39	20	6.36 (2.22)
Full Sample	15.52 (1.14)	127	58	6.41 (2.15)

Note. This table shows that participants that identified as "He" were underrepresented in the sample.

In addition to controlling for the preexisting characteristics of gender and instrumental playing experience, the positive and negative associations participants had with their music-making experiences during interventions may have influenced changes in dispositional empathy. Table 4.3 shows participants' responses on the Positive and Negative Affect Schedule (PANAS; Watson et al., 1988) across music-making conditions. Differences between positive and negative responses on the PANAS were used to control for affective valence in the regression models.

Affective valence was treated as a time invariant variable by averaging the sum of participant responses on the PANAS after each intervention over the eight-week treatment period. Theorists assert that positive and supportive social environments are important antecedents for empathic development (Barnett, 1987; Eisenberg et al., 1997; Stueber, 2017). Therefore, controlling for affective valence was essential for disaggregating the effects of the musical interactions from positive and negative associations with the treatments on dispositional empathy change.

Table 4.3

Average Response on the Positive and Negative Affect Schedule (PANAS)

	Positive Response	Negative Response	Affective Valence
Condition	*M (SD)*	*M (SD)*	*M (SD)*
Improvising Dyads	29.87 (7.15)	13.91 (3.42)	15.97 (7.70)
Notated Duets	26.27 (7.65)	13.76 (2.82)	12.51 (7.98)
Large Ensemble Rehearsal	30.63 (7.64)	14.64 (4.84)	15.99 (8.99)
Full Sample	28.91 (7.68)	14.09 (3.77)	14.82 (8.34)

Note. Affective valence is the difference between positive and negative response ratings on the PANAS. Positive and negative responses on the PANAS were aggregated by averaging the sum of responses after each intervention over the 8-week intervention period.

Musical Interventions and Changes in Empathy

To examine the effects of the musical interventions on dispositional empathy change, and to make comparisons between the conditions, I started the analysis with an initial DID model that included factors of observation, music-making condition, and the interactions of observation and

condition. The interaction coefficients determined if there were significant differences between conditions as a result of musical interventions. In an effort minimize omitted variable bias and to account for more empathy variation in the regression, I completed a stepwise model that controlled for gender identity (Step 2), instrumental playing experience (Step 3), and affective valence (Step 4).

Composite Empathy

Table 4.4 shows the results for each level in the model using composite empathy scores from the BES as the outcome variable.

Table 4.4

Regression of Composite Empathy (BES) on Music-Making Conditions

	(1) Initial Model *B/SE/Beta/p*	(2) +Gender/Age *B/SE/Beta/*	(3) +Instr. Playing Exp. *B/SE/Beta/*	(4) +Affective Valence *B/SE/Beta/*
Intercept	74.844***	76.613***	74.10***	70.813***
(Control/Large Ensemble)	(0.990)	(0.978)	(1.487)	(1.599)
	.000	.000	.000	.000
Notated Duet	0.126	-.212	-0.241	0.482
(1 = Yes, 0 = No)	(1.382)	(1.312)	(1.305)	(1.276)
	.008	-.013	-.015	.030
	.927	.872	.854	.706
Improvising Dyad	-0.139	-0.196	-0.220	-0.219
(1 = Yes, 0 = No)	(1.372)	(1.301)	(1.294)	(1.257)
	-.009	-.012	-.014	-.014
	.919	.880	.865	.862
Observation	1.047	1.047	1.047	1.047
(1 = Post, 0 = Pre)	(1.399)	(1.327)	(1.320)	(1.282)
	.069	.069	.069	.069
	.455	.431	.428	.415
Notated Duet	-0.353	-0.353	-0.353	-0.353
*Observation	(1.955)	(1.854)	(1.844)	(1.791)
(Interaction)	-.017	-.017	-.017	-0.017
	.857	.849	.848	.844

(continued)

Table 4.4 (continued)

Improvising Dyad	-0.117	-0.117	-0.177	-0.117
*Observation	(1.940)	(1.840)	(1.830)	(1.777)
(Interaction)	-.006	-.006	-.006	-.006
	.952	.949	.949	.948
Gender		-5.218***	-5.094***	-5.420***
(F.I.P. = 0, M.I.P. = 1)		(0.809)	(0.807)	(0.786)
		-.321	-.313	-.333
		.000	.000	.000
Instrumental Playing			0.388*	0.386*
Experience (yrs.)			(0.174)	(0.169)
			.110	.110
			.026	.023
Affective Valence				0.214***
				(0.045)
				.235
				.000
Adj. R^2	.010	.091	.101	.153
SER	7.601	7.210	7.171	6.962

Note. Affective valence was treated as a time invariant factor by averaging responses from all the interventions.
* $p < .05$ ** $p < .01$ *** $p < .001$

The initial model (Step 1) confirmed that there were no significant differences in composite empathy levels between the three musical intervention groups (improvising dyads, notated duets, and large ensembles). Step 1 also showed that there were no within group differences between pre-and-posttest observations or between group differences as a result of the interaction between observation and condition. Not surprisingly, the lack of variation between groups and within groups based on musical interventions diminished the power of the initial model to explain any variation in composite empathy levels. The initial model generated a nonsignificant F test, $F(5, 364) = 0.27$, $p = .920$ and an adjusted R^2 of .01, which indicates that condition assignment and pre-and-posttest observations did not account for any of the variation in composite empathy levels.

Despite a lack of variation within groups and between groups as a result of musical interventions, the full sample of observations had a range of 41 points on the composite empathy scale, indicating a substantive amount of empathy variation between participants. To explore the variation in empathy between individual observations, I completed additional steps in the regression model to examine how variables of gender, instrumental playing experience, and affective valence predicted outcomes of composite empathy.

Step 2 in the model included gender identity as a control variable. Aligning with observations from previous research (Dereli & Aypay, 2012; Garaigordobil, 2009; Jolliffe & Farrington, 2006; Schulte-Rüther et al., 2008; Schwenck et al., 2014; Van der Graaff et al., 2018), gender ($p < .001$) was a significant predictor of composite empathy. The model F test was significant, $F(6, 363) = 7.18$, $p < .001$, with the model explaining approximately nine percent of the variation in composite empathy levels (adjusted $R^2 = .091$). While holding the factors of condition assignment and observation level constant, the coefficient for gender in the model shows that M.I.P participants generated a composite empathy score that was 5.22 points lower than F.I.P. participants. Although the different music-making conditions did not explain any of the variance in empathy, gender was a strong predictor of empathy levels.

In step 3 of the model, I retained the factors of condition assignment, observation level, and gender, and added the variable of instrumental playing experience. I added this predictor with the assumption that musical interactions foster social connection and stimulate empathic response (Cirelli et al., 2014; Clarke et al., 2015; Davies, 2011; Hietolahti-Ansten & Kalliopuska, 1990; Kalliopuska & Ruókonen, 1986, 1993; Kirschner & Tomasello, 2010; Krueger, 2013; Rabinowitch et al., 2012; Rabinowitch & Meltzoff, 2017). As step 3 in the model

shows, instrumental playing experience was a predictor of empathy variation ($p < .05$). The model F test was significant, $F(7, 362) = 6.93$, $p < .001$, with the model explaining approximately 10% of the variation in composite empathy levels (adjusted $R^2 = .101$). While holding factors of condition, observation, and gender constant, the coefficient for instrumental playing experience shows that for every year of instrumental playing experience there was, on average, a 0.39-point increase in composite empathy scores.

The final step in the model (Step 4) retained all the previous variables while adding the variable of affective valence. The model shows that affective valence was a significant predictor of composite empathy scores ($p < .001$). The F test was significant, $F(8, 361) = 9.31$, $p < .001$, with the model accounting for approximately 15% of the variation in composite empathy scores (adjusted $R^2 = .153$). While holding factors of condition, observation, gender, and instrumental playing experience constant, the coefficient for affective valence shows that for every point increase in positive associations with collective music experiences, participants demonstrated a 0.24-point increase in composite empathy scores.

In the final step of the model (Step 4), condition assignment, observation level, and the interaction of condition and observation were all nonsignificant factors on empathy variation. This result indicates that the different musical interventions did not have different effects on composite empathy variation and the treatments did not induce significant empathy change from pre- to posttest. Despite the null result from the experimental interventions, serval factors in the model were associated with empathy levels. Gender ($p < .001$), instrumental playing experience ($p < .05$), and affective valence ($p < .001$) were all significant predictors. While holding all other factors constant, female identifying participants, on average, had higher composite empathy

scores than male identifying participants. For every year of instrumental playing experience, participants demonstrated increases in composite empathy scores. Affective valence was positively related to composite empathy scores. Exploratory post-hoc analysis was used to examine how these relationships may have impacted the effects of the music interventions. The results of the post-hoc analysis will be presented later in this chapter.

In the next section, I used stepwise regression analysis to examine the relationship between the previously explored variables and the BES subscales that measured the domains of cognitive and affective empathy. The purpose of these analyses was to determine if cognitive and affective empathy demonstrated different reactions to the experimental interventions while controlling for preexisting characteristics.

Affective and Cognitive Empathy Subscales

I used the same analytic procedures for the subscales on the BES as those used for composite empathy scores. Results from these analyses are represented in tables 4.5 and 4.6. The initial models (Step 1) regressed affective and cognitive empathy subscales on condition assignment, observation level, and the interaction between observation and condition. After regressing the initial models, I ran a series of additional regressions by adding factors of gender (Step 2), instrumental playing experience (Step 3), and affective valence (Step 4) to each successive model. This stepwise process showed the level of significance of each predictor and how those relationships changed with the introduction of new predictors. In addition, the stepwise process also showed how the explanatory power of the models for each empathic domain changed with additional predictors.

Affective Empathy

Table 4.5 shows the results from the DID regression model that used affective empathy as the outcome variable.

Table 4.5

Regression of Affective Empathy (BES-Subscale) on Music-Making Conditions

	(1) Initial Model	(2) +Gender	(3) +Instr. Playing Exp.	(4) +Affective Valence
	B/SE/Beta/p	*B/SE/Beta/p*	*B/SE/Beta/p*	*B/SE/Beta/p*
Intercept	38.165***	39.329***	37.198***	35.719***
(Control/Large Ensemble)	(0.731)	(0.731)	(1.109)	(1.216)
	.000	.000	.000	.000
Notated Duet	0.174	-.049	-0.074	0.251
(1 = Yes, 0 = No)	(1.021)	(0.981)	(0.974)	(0.971)
	.015	-.004	-.006	.021
	.865	.960	.940	.796
Improvising Dyad	-0.122	-0.160	-0.180	-0.180
(1 = Yes, 0 = No)	(1.013)	(0.972)	(0.965)	(0.956)
	-.010	-.014	-.015	-.015
	.904	.870	.852	.851
Observation	0.660	0.660	0.660	0.660
(1 = Post, 0 = Pre)	(1.034)	(0.992)	(0.985)	(0.975)
	.059	.059	.059	.059
	.524	.506	.503	.499
Notated Duet	-0.140	-0.140	-0.140	-0.140
*Observation	(1.034)	(1.386)	(1.376)	(1.362)
Interaction	-.009	-.009	-.009	-.009
	.923	.920	.919	.918
Improvising Dyad	0.107	0.107	0.107	0.107
*Observation	(1.433)	(1.375)	(1.365)	(1.352)
Interaction	.007	.007	.007	.007
	.941	.938	.938	.937
Gender		-3.433***	-3.328***	-3.474***
(F.I.P. = 0, M.I.P. = 1)		(0.605)	(0.602)	(0.598)
		-.285	-.277	-.289
		.000	.000	.000
Instrumental Playing			0.330*	0.329*
Experience (yrs.)			(0.130)	(0.129)
			.127	.126
			.012	.011

(continued)

Table 4.5 (continued)

Affective Valence				0.096** (0.034) .143 .005
Adj. R^2	.010	.070	.083	.101
SER	5.614	5.388	5.348	5.297

Note. Affective valence was treated as a time invariant factor by averaging responses from all the interventions.
* $p < .05$, ** $p < .01$, *** $p < .001$

Much like results from composite scores, the initial model (Step 1) in table 4.5 shows that there were no significant differences in affective empathy scores between pre-and-posttest observations or between conditions. The model F test lacked significance, $F(5, 364) = 0.27$, $p = .932$, demonstrating that observation level and condition assignment did not explain any of the variation in empathy scores (adjusted $R^2 = .010$). This result indicates that none of the musical interventions accounted for any change in affective empathy levels. To explain some of the variation in affective empathy scores between participants, I completed additional steps in regression modeling using gender, instrumental playing experience, and affective valence as predictor variables.

Step 2 in the model shows that gender was a significant predictor ($p < .001$) of affective empathy variation. The F test for the model was significant, $F(6, 363) = 5.61$, $p > .001$, and the model explained approximately seven percent of the variation in affective empathy (adjusted $R^2 = .070$). The model shows that while holding condition assignment, observation, and interactions constant, female identifying participants responded with affective empathy scores that were, on average, 3.42 points higher than male identifying participants.

In Step 3 of the model, both gender ($p < .001$) and instrumental playing experience ($p < .05$) were significant predictors of affective empathy. The third model had a significant F statistic, $F(7, 362) = 5.80$, $p < .001$, and explained around eight percent of affective empathy variation (adjusted $R^2 = .083$). While holding all factors constant, the model in Step 3 shows that female identifying participants responded with affective empathy scores that were 3.33 points higher than male identifying participants. On average, every year of instrumental playing experience was associated with a 0.33-point increase in affective empathy response.

The final model (Step 4) showed that while holding all other factors constant, gender ($p < .001$), instrumental playing experience ($p < .05$), and affective valence ($p < .01$) were significant predictors of affective empathy. The final model also explained the most variation in affective empathy scores (10%) when compared with the previous models, $F(8, 361) = 6.18$, $p > .001$, adjusted $R^2 = .101$. Step 4 showed that female identifying participants had higher affective empathy response scores by 3.47 points. It also appears that for every year increase in instrumental playing experience, affective empathy ratings increased by 0.33 points. For every point increase in positive valence, participants increased their reported affective empathy ratings by 0.10 points. Both instrumental playing experience and affective valence demonstrated statistically significant although subtle positive relationships with affective empathy outcomes.

Results from the regression analysis of affective empathy in many ways mirror composite empathy results. The primary factors of interest—the interactions of observation and condition assignment—were not significant. The model that only included the primary factors (Step 1) did not account for any of the variation in affective empathy scores. When the control variables of gender, instrumental playing experience, and affective valence were included, they represented

significant predictors of between participant variation in affective empathy response. Gender in both composite and affective empathy modeling was a significant predictor of empathy response while instrumental playing experience and affective valence were statistically significant but explained less of the variation.

Cognitive Empathy

Table 4.6 shows the stepwise regression model used to analyze the effects of the musical interventions on cognitive empathy development along with steps that explored the relationships between cognitive empathy and the control variables.

Table 4.6

Regression of Cognitive Empathy (BES-Subscale) on Music-Making Conditions

	(1) Initial Model	(2) +Gender	(3) +Instr. Playing Exp.	(4) +Affective Valence
	B/SE/Beta/p	*B/SE/Beta/p*	*B/SE/Beta/p*	*B/SE/Beta/p*
Intercept	36.379***	37.284***	36.906***	35.094***
(Control/Large Ensemble)	(0.499)	(0.508)	(0.777)	(0.833)
	.000	.000	.000	.000
Notated Duet	-0.047	-.163	-0.167	0.231
(1 = yes, 0 = no)	(0.697)	(0.682)	(0.682)	(0.665)
	-.006	-.020	-.021	.029
	.946	.811	.807	.729
Improvising Dyad	-0.017	-0.036	-0.040	-0.039
(1 = yes, 0 = no)	(0.691)	(0.676)	(0.676)	(0.654)
	-.002	-.005	-.005	-.005
	.980	.957	.953	.952
Observation	0.387	0.387	0.387	0.387
(1=Post, 0=Pre)	(0.705)	(0.689)	(0.690)	(0.668)
	.051	.051	.051	.051
	.584	.575	.575	.562
Notated Duet	-0.213	-0.213	-0.213	-0.213
*Observation	(0.985)	(0.963)	(0.964)	(0.933)
(Interaction)	-.021	-.021	-.021	-.021
	.829	.825	.825	.820

(continued)

Table 4.6 (continued)

Improvising Dyad *Observation (Interaction)	-0.223 (0.978) -.022 .819	-0.223 (0.956) -.022 .815	-0.223 (0.956) -.022 .815	-0.223 (0.925) -.022 .809
Gender (F.I.P. = 0, M.I.P. = 1)		-1.785*** (0.420) -.218 .000	-1.766*** (0.422) -.215 .000	-1.946*** (0.410) -.237 .000
Instrumental Playing Experience (yrs.)			0.058 (0.091) .033 .522	0.057 (0.088) .032 .517
Affective Valence				0.118*** (0.023) .257 .000
Adj. R^2	.012	.033	.031	.093
SER	3.831	3.744	3.747	3.626

Note. Affective valence was treated as a time invariant factor by averaging responses from all the interventions.
* $p < .05$, ** $p < .01$, *** $p < .001$

Following the pattern established in analyses of both composite empathy and affective empathy, the initial model (Step 1) of cognitive empathy showed that it was not responsive to any of the musical interventions and there were no statistical differences between the musical conditions. The model in step 1 included factors of condition assignment, observation level, and the interaction of observation and condition. The *F* test for this model was not significant, $F(5, 364) = 0.11$, p = .991, and the model did not attend to any of the variation in cognitive empathy response (adjusted $R^2 = .012$).

In step 2 of the regression sequence, I added the control variable of gender and retained factors for condition, observation, and the interaction of condition and observation in the analysis. The *F* test for the model was significant, $F(6, 363) = 3.10$, $p < .01$, but the model

explained only about three percent of the variation in cognitive empathy response (adjusted R^2 = .033). The model indicates that female identifying participants responded to the cognitive empathy subscale, on average, 1.79 points higher than male identifying participants. It is interesting to note that gender, although significant, had a smaller effect on cognitive empathy than it did for the composite scale and the affective subscale.

Adding instrumental playing experience to the model in step 3 of this analysis slightly reduced the amount of cognitive empathy variation explained by the model (adjusted R^2 = .031). Although the model remained significant when adding the variable of instrumental playing experience, $F(7, 362) = 2.71$, $p < .01$, instrumental playing experience was not a significant predictor of cognitive empathy ($p = .522$). This result contrasts results from the composite and affective empathy models, where instrumental playing experience remained a significant predictor throughout stepwise analysis.

I retained all the previously included variables in the final step (Step 4) of the analysis to hold those factors constant while adding affective valence. The final model was significant, $F(8, 361) = 5.75$, $p < .001$, and the addition of affective valence produced a substantive increase in the amount of cognitive empathy variation explained by the model to around nine percent (adjusted R^2 = .093). Affective valence was a significant factor ($p < .001$) in the model, and the model showed that for every, point increase in positive valence cognitive empathy increased by 0.12 points. Gender remained a significant predictor ($p < .001$) in the final model and showed that female identifying participants, on average, responded with higher cognitive empathy scores by 1.95 points.

Summary of Results for Empathy Variation

The primary question these analyses hoped to answer was to what extent, if any, do small group collaborative improvisation experiences shape dispositional empathy development when compared with small and large group interactive performance experiences using traditional notation over an eight-week treatment period. A secondary query for these analyses was how do the subscales of dispositional empathy (affective and cognitive empathy) react differently to different types of interactive musical experiences. In an effort to clarify the effect of musical interventions on changes in dispositional empathy, I controlled for factors assumed to influence variation in empathy response in regression modeling. Controlling for factors of gender, instrumental playing experience, and affective valence generated implicit questions about how these factors predicted dispositional empathy response. This section will summarize the results concerning these questions and provide a rationale for the post-hoc analysis.

Models for the main effects of condition assignment and observation along with the interaction of these variables showed that the musical interventions had no effect on dispositional empathy. Not only did improvisation not differ from any of the other musical interventions, but none of the musical interventions showed any differences from pre- to posttest. The null result of empathy change from pre- to posttest for the all of the musical interventions suggests three possible outcomes: (a) musical interventions do not influence dispositional empathy, (b) the dosage and length of the treatment in this experiment was not sufficient to influence dispositional empathy change, (c) the preexisting characteristics and previous musical experiences of the participants may have contributed to a ceiling effect, thus minimizing any variation from pre- to

posttest caused by the experimental interventions. An exploratory post-hoc analysis of the data will examine the possibility of these outcomes.

The regression models in tables 4.4 – 4.6 showed that the control variables explained some of the variation for composite, affective, and cognitive dispositional empathy. Although the influence of these variables was not the primary question for this research, developing an understanding of how these variables shaped empathy response in the context of music learning environments was critical for generating an unbiased signal from the condition variables in the experimental design. Understanding the variation associated with the control variables not only enhanced the signal from the different musical experiences, but this understanding was also informative for developing explanations for the null results.

All the models for both composite and subscales that included gender as a control variable showed that gender was a significant predictor of empathy variation. Female identifying participants, on average, responded with higher levels of empathy on the BES. Interestingly, the inclusion of gender in the models showed differences in the level of empathy variation the models were able to explain depending on the response domain being examined. Both composite and affective empathy models showed a dramatic increase in the explanatory power of the models when gender was added as a predictor. Although gender was still a significant factor, the model for cognitive empathy showed a decrease in fit when gender was included.

Instrumental playing experience was a statistically significant variable in empathy outcomes for the composite scale and affective subscale, but the variable's contribution only slightly increased the explanatory power of the models, and the relatively small beta coefficients suggest that instrumental playing experience was a weak predictor of empathy outcomes.

Instrumental playing experience was not a significant predictor of empathy outcomes for the cognitive subscale.

Finally, affective valence, or levels of positive response to the musical interventions, was a significant predictor of empathy outcomes for the composite scale and both subscales. Much like gender, however, the impact of this variable was not uniform in all domains of empathy response. The model of cognitive empathy demonstrated the largest increase in explanatory power when affective valence was added as a predictor. The standardized beta coefficients also showed that affective valence was a strong predictor in cognitive empathy outcomes. The composite scale and affective subscale were less responsive to the addition of affective valence and standardized beta coefficients showed that affective valence was a weaker predictor of empathy levels in these models.

The primary finding from this analysis showed that the eight-week intervention (freely improvising dyads, notated duets, traditional large performance ensembles for 20 minutes a week) demonstrated no effect or different effects on dispositional empathy in any processing domain (affective, cognitive, composite). Despite a lack of variation caused by the musical interventions used in the experiment, analyses of the control variables showed that different preexisting characteristics were associated with empathy response systems (affective and cognitive) at different levels. For example, affective empathy was more responsive to gender and instrumental playing experience while cognitive empathy was more responsive to affective valence.

In the next section, I describe the post-hoc analysis I used to explore the pre-existing characteristics of participants to determine whether there is evidence of insufficient dosage or the

existence of ceiling effects that may have nullified any possible variation that could have been caused by the experimental treatments.

Post-Hoc Analysis of Preexisting Characteristics

I completed a post-hoc analysis of participants' preexisting characteristics to explore the possibility that these characteristics were associated with pretest empathy levels, and that they may have mediated changes caused by the musical interventions used in the experiment. I examined the association between pretest empathy levels and the significant control variables used in the DID models during the primary analysis.

Gender identity, affective valence, and instrumental playing experience were all significant predictors in the primary analysis. Although affective valence was a significant predictor of empathy variation in the DID models, these data were collected to control for positive and negative associations to the musical interventions. Pretest data were gathered prior to the implementation of interventions; therefore, affective valence was not included in the post-hoc analysis. Instrumental playing experience, however, was a significant predictor of empathy variation and was used as a regressor in pretest empathy outcomes. Gender was another significant predictor in all models and served as an essential preexisting control factor to clarify the relationship between instrumental playing experience and pretest empathy variation in the post-hoc analysis.

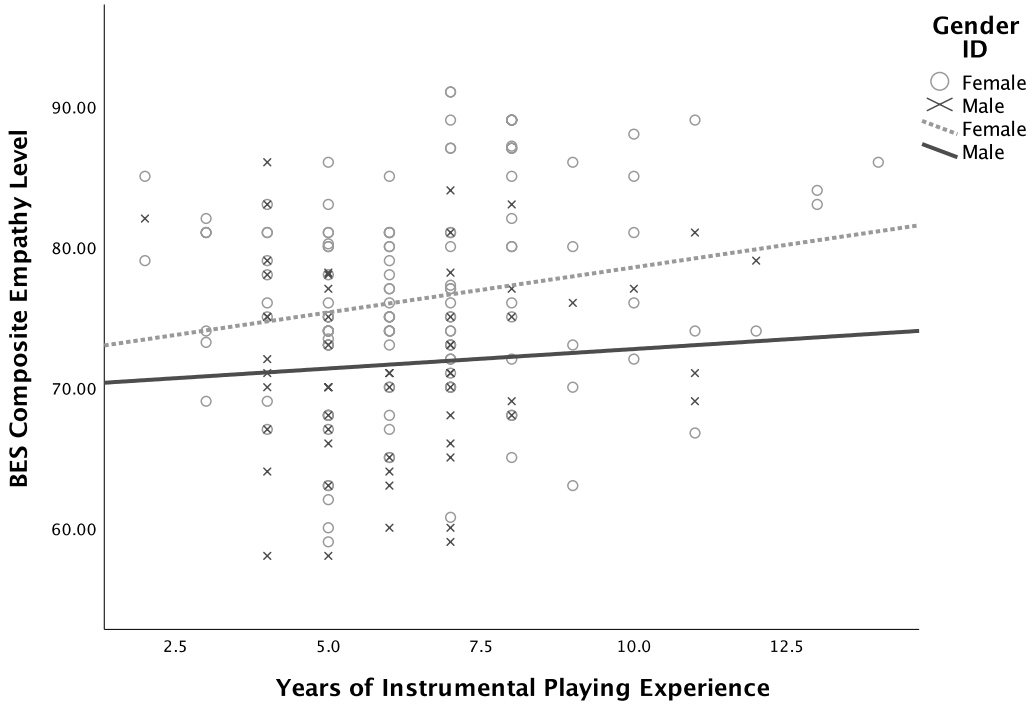
Gender and Instrumental Playing Experience

Figure 4.1 shows the regression lines for the relationship between instrumental playing experience and pretest levels of dispositional empathy grouped by gender. The regression lines suggest a positive, although subtle, relationship between instrumental playing experience and

dispositional empathy level. The different slopes for the gender lines also indicate the possibility of an interaction effect between gender identity and playing experience on empathy levels.

Figure 4.1

Regression Lines for Empathy and Instrumental Playing Experience Grouped by Gender



I regressed composite empathy scores on instrumental playing experience, gender identity, and the interaction of instrumental playing experience and gender using ordinary least squares (OLS) regression modeling. The interaction of gender and playing experience was excluded as a regressor in the final model because it was not a significant factor and because its inclusion reduced the explanatory power of the model. Table 4.7 shows the results from this regression model.

Table 4.7

Regression of BES Pretest on Instrumental Playing Experience and Gender

	b	*SE*	*β*	*t*	*p*
Intercept	72.80	1.69		43.14	.000
Gender ID (F.I.P. = 0, M.I. P. = 1)	-4.46	1.12	-.28	-4.00	.000
Instrumental Playing Experience (yrs)	0.54	0.24	.16	2.23	.027

Note. $F(2, 182) = 11.14$, $p < .001$; adjusted $R^2 = .10$

The *F* test for the model was significant, $F(2, 182) = 11.14$, $p < .001$, and the model explained approximately 10% of the variation in BES scores (adjusted $R^2 = .10$). Gender was a significant predictor *(*$p < .001$) with female identifying participants responding to the pretest empathy scale with higher scores than male identifying participants at an average of 4.46 points. Instrumental playing experience was also a significant factor ($p < .05$), with every year of instrumental playing experience predicting an average increase in empathy scores by 0.54 points. Although the different slopes in figure 4.1 suggest the potential for an interaction between gender and playing experience, the interaction was not statistically significant.

The results of the model in table 4.7 lend some credence to speculation that participants had reached a ceiling to any change that could be caused by musical interventions, and that the dosage and length of the intervention in this experiment was not long enough to cause any changes in dispositional empathy. This sample had an average of just over six years of instrumental playing experience and the model showed that there was a small, positive association between playing experience and empathy levels. The participants in this study may

have, by virtue of their music participation, been receiving musical treatments that enhanced empathy development over an extended period of time.

Pretest Empathy Scores

A comparison of pretest Basic Empathy Scale means between this sample and samples from other studies showed that the participants in this study did not have abnormally high levels of dispositional empathy as a result of their extensive musical experiences. Table 4.8 shows the mean empathy scores for the full sample in this study and the means from other studies that have used the BES with socially and developmentally typical students sampled from high school settings. The means in table 4.8 indicate that there is nothing atypical about the sample selected for this study. This lack of atypicality makes a ceiling effect an unlikely cause for the lack of significant differences between groups and within groups from pre- to posttest as a result of the experimental interventions.

Table 4.8

Basic Empathy Scale (BES) and Subscale Means from a Sample of Studies Using the Measure

Study Citation	Age (*M*)	Affective Subscale			Cognitive Subscale			BES Composite Scale		
		M.I.P. (Male)	F.I.P. (Female)	Full Sample	M.I.P. (Male)	F.I.P. (Female)	Full Sample	M.I.P. (Male)	F.I.P. (Female)	Full Sample
Current Study	**15.5**	**35.8**	**39.3**	**38.2**	**35.9**	**37.0**	**36.7**	**71.7**	**76.3**	**74.9**
Ang & Goh (2010)	14.9	35.3	40.4	NA[3]	31.4	33.8	NA[3]	66.7	74.2	NA[3]
Euler, Steinlin, and Stadler (2017)	14.9	NA[2]	NA[2]	37.5	NA[2]	NA[2]	37.6	NA[2]	NA[2]	75.1
Jolliffe & Farrington (2006)	14.8	32.1	40.3	NA[3]	32.2	35.0	NA[3]	64.3	75.3	NA[3]
Jolliffe & Farrington (2011)	14.8	32.4	40.6	NA[3]	32.4	35.1	NA[3]	64.8	75.7	NA[3]
Lalama (2016)	NA[1]	NA[2]	NA[2]	35.1	NA[2]	NA[2]	35.9	NA[2]	NA[2]	71.0
Silke, Swards, and Heary (2017)	15.5	NA[2]	NA[2]	37.9	NA[2]	NA[2]	35.2	NA[2]	NA[2]	73.1

Note. The means from the Basic Empathy Scale (BES) presented in this table were all drawn from studies with descriptive statistics of socially typical students attending high schools. If the study in the table compared socially typical students with a sample of students that demonstrated atypical social behavior or traits (i.e., bullying behavior), then the means on this table only represent the control group or socially typical students in the participant sample.

NA – Represents information that was not available in the descriptive statistics provided by study authors.
[1] The mean of participant ages was not provided but the sample utilized students participating in high school bands.
[2] Disaggregated empathy scores by gender were not reported
[3] Aggregated empathy scores for the full sample were not reported.

Omitted Variable of Age

The significant but subtle relationship between instrumental playing experience and empathy development in the previous models may have been overestimated as a result of omitted variable bias. There was a significant correlation between age and instrumental experience, $r(185) = .46$, $p < .01$, suggesting the possibility that these two variables may have shared some variation with empathy levels. Although theorists have asserted and researchers have found that empathy changes with age and development (Barnett, 1987; Eisenberg et al., 2015; Eisenberg et al., 1997; Schwenck et al., 2014; Thompson, 1987), age was not included in the primary analytic models because all participants were categorized as adolescents and considered to be within a singular developmental stage. However, the age range of participants in this study (13-18) may have been variable enough to make this is a spurious assumption.

Table 4.9

Regression of BES Pretest Response on Gender Identity, Instrumental Playing Experience, and Age

	b	*SE*	*β*	*t*	*p*
Intercept	59.32	7.29		8.14	.000
Gender ID (F.I.P. = 0, M.I.P. = 1)	-4.69	1.11	-.30	-4.21	.000
Instrumental Playing Experience	0.30	0.27	.09	1.10	.275
Age	0.97	0.51	.15	1.90	.059

Note. $F(3, 181) = 8.73$, $p < .001$; adjusted $R^2 = .11$

Table 4.9 shows the results from a regression of BES pretest responses on gender identity and instrumental playing experience while also controlling for age. The *F* statistic for the model

was significant, $F(3, 181) = 8.73$, $p < .001$, and the model accounted for approximately 11% of empathy variation (adjusted $R^2 = .11$).

While holding age constant, gender remained a significant predictor of empathy outcomes. Instrumental playing experience, however, was no longer a significant predictor of empathy outcomes ($p = .28$) when age was included. This result, along with the comparatively normal BES ranges at pretest (see table 4.8), reduces the likelihood that the participants in this study had reached a ceiling in empathy development caused by their musical experiences prior to the implementation of experimental interventions.

Summary of Post-Hoc Analysis

Findings from the post-hoc analysis suggest that the null result from the experiment was likely not attributed to a ceiling effect in empathy levels caused by previous musical experiences. Rather, these results support the primary findings that the musical interventions either had no effect on dispositional empathy outcomes, or that the treatment dosage was not high enough or long enough to initiate an effect on empathy change. If longitudinal interventions are implemented in future research, findings from this post-hoc analysis support the need to control for age variation and the social growth and human development that accompany advances in age when examining the effects of musical interventions on empathy change.

Chapter Conclusion

The primary focus of the analysis in this chapter was to understand the effects of small group free improvisation experiences on dispositional empathy development when compared with musical experiences in small and large ensembles that used traditional notation. The analysis also examined affective and cognitive empathic response processes to determine if they

demonstrated varying reactions to the different musical experiences and control characteristics. The primary finding indicates that there were no significant differences in empathy development between the three different musical experiences nor were there any differences in empathy development within the groups from pre- to posttest.

One of the secondary concerns addressed in the primary analysis was to determine if the composite scale and the subscales reacted differently to the musical interventions and control factors. Stepwise linear regressions of the composite scale and affective and cognitive subscales showed that none of the empathic response domains were influenced by the experimental interventions. However, control variables such as gender identity, instrumental playing experience, and affective valence shaped empathic response processing in different ways.

Gender identity was among the constructs that demonstrated a significant influence at all levels of analyses. This result is congruent with previous research that has found similar relationships between gender and empathy response (Dereli & Aypay, 2012; Garaigordobil, 2009; Jolliffe & Farrington, 2006; Schulte-Rüther et al., 2008; Schwenck et al., 2014; Van der Graaff et al., 2018). Despite its ubiquitous influence, gender identity accounted for less variation on the cognitive empathy subscale than for the affective empathy subscale and the composite empathy scale. Affective valence was also a significant predictor in empathy outcomes for all three levels of analyses, but it accounted for more variation in the cognitive empathy model than the other models. Finally, it seems that instrumental playing experience had a small amount of influence on affective empathy and composite empathy development, but as the post-hoc analysis showed, that influence may be partially attributed to age rather than instrumental playing experience. Instrumental playing experience and age demonstrated significant

correlations and explanatory overlap in the analytic models, making causal attributions from either factor unclear.

The results from analyses of preexisting characteristics showed that gender and instrumental playing experience were associated with dispositional empathy in different ways, depending on the response process being examined (cognitive or affective). The results also revealed the need to control for these characteristics when attempting to make causal conclusions about the effects of musical experiences on empathy development. Based on the data collected from this sample and analyzed for this study, musical experiences, either through experimental interventions or preexisting exposure, demonstrated no significant influences on empathy development or change. I will discuss implications from these findings in chapter six. In the next chapter, I will discuss analyses and findings for the research questions concerned with the relationships between group empathy levels and performance achievement in the improvising dyads and notated duets.

CHAPTER 5: EMPATHY AND PERFORMANCE ACHIEVEMENT

Empathy and Music Performance Relationships

The analysis in this chapter examined the relationships between the three empathic response domains measured on the BES (composite empathy, affective empathy, and cognitive empathy) and levels of performance achievement. In addition, the analysis examined whether changes in performance achievement associated with empathic response were different for the improvising dyad and notated duet conditions. I addressed three questions about the relationship between empathy and performance achievement:

1. Is there a relationship between co-performer empathy scores at pretest and performance scores at pretest and co-performer empathy scores at posttest and performance scores at posttest? Are these relationships influenced by performance modality (improvising dyads or notated duets)?
2. Is there a relationship between the empathy scores of co-performers at baseline (pretest) and changes in performance ratings between pre-and-posttest achievement scores? Are these changes affected by performance condition?
3. Is there a relationship between changes in empathy scores and changes in performance achievement from pre- to posttest? Are the relationships between these changes affected by performance condition?

Unlike the analyses in chapter 4, where I was interested in individual empathy variation in response to interactions during the musical interventions, I used the analyses in this chapter to

explore the relationship between ensemble performance achievement and co-performer empathy levels. Although pre-and-posttest performance achievement data from the Collaborative Improvisation Measure (CIM) and the Small Ensemble Adjudication Form (SEAF) were collected from ensemble dyads, measures of empathy (BES), affective valence (PANAS), and instrumental playing experience were collected at the individual level. To generate group level data from these measures, responses were aggregated by averaging the scores between ensemble members. In the next section, I provide descriptive statistics for ensemble performance achievement along with the independent variables of dispositional empathy, instrumental playing experience, and affective valence.

Descriptive Statistics

Outcome Variable: Performance Achievement

Performance achievement data for freely improvising dyads and notated duets were collected during pre-and-posttest administrations of the Collaborative Improvisation Measure (CIM) and the Small Ensemble Adjudication Form (SEAF). Pre-and-posttest performance tasks on the CIM and SEAF were audio recorded and sent to a panel of four expert raters in randomized orders using *Qualtrics XM* online surveys. Both assessment instruments generated a composite performance score based on six items using five-point Likert-type scales. The performance assessment from each judge had a potential range of 6 – 30 points. Performance achievement ratings were calculated by combining the scores from all four judges creating a potential achievement range of 24 – 120 points. Table 5.1 shows the performance achievement means at pre- and posttest for the full sample of dyads and each performance condition along with gains in performance achievement.

Table 5.1

Pre-and-Posttest Means of Performance Achievement and Gains

Ensemble (Measure)	Dyads (*n*)	Pretest *M* (*SD*)	Posttest *M* (*SD*)	Gains *M* (*SD*)
Freely Improvising Dyads (CIM)	32	67.53 (19.55)	76.31 (20.31)	8.79 (16.91)
Notated Duets (SEAF)	31	58.42 (16.99)	76.29 (21.49)	17.87 (12.49)
Full Sample of Ensemble Dyads	63	63.05 (18.76)	76.30 (20.73)	13.25 (15.47)

Note. The CIM and SEAF are scored using 5-point Likert-type scales on six items. Pre-and-posttest performances were rated by a panel of 4 judges. The scores from each judge were aggregated to generate total scores. The measure had a range of 24-120 points.

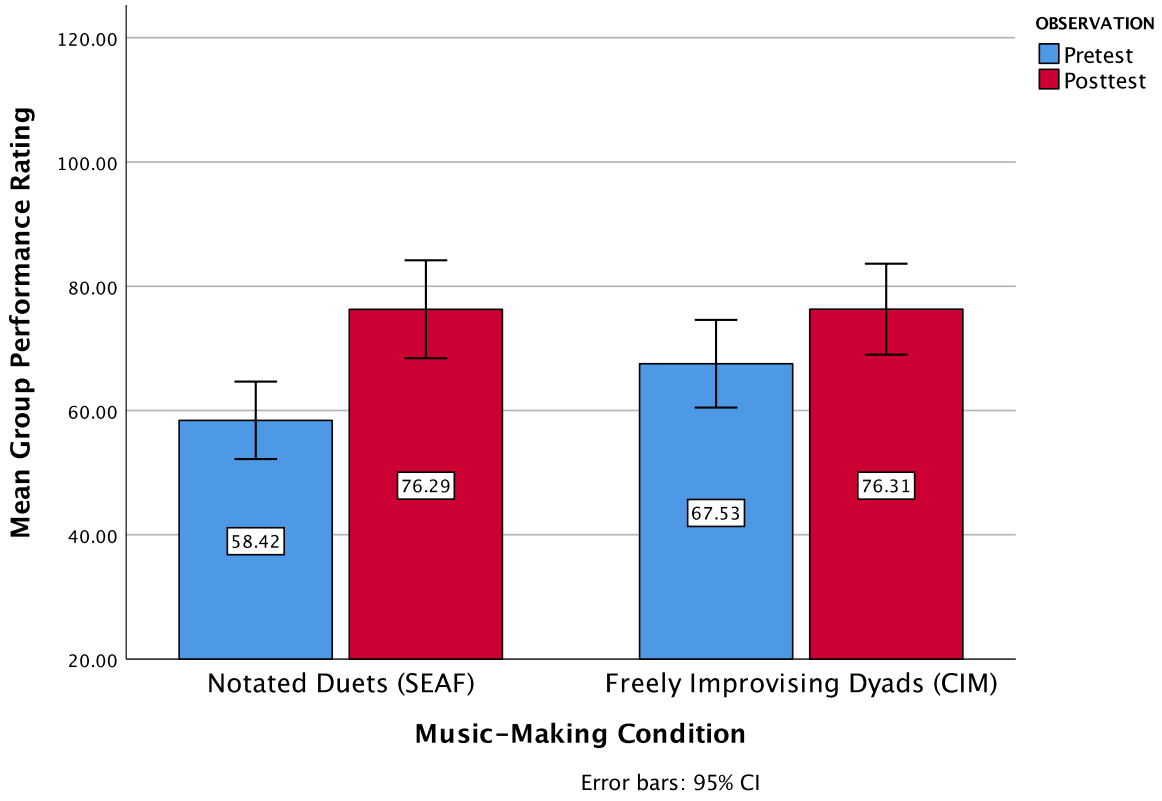
Figure 5.1 shows the differences in performance achievement means from pre- to posttest for both freely improvising dyads and the noted duets. A paired samples *t* test confirmed that scores on the posttest ($M = 76.31$) were significantly higher ($M = 8.79$) than the scores on the pretest ($M = 67.53$) for the freely improvising dyad condition, $t(31) = 2.94$, $p < .01$, with a moderate effect size ($d = .44$). The Shapiro-Wilk test of normality did not suggest a significant departure from normality for differences in pre-and-posttest observations, $W(32) = .113$, $p = .50$. This result supports the assumptions needed to validate significant differences in the paired samples analysis.

The gains ($M = 17.87$) from pretest ($M = 58.42$) to posttest ($M = 76.29$) on the SEAF for the notated duets were also statistically significant based on a paired samples *t* test, $t(30) = 7.97$, $p < .001$, $d = .92$. Once again, the Shapiro-Wilk test of normality did not show a significant

deviation from normality for the gain scores, W(31) = .975, p = .66, supporting the assumptions for a valid finding from the paired samples t test.

Figure 5.1

Mean Performance Ratings for Notated Duets (SEAF) and Freely Improvising Dyads (CIM)



Given that both freely improvising dyads and the notated duets demonstrated significant differences from pre- to posttest, I was interested in examining how much of that difference was associated with group empathy levels. In addition, I wanted to examine if the association between empathy and performance outcomes was shaped by performance condition. I used a series of ordinary least squares (OLS) regression analyses to determine how much composite, affective, and cognitive empathy predicted performance outcomes while controlling for previous

instrumental playing experience and affective associations with the musical interventions. Descriptive statistics for the regressor variables are provided in the next section.

Independent Variable: Group Empathy Levels

The relationship between group empathy and performance achievement, and the association of group empathy on changes in performance achievement were the primary interests of the analyses described in this chapter. Empathy data were collected from individual participants using the Basic Empathy Scale (Jolliffe & Farrington, 2006). Group empathy scores for ensemble dyads were generated by averaging co-performer empathy scores on the composite scale and on affective and cognitive empathy subscales. Table 5.2 shows pre-and-posttest group empathy levels along with group empathy change for each small ensemble performance condition and the full sample of ensemble dyads for the three empathic processing domains (composite, affective, cognitive).

Table 5.2

Group Empathy Means by Condition and Observation

		Improvising Dyads (n = 32)	Notated Duets (n = 31)	Full Sample of Dyads (n = 63)
BES Scale	Observation	*M (SD)*	*M (SD)*	*M (SD)*
Composite	Pretest	74.70 (6.07)	74.97 (5.05)	74.84 (5.55)
	Posttest	75.63 (5.66)	75.66 (4.72)	75.65 (5.18)
	Change	0.93 (5.50)	0.69 (4.07)	0.81 (4.81)
Affective	Pretest	38.04 (4.42)	38.33 (3.68)	38.19 (4.04)

(continued)

Table 5.2 (continued)

	Posttest	38.81 (4.24)	38.85 (3.29)	38.83 (3.78)
	Change	0.77 (3.71)	0.52 (2.65)	0.64 (3.21)
Cognitive	Pretest	36.66 (2.95)	36.63 (3.02)	36.65 (2.96)
	Posttest	36.83 (2.21)	36.81 (2.70)	36.82 (2.44)
	Change	0.16 (2.92)	0.17 (2.34)	0.17 (2.63)

Note. The BES was administered to individual participants at pre-and-posttest collection periods. The scale generates a composite score of dispositional empathy on subscales of affective (11 items) and cognitive (9 items) empathy using 5-point Likert-type scales. Group empathy levels were generated by averaging the empathy levels of co-performers.

Control Variables: Instrumental Playing Experience and Affective Valence

Although the questions in this chapter were focused on examining the association between empathy levels and performance achievement, I controlled for factors of instrumental playing experience and affective valence within regression models. Previous instrumental playing experience and affective valence toward the collaborative music-making experiences likely contributed to levels of performance achievement and any changes that may have occurred during the treatment period. Therefore, controlling for these factors was necessary to enhance the associative signal between the variation in performance achievement and variation in group empathy during OLS modeling.

Table 5.3 shows the average amount of instrumental playing experience and affective valence between co-performers in the freely improvising dyads and the notated duets. Group instrumental playing experience was the average instrumental playing experience between co-performers. Group affective valence was generated by averaging the differences in positive and

negative responses between co-performers on the Positive and Negative Affect Schedule (PANAS).

Table 5.3

Group Instrumental Playing Experience and Affective Valence

	Instrumental Playing Experience (yrs.)	Affective Valence
Condition	*M (SD)*	*M (SD)*
Improvising Dyads (*n* = 32)	6.42 (1.95)	15.97 (6.25)
Notated Duets (*n* = 31)	6.45 (1.91)	12.51 (6.79)
Full Sample of Dyads (*n* = 63)	6.44 (1.91)	14.27 (6.70)

Note. Affective valence is the difference between positive and negative responses on the PANAS. Positive and negative responses on the PANAS were aggregated by averaging the sum of ratings from each intervention over the 8-week treatment period. Group instrumental playing experience and affective valence were the average of individual responses between co-performers.

Pre-and-Posttest Performance Achievement and Group Empathy

Using the OLS models outlined at the end of chapter 3, I completed multiple levels of analysis to examine the relationship between group empathy and performance achievement. The first series of analyses examined the relationships between small ensemble performance achievement for the different music-making conditions and composite, affective, and cognitive empathy at pre- and posttest. The second series of analyses examined the relationships between the three domains of empathy and gains in performance achievement for the different music-making conditions. Finally, the third level of analysis examined the relationships between changes in performance achievement and changes in composite, affective, and cognitive

empathy throughout the treatment period and the association of those changes with the two performance modalities.

Pretest Empathy and Performance Achievement

The first question addressed in this section was the relationship between empathy and performance achievement at concurrent collection periods. I completed a series of OLS regressions to analyze this relationship for both the freely improvising dyads and notated duets. In addition, I examined whether the relationship between empathy and performance outcomes was associated with the different music-making experiences.

Composite Empathy and Pretest Performance Achievement

Table 5.4 shows the results from the model that regressed pretest performance achievement on performance condition and composite empathy levels while controlling for instrumental playing experience and affective valence. Although data related to affective valence were collected during the treatment period, the performance tasks on the pretest reflected the music-making conditions during the treatment periods. It was assumed, for the purposes of modeling responses to the pretest performance tasks in each condition, that affective valence during the musical interventions were congruent with affective associations to the performance tasks during pre-and-posttest administrations. The model F test was significant, $F(5, 57) = 5.47$, $p < .001$, while explaining a moderate amount of the variation in performance achievement (adjusted $R^2 = .27$).

Table 5.4

Regression of Pretest Performance Achievement on Composite Empathy

	b	*SE*	*β*	*t*	95% CI	*p*
Intercept***	46.48	4.92		9.45	[36.64, 56.33]	.000
Condition (1 = IMP, 0 = ND)	5.49	4.21	.147	1.30	[-2.94, 13.91]	.198
Pretest BES Composite**	1.68	0.62	.497	2.73	[0.45, 2.91]	.008
Condition*BES (Interaction)	-1.26	0.76	-.288	-1.66	[-2.79, 0.27]	.103
Instrumental Playing Experience	0.84	1.14	.086	0.73	[-1.44, 3.13]	.463
Affective Valence**	0.99	0.32	.353	3.12	[0.36, 1.62]	.003

Note. $F(5, 57) = 5.47$, $p < .001$; adjusted $R^2 = .27$
* $p < .05$ ** $p < .01$ *** $p < .001$

The model in table 5.4 shows that there were no significant differences in pretest performance achievement by condition ($p = .159$), but composite empathy was a significant ($p < .01$) predictor of pretest performance achievement. The results also show that on average, for every point increase in composite empathy level, pretest performance achievement increased by 1.68 points while holding all other factors constant.

A second interest in this analysis was to determine if composite empathy had different associations with performance outcomes for the two different performance conditions. The interaction between performance condition and composite empathy was not significant ($p = .103$), indicating there were no statistical differences in performance outcomes between the two conditions that were associated with composite empathy. Although only serving as control variables in the analysis, it appears that instrumental playing experience was not a significant predictor of pretest performance outcomes ($p = .463$) while affective valence was ($p < .001$). The next series of analyses examined the subscales of affective and cognitive empathy to determine if

these domains demonstrated different amounts of association with performance achievement and whether those associations were shaped by performance modality.

Affective Empathy and Pretest Performance Achievement

Table 5.5 shows the results from a model that regressed pretest performance achievement on performance condition and affective empathy while controlling for instrumental playing experience and affective valence. The model F statistic was significant, $F(5, 47) = 4.66$, $p < .01$, and the model explained a moderate amount of the variation in pretest performance achievement (adjusted $R^2 = .23$).

Table 5.5

Regression of Pretest Performance Achievement on Affective Empathy

	b	*SE*	*β*	*t*	95% CI	*p*
Intercept***	45.94	5.04		9.15	[35.86, 56.02]	.000
Condition (1 = IMP, 0 = ND)	5.47	4.31	.147	1.27	[-3.16, 14.10]	.209
Pretest BES Affective Subscale*	1.84	0.85	.397	2.17	[0.14, 3.55]	.035
Condition*Affective Interaction	-1.47	1.06	-.245	-1.39	[-3.60, 0.66]	.172
Instrumental Playing Experience	1.18	1.16	.121	1.02	[-1.15, 3.51]	.313
Affective Valence**	1.02	0.33	.365	3.15	[0.37, 1.67]	.003

Note. $F(5, 57) = 4.66$, $p < .01$; adjusted $R^2 = .23$
* $p < .05$ ** $p < .01$ *** $p < .001$

Much like the results from the composite model, when holding all other factors constant, the difference in pretest performance achievement between conditions was not significant ($p = .173$). Affective empathy was a significant predictor of performance achievement ($p < .05$) with groups, on average, demonstrating a 1.84-point increase in performance achievement for every

point increase in affective empathy for both performance conditions. The association of affective empathy with performance achievement was slightly higher than composite empathy.

The interaction between affective empathy and performance condition was not a significant predictor of performance achievement ($p = .172$). This result indicates that although affective empathy was positively associated with performance outcomes, it did not demonstrate a significantly different amount of association between the performance conditions.

Both instrumental playing experience and affective valence improved the explanatory power of the model, but they demonstrated differences in predictive significance. Instrumental playing experience was not a significant predictor of pretest performance achievement ($p = .313$). Affective valence was a significant predictor of performance achievement ($p < .01$) and was associated with a 1.08-point increase in performance outcomes for every point increase.

Of the significant predictors in the model, standardized beta weights show that affective empathy was the strongest predictor ($\beta = .397$) of pretest performance outcomes followed by affective valence ($\beta = .365$). Although condition assignment, the interaction of condition and affective empathy, and instrumental playing experience were not statistically significant predictors in the model, their inclusion improved the explanatory power of the model and enhanced the associated signal from the significant predictors.

Cognitive Empathy and Pretest Performance Achievement

Table 5.6 shows the regression of pretest performance achievement on performance condition and cognitive empathy while controlling for instrumental playing experience and affective valence. The model F test was significant, $F(2, 58) = 5.34$, $p < .01$, and the model explained a moderate amount of the variation in performance achievement ($R^2 = .22$).

Table 5.6

Regression of Pretest Performance Achievement on Cognitive Empathy

	b	*SE*	*β*	*t*	95% CI	*p*
Intercept***	46.21	5.08		9.09	[36.04, 56.38]	.000
Condition (1 = IMP, 0 = ND)	5.72	4.33	.154	1.32	[-2.94, 14.39]	.191
Pretest BES Cognitive Subscale	1.28	0.73	.202	1.77	[-0.17, 2.73]	.083
Instrumental Playing Experience	1.69	1.11	.172	1.52	[-0.54, 3.91]	.135
Affective Valence**	0.99	0.33	.352	3.00	[0.32, 1.64]	.004

Note. $F(4.\ 58) = 5.34$, $p < .01$; adjusted $R^2 = .22$
* $p < .05$ ** $p < .01$ $p < .001$

Similar to findings from the previous models, there were no significant differences in performance achievement between the music-making conditions ($p = .191$). Unlike the previous models, when controlling for instrumental playing experience and affective valence, cognitive empathy was not a significant predictor of pretest performance outcomes ($p = .083$). Given the lack of significance for the main effects of condition assignment and cognitive empathy, and the reduction in explanatory power by its inclusion, the interaction of these terms was not included in the model.

The control variables of instrumental playing experience and affective valence were included in the model to minimize omitted variable bias. When these variables were not included, cognitive empathy was a significant predictor of pretest performance achievement ($p < .05$), $F(2, 60) = 4.53$, $p < .05$, $R^2 = .102$. Cognitive empathy remained significant when instrumental playing experience was added; however, it was no longer significant when affective valence was added to the model. This result indicates that cognitive empathy and affective

valence shared some of the variance with performance outcomes. Not including affective valence in the model resulted in an overestimation for the predictive significance of cognitive empathy.

Findings from Pretest Analyses

Results from the preceding analyses indicate that empathy was a significant predictor of pretest performance achievement while controlling for factors of instrumental playing experience and affective valence. Composite and affective empathy predicted pretest performance outcomes with relatively strong standardized beta coefficients, but cognitive empathy was not a significant factor in explaining the variation in pretest performance outcomes when control variables were included. None of the models showed a significant interaction between empathy and condition assignment. This result indicates that although empathy in composite and affective processing domains was predictive of performance achievement, empathy did not demonstrate different associations with performance outcomes based on performance modality.

Posttest Empathy and Performance Achievement

Using similar OLS regression models as the preceding section, relationships between posttest empathy levels and posttest performance outcomes were examined while controlling for instrumental playing experience and affective valence. These relationships were examined for each empathic processing domain: composite empathy, affective empathy, and cognitive empathy. Each model included regressors for condition assignment, empathy level, and the interaction of condition and empathy to determine if different empathic domains were significant predictors of posttest performance achievement. The interaction between condition and empathy was not included in models when it was not a significant factor on performance outcomes and when it reduced the explanatory power of the model

Composite Empathy and Posttest Performance Achievement

Table 5.7 shows the model that regressed posttest performance achievement on performance condition and composite empathy levels while controlling for instrumental playing experience and affective valence. The model *F* test was significant, $F(5.\ 57) = 5.58$, $p < .001$, and explained a moderate amount of posttest performance achievement ($R^2 = .27$).

Table 5.7

Regression of Posttest Performance Achievement on Composite Empathy

	b	*SE*	*β*	*t*	95% CI	*p*
Intercept***	63.53	5.45		11.66	[52.62, 74.43]	.000
Condition (1 = IMP, 0 = ND)	-2.76	4.65	-.067	-0.59	[-12.06, 6.55]	.555
Posttest BES Composite	1.10	0.71	.274	1.55	[-0.32, 2.51]	.126
Condition*BES (Interaction)	-1.12	0.89	-.217	-1.26	[-2.91, 0.66]	.213
Instrumental Playing Experience***	4.47	1.21	.413	3.71	[2.06, 6.89]	.000
Affective Valence	0.98	0.36	.316	2.75	[0.27, 1.69]	.008

Note. $F(5, 57) = 5.58$, $p < .001$; adjusted $R^2 = .27$
* $p < .05$ ** $p < .01$ *** $p < .001$

Unlike pretest regression results, which showed a positive relationship between performance outcomes and empathy levels, results from the posttest analysis indicate that composite empathy was not a significant predictor of performance outcomes ($p = .126$). Similar to pretest findings, there were no significant differences between performance conditions ($p = .555$). Despite the lack of significance for the main effects of performance condition and posttest empathy levels, I included the nonsignificant interaction of these factors ($p = .213$) because it improved the explanatory power of the model.

While holding all other factors constant, instrumental playing experience ($p < .001$) and affective valence ($p < .01$) were both significant predictors of posttest performance outcomes. This result diverges from the pretest model where instrumental playing experience was not a significant predictor of performance outcomes. In the posttest model, instrumental playing experience was not only a significant predictor, but it was also the strongest predictor of performance outcomes ($\beta = .413$). The model indicates that for every year increase in instrumental playing experience, posttest performance outcomes increased by an average of 4.47 points. Affective valence continued to be a significant predictor of performance achievement, with every point increase in positive valence being associated with a 0.99-point increase in performance outcomes.

The most striking differences between pre-and-posttest composite empathy models were the predictive significance of empathy and instrumental playing experience. Composite empathy was a significant predictor of performance achievement at pretest but was not at posttest. Conversely, instrumental playing experience was not a significant predictor at pretest but was a significant predictor of performance outcomes at posttest. The next section examined whether there were similar associations between posttest performance outcomes and affective and cognitive empathy domains.

Affective Empathy and Posttest Performance Achievement

Table 5.8 shows the model that regressed posttest performance achievement on posttest affective empathy and condition while controlling for instrumental playing experience and affective valence. The F statistic for the model was significant, $F(5,57) = 5.58$, $p < .001$, and accounted for a moderate amount of the variance in performance achievement (adjusted R^2 =

.281). The model in table 5.8 shows that condition assignment (p = .459), affective empathy (p = .072), and the interaction of condition and affective empathy (p = .147) were nonsignificant factors in explaining the variation of performance outcomes. Instrumental playing experience (p < .001) and affective valence (p < .01) were both significant predictors of performance outcomes. Instrumental playing experience was the strongest predictor of posttest performance variation (β = .411). The relationship between affective empathy and posttest performance outcomes aligned with the composite empathy model.

Table 5.8

Regression of Posttest Performance Achievement on Affective Empathy

	b	*SE*	*β*	*t*	95% CI	*p*
Intercept***	63.06	5.36		11.76	[52.33, 73.80]	.000
Condition (1 = IMP, 0 = ND)	-3.42	4.59	-.083	-0.75	[-12.61, 5.77]	.459
Posttest BES Affective Subscale	1.82	0.99	.331	1.83	[-0.17, 3.80]	.072
Condition*Affective (Interaction)	-1.81	1.23	-.262	-1.47	[-4.28, -0.66]	.147
Instrumental Playing Experience***	4.45	1.19	.411	3.73	[2.06, 6.84]	.000
Affective Valence**	1.05	0.35	.339	3.03	[0.36, 1.74]	.004

Note. $F(5, 57) = 5.58$, $p < .001$; adjusted $R^2 = .28$
* $p < .05$ ** $p < .01$ *** $p < .001$

Cognitive Empathy and Posttest Performance Achievement

Table 5.9 shows the model that regressed posttest performance achievement on posttest cognitive empathy levels and condition assignment while controlling for instrumental playing experience and affective valence. The interaction of condition and affective valence was dropped from the model because it was a nonsignificant factor and also reduced the explanatory power of

the model. The *F* statistic for the model was significant, $F(4, 58) = 6.230$, $p < .001$, with an adjusted R^2 of .252. Following the pattern from posttest regressions of composite and affective empathy, condition assignment ($p = .480$) and cognitive empathy ($p = .812$) were not significant predictors of posttest performance outcomes.

Table 5.9

Regression of Posttest Performance Achievement on Cognitive Empathy

	b	*SE*	*β*	*t*	95% CI	*p*
Intercept***	63.57	5.70		11.15	[52.16, 74.98]	.000
Condition (1 = IMP, 0 = ND)	-3.34	4.70	-.081	-0.71	[-12.74, 6.07]	.480
Posttest BES Cognitive Subscale	0.24	1.00	.028	0.24	[-1.76, 2.24]	.812
Instrumental Playing Experience***	4.82	1.20	.446	4.03	[2.43, 7.22]	.000
Affective Valence**	1.01	0.38	.327	2.70	[0.26, 1.76]	.009

Note. $F(4, 58) = 6.23$, $p < .001$; adjusted $R^2 = .25$
* $p < .05$ ** $p < .01$ *** $p < .001$

Instrumental playing experience ($p < .001$) and affective valence ($p < .01$) were significant predictors of performance achievement. Cognitive empathy was not a predictor of performance achievement on either pre- or posttest outcomes. Instrumental playing experience (β = .411) continued to be the strongest predictor of performance achievement when focusing on posttest performance outcomes.

Findings from Posttest Analyses

In a rather surprising reversal of associations from pre- to posttest, it appears that empathy was not a significant predictor of posttest performance outcomes. This trend was consistent across cognitive, affective, and composite empathy domains. When only factors of

condition assignment and empathy were included in the models, the models lacked explanatory significance. The models attained explanatory significance when affective valence and instrumental playing experience were included as regressors. Instrumental playing experience was the strongest predictor of performance outcomes across all posttest models. These findings demonstrate a contrast to the positive association between performance achievement and empathy found in pretest models.

Summary of Pre-and-Posttest Empathy and Performance Achievement

This first section of analysis examined the relationship between empathy and performance outcomes at pre- and posttest. In addition, I examined whether this relationship was influenced by performance modality (improvising dyads or notated duets) and how different empathic processing domains (composite, affective, cognitive) may have exhibited different associations.

One of the striking differences from pre-to-posttest models was the reversal of significant associations to performance outcomes. In pretest models, empathy was a significant predictor of performance achievement when using composite and affective empathy as regressors. The association of empathy with performance variation for posttest outcomes was not significant regardless of the empathy domain. Interestingly, instrumental playing experience was not significantly related to performance achievement at pretest but was the strongest predictor of performance achievement at posttest.

Although composite and affective empathy were significant predictors of performance outcomes in pretest models, neither condition assignment nor the interaction of empathy and condition demonstrated statistically significant associations with performance achievement.

These findings indicate that there were no statistical differences in performance outcomes between performance conditions as a result of co-performer empathy.

Affective valence was a relatively stable and strong predictor of performance achievement across pre-and-posttest administrations while holding all other variables constant. Although affective valence was not the primary interest of this study, it served as an important control variable for the models because its lack of inclusion inflated the differences in performance outcomes between the music-making conditions. When affective valence was not included in the pretest models, there was a small but significant difference in the performance outcomes between the notated duets and the improvising dyads. Affective valence improved the explanatory power of the models and demonstrated that differences in performance outcomes between the notated duets and improvising dyads were associated with affective responses to the music-making experiences rather than the interactions through which the music was made.

The results from this first section of analysis show that empathy was significantly associated with pretest performance outcomes. The association between empathy and performance outcomes was only significant when performance outcomes were regressed on composite and affective processing domains. None of the empathy domains demonstrated significant relationships with posttest performance outcomes. The notated duets and the improvising dyads did not demonstrate statistical differences in performance outcomes at either pre- or posttest. The relationship between empathy and performance outcomes was not statistically different for the two performance modalities.

Group Empathy and Performance Change

The second question addressed in this chapter of analysis was concerned with the relationship between performance gains and baseline (pretest) co-performer empathy and how that relationship was shaped by performance condition. I regressed performance gains on the three empathic processing domains and performance condition while controlling for instrumental playing experience and affective valence.

Composite Empathy and Performance Change

Table 5.10 shows the results of performance gains regressed on composite empathy. The model includes the interaction of empathy and condition to determine if empathy had a significantly different association with performance gains based on performance modality. In addition to examining the main effects of composite empathy and performance condition, the model controls for factors of instrumental playing experience and affective valence. The *F* test for the model was significant and explained a moderate amount of the variance of performance change (adjusted $R^2 = .19$).

Table 5.10

Regression of Performance Change on Composite Empathy

	b	*SE*	*β*	*t*	95% CI	*p*
Intercept***	17.65	4.24		4.16	[9.16, 26.13]	.000
Condition (1 = IMP, 0 = ND)*	-9.21	3.63	-.300	-2.54	[-16.49, -1.94]	.014
Pretest BES Composite	-0.50	0.53	-.180	-0.94	[-1.57, 0.56]	.349
Condition * BES (Interaction)	-0.16	0.66	-.043	-0.24	[-1.47, 1.16]	.815
Instrumental Playing Experience (yrs)**	3.40	0.99	.421	3.45	[1.43, 5.38]	.001

(continued)

Table 5.10 (continued)

Affective Valence	0.02	0.27	.009	0.07	[-0.53, 0.57]	.942

Note. $F(5, 57) = 3.94$, $p < .01$; adjusted $R^2 = .19$
* $p < .05$ ** $p < .01$ *** $p < .001$

Composite empathy was not a significant predictor of performance change ($p = .349$) nor was the interaction between empathy and condition ($p = .815$). While holding all other factors constant, the different music-making conditions demonstrated statistically significant differences in performance gains ($p < .05$). The notated duets, on average, increased their performance scores from pre- to posttest by 9.21 points more than the improvising dyads. While the two different music-making conditions demonstrated differences in performance gains, the variation in these differences was not associated with composite empathy.

Instrumental playing experience was a significant predictor of performance change ($p < .001$) with every year of experience being associated with an increase in performance gains by an average of 3.40 points. Interestingly, although affective valence was a significant predictor of performance outcomes for both pre-and-posttest models in the previous section, affective valence was not a significant predictor of performance change from pre- to posttest ($p = .942$). The principle finding from this analysis was that there were significant differences in performance gains from pre- to posttest within and between the music-making conditions; however, composite empathy did not demonstrate any statistically significant associations with this change.

Affective Empathy and Performance Change

Table 5.11 shows the results for the model of performance gains regressed on pretest affective empathy. Stepwise modeling showed that including the interaction of performance condition and affective empathy reduced the explanatory power of the model. Since the interaction term and affective valence were not statistically significant, they were dropped from the model. Instrumental playing experience was retained as a control variable because of its predictive significance and contributions to the explanatory power of the model. The model was significant, $F(3, 59) = 5.71$, $p < .01$, and explained a moderate amount of the variance of performance change (adjusted $R^2 = .19$).

Table 5.11

Regression of Performance Change on Affective Empathy

	b	*SE*	*β*	*t*	95% CI	*p*
Intercept***	17.89	2.51		7.13	[12.87, 22.92]	.000
Condition (1 = IMP, 0 = ND)*	-9.12	3.52	-.297	-2.59	[-16.16, -2.07]	.012
Pretest BES Affective Subscale	-0.41	0.47	-.106	-0.87	[-1.34, 0.53]	.288
Instrumental Playing Experience (yrs)**	3.17	0.98	.392	3.22	[1.20, 5.14]	.002

Note. $F(3, 59) = 5.71$, $p < .01$; adjusted $R^2 = .19$
* $p < .05$ ** $p < .01$ *** $p < .001$

Much like the model that regressed performance change on composite empathy, the different performance conditions (notated duets and improvising dyads) in this model demonstrated significant differences in performance change ($p < .05$), with the notated duets demonstrating more gains than the improvising dyads by 9.12 points while holding all other variables constant. Affective empathy was not a significant predictor of performance gains ($p =$

.288) and the interaction of affective empathy and performance condition was dropped from the model. Instrumental playing experience continued to be a significant predictor of performance change ($p < .01$), with every year of group instrumental playing experience, on average, being associated with an increase in performance gains by 3.17 points.

Cognitive Empathy and Performance Change

Table 5.12 shows the regression of performance change on pretest cognitive empathy and performance condition. The interaction of condition assignment and cognitive empathy was dropped from the model because it was not a significant factor and reduced the explanatory power of the model. Affective valence was also excluded. Instrumental playing experience was included because of its predictive significance. The model F test was significant, $F(3, 59) = 7.28$, $p < .01$, and the model explained a moderate amount of the variance in performance gains (adjusted $R^2 = .23$).

Table 5.12

Regression of Performance Change on Cognitive Empathy

	b	*SE*	*β*	*t*	95% CI	*p*
Intercept***	17.81	2.43		7.32	[12.94, 22.68]	.000
Condition (1 = IMP, 0 = ND)**	-8.96	3.42	-.292	-2.62	[-15.79, -2.12]	.011
Pretest BES Cognitive Subscale*	-1.25	0.59	-.237	-2.11	[-2.42, -0.06]	.039
Instrumental Playing Experience (yrs)**	3.16	0.91	.390	3.48	[1.34, 4.97]	.001

Note. $F(3, 59) = 7.28$, $p < .01$; adjusted $R^2 = .23$
* $p < .05$ ** $p < .01$ *** $p < .001$

Condition assignment was a significant predictor of performance change ($p < .05$), with the notated duets generating an average of 8.96 points more in performance gains than the

improvising dyads while holding all other factors constant. Interestingly, cognitive empathy had a significant negative relationship ($p < .05$) with performance change. Every point increase in cognitive empathy was associated with an average of a 1.25-point reduction in performance gains. Instrumental playing experience continued to be a significant predictor of performance change ($p < .01$), with every year of instrumental playing experience increasing performance change by an average of 3.16 points.

Summary of Group Empathy and Performance Change

The models that regressed performance change on baseline empathy in the three processing domains (composite, affective, cognitive) indicate that empathy did not have a positive association with performance change. Cognitive empathy showed a subtle negative relationship with performance change. The lack of performance gains associated with co-performer empathy may be an artifact of high-performance achievement during pretesting for ensembles with higher empathy levels. This enhanced performance achievement at pretest may have reduced the possibility of performance gains and minimized the variation in change for co-performers with higher levels of empathy.

The performance conditions demonstrated different amounts of performance change, with the notated duets generating more gains than the improvising dyads. The lack of significant interaction between empathy and performance condition showed that empathy was not associated with the different performance outcomes between the performance modalities. Instrumental playing experience was the strongest predictor of performance change in all three models. Although affective valence was a strong predictor of pre-and-posttest performance outcomes, it was not a significant factor associated with performance change. Much like the

findings for empathy associations, this might indicate that performance achievement was quite high at both pre-and-posttest collection periods for those with positive associations to the musical experiences, thereby reducing the possibility of gains for co-performers with these characteristics. Most of the performance gains were associated with other factors such as previous instrumental playing experience.

Pre-and-Posttest Empathy and Performance Relationships

The analysis in this section attended to the third question which was concerned with the relationship between changes in group empathy and changes in performance achievement. To make pre-and-posttest comparisons between group empathy levels and performance outcomes, the data were configured into long format using two observations (pre and posttest). I analyzed the data using a DID regression model with performance ratings operating as the outcome variable. Group empathy, observation level, and condition assignment were the main effects in the model. The interactions of the main effects along with the control variables of instrumental playing experience and affective valence were included as regressors in the model. Once again, three models of analysis were completed for composite, affective, and cognitive empathy to isolate the impact of these domains on performance outcomes.

Performance Outcomes and Composite Empathy

The model in table 5.13 regressed performance outcomes on composite empathy at pre-and-posttest for both performance conditions. The main effects of observation, performance condition, co-performer empathy, and the interactions of these factors served as the predictors of interest to examine the association between changes in empathy and changes in performance

outcomes. The F test for the model was significant, $F(9, 116) = 7.58$, $p < .001$, and explained a moderate amount of performance variation (adjusted $R^2 = .32$).

Table 5.13

Regression of Performance Achievement on Composite Empathy at Pre-and-Posttest

	b	*SE*	*β*	*t*	95% CI	*p*
Intercept***	46.46	4.31		10.77	[37.92, 55.01]	.000
Condition (1 = IMP, 0 = ND)	5.59	4.41	.135	1.27	[-3.14, 14.31]	.207
Observation (1 = POST, 0 = PRE)***	16.96	4.36	.410	3.89	[8.32, 25.59]	.000
Cond*Observ (Interaction)	-8.34	6.12	-.175	-1.36	[-20.46, 3.78]	.176
BES Composite*	1.35	0.64	.349	2.12	[0.09, 2.62]	.036
Cond*BES (Interaction)	-1.06	0.81	-.212	-1.32	[-2.66, 0.54]	.190
Observ*BES Comp (Interaction)	-0.05	0.91	-.009	-0.06	[-1.85, 1.75]	.954
Cond*Observ*BES Comp (Interaction)	-0.21	1.17	-.029	-0.18	[-2.54, 2.12]	.856
Instrumental Playing Experience**	2.73	0.84	.251	3.25	[1.07, 4.40]	.002
Affective Valence***	0.98	0.24	.315	4.08	[0.51, 1.46]	.000

Note. $F(9, 116) = 7.58$, $p < .001$; adjusted $R^2 = .32$
* $p < .05$ ** $p < .01$ *** $p < .001$

Observation ($p < .001$) and composite empathy ($p < .05$) were significant predictors of performance outcomes. While holding all other factors constant, performance scores increased by an average of 16.96 points from pre- to posttest and the overall performance scores for pre-and-posttest observations were, on average, 1.35 points higher for every point increase in composite empathy scores. The interaction of empathy and observation was not significant ($p = .954$), indicating that changes in empathy were not associated with changes in performance outcomes form pre- to posttest.

While controlling for all other factors, the main effect of performance condition did not have a significant influence on performance outcomes ($p = .207$), indicating no statistically significant differences between improvising dyads and notated duets. The interaction of condition and observation was not significantly associated with performance achievement ($p = .176$), indicating that while holding all other factors constant, the differences in performance change from pre- to posttest between improvising dyads and notated duets was not statistically different. The interaction between observation, condition, and composite empathy was also not significant ($p = .856$). These results show that while there were significant differences between pre-and-posttest performance observations and that empathy was a significant predictor of performance outcomes, there were no statistically significant differences in performance change between performance conditions associated with empathy and empathy was not associated with performance gains.

Instrumental playing experience ($p = .01$) and affective valence ($p < .001$) were significant predictors of performance outcomes. It appears that for every year of instrumental playing experience, performance achievement across both pre-and-posttest performance observations increased by an average of 2.73 points. For every point increase in positive valence, performance outcomes increased by an average of 0.98 points. Standardized beta weights show that composite empathy ($\beta = .349$), affective valence ($\beta = .315$), and instrumental playing experience ($\beta = .251$) were among the strongest predictors of performance outcomes. These results reflect findings in the previous analyses that showed empathy was a predictor of pretest performance outcomes, but it was not a predictor of performance change and there was no

evidence that empathy demonstrated different levels of association with performance outcomes between the improvising dyads and notated duets.

Performance Outcomes and Affective Empathy

Table 5.14 shows the results for the model that regressed performance outcomes on affective empathy levels at pre- and posttest for both performance conditions. The main effects of observation, performance condition, affective empathy, and the interactions of these factors served as the main predictors of interest to examine the relationship between changes in affective empathy and changes in performance outcomes. Instrumental playing experience and affective valence were included as control variables in the model. The *F* test for the model was significant, $F(9, 116) = 7.45$, $p < .001$, and explained a moderate amount of pre-and-posttest performance variation (adjusted $R^2 = .32$).

Table 5.14

Regression of Performance Achievement on Affective Empathy at Pre-and-Posttest

	b	*SE*	*β*	*t*	95% CI	*p*
Intercept***	45.69	4.31		10.61	[37.16, 54.21]	.000
Condition (1 = IMP, 0 = ND)	5.43	4.42	.131	1.23	[-3.32, 14.18]	.221
Observation (1 = POST, 0 = PRE)***	16.90	4.38	.408	3.86	[8.23, 25.57]	.000
Cond*Observ (Interaction)	-8.22	6.14	-.173	-1.34	[-20.38, 3.95]	.184
BES Affective Empathy	1.50	0.87	.283	1.73	[-0.22, 3.22]	.086
Cond*BES Aff (Interaction)	-1.35	1.10	-.199	-1.22	[-3.54, 0.84]	.223
Observ*BES Aff (Interaction)	0.56	1.28	.071	0.44	[-1.97, 3.09]	.664
Cond*Observ*BES Aff (Interaction)	-0.61	1.63	-.062	-0.37	[-3.84, 2.62]	.710
Instrumental Playing Experience**	2.88	0.84	.264	3.43	[1.22, 4.55]	.001

(continued)

Table 5.14 (continued)

Affective Valence***	1.04	0.24	.333	4.33	[0.56, 1.51]	.000

Note. $F(9, 116) = 7.45$, $p < .001$; adjusted $R^2 = .32$
* $p < .05$ ** $p < .01$ *** $p < .001$

Of the primary factors of interest—condition, observation, affective empathy—and their interactions, only observation was a significant predictor of performance outcomes ($p < .001$), with the ensembles demonstrating an average of 16.90 points of performance gains from pre- to posttest while holding all other factors constant. Condition assignment ($p = .221$) and pre-and-posttest affective empathy ($p = .086$) were not statistically significant predictors of performance outcomes. The lack of interaction between affective empathy and observation ($p = .664$), affective empathy and condition ($p = 223$), and affective empathy, condition, and observation ($p = .710$) showed that affective empathy lacked a statistically significant association with performance change and that there was no statistical difference between performance conditions.

Instrumental playing experience ($p < .01$) and affective valence ($p < .001$) remained significant predictors of performance outcomes in this model. Every year of instrumental playing experience was associated with an average increase in performance outcomes by 2.88 points and every point increase in positive valance was associated with an increase in performance scores by 1.04 points. The most notable difference between this model, which isolated affective empathy, from the previous model, which used composite empathy as the regressor, was the lack of a significant association between affective empathy and performance outcomes while holding all other factors constant.

Performance Outcomes and Cognitive Empathy

The results from the regression of performance outcomes on cognitive empathy from both pre-and-posttest collection periods is shown in table 5.15. The model included regressors for observation level, performance condition, and the interaction of these factors with cognitive empathy. Instrumental playing experience and affective valence were included as control variables. The *F* test for the model was significant, $F(9, 116) = 6.69$, $p < .001$, and explained about 29 percent of the variance in performance outcomes (adjusted $R^2 = .29$).

Table 5.15

Regression of Performance Achievement on Cognitive Empathy at Pre-and-Posttest

	b	*SE*	*β*	*t*	95% CI	*p*
Intercept***	45.93	4.46		10.30	[37.09, 54.76]	.000
Condition (1 = IMP, 0 = ND)	5.65	4.50	.136	1.26	[-3.26, 14.56]	.212
Observation (1 = POST, 0 = PRE)***	17.67	4.45	.427	3.97	[8.86, 26.48]	.000
Cond*Observ (Interaction)	-8.92	6.24	-.188	-1.43	[-21.29, 3.44]	.155
BES Cognitive Empathy	1.40	1.07	.183	1.31	[-0.72, 3.53]	.193
Cond*BES Cog (Interaction)	-0.54	1.51	-.048	-0.36	[-3.54, 2.46]	.721
Observ*BES Cog (Interaction)	-0.60	1.60	-.050	-0.38	[-3.76, 2.57]	.709
Cond*Observ*BES Cog (Interaction)	-0.54	2.38	-.028	-0.23	[-5.26, 4.19]	.822
Instrumental Playing Experience***	3.20	0.83	.294	3.84	[1.55, 4.86]	.000
Affective Valence***	1.01	0.25	.323	3.99	[0.51, 1.51]	.000

Note. $F(9, 116) = 6.69$, $p < .001$; adjusted $R^2 = .29$
* $p < .05$ ** $p < .01$ *** $p < .001$

Similar to findings from the affective empathy model, the only significant factor of interest was observation ($p < .001$), with ensembles in all conditions demonstrating an average

17.67-point increase in performance outcomes from pre- to posttest while holding all other factors constant. Condition assignment (p = .212) and cognitive empathy (p = .193) were not significant predictors of performance outcomes. The lack of statistically significant interactions between cognitive empathy and observation (p = .709), cognitive empathy and condition (p = .721), and cognitive empathy, condition, and observation (p = .822) showed that changes in cognitive empathy did not have a significant association with the variation in performance outcomes from pre- to posttest nor were there significant differences between performance conditions.

Instrumental playing experience (p < .001) and affective valence (p < .001) continued to be significant predictors of performance outcomes. When isolating cognitive empathy as the predictor of performance outcomes, every year of instrumental playing experience contributed to an average 3.20-point increase in performance scores and affective valence contributed to an average 1.01-point increase in performance scores. Although empathy was not a significant predictor of performance outcomes, observation level (β = .427), affective valence (β = .323), and instrumental playing experience (β = .294) were the most significant predictors of performance variation in the cognitive empathy model.

Summary of Pre-and-Posttest Performance and Empathy Relationships

The analysis in this section addressed the question about the relationships between performance and empathy change from pre-to-posttest observations. Composite empathy, affective empathy, and cognitive empathy were utilized as regressors to determine if there were any differences in the association between the three empathic processing domains and performance variation. Findings showed that a combination of affective and cognitive response

as measured on the composite empathy scale was a significant predictor of performance outcomes for both pre-and-posttest observations (see table 5.13). However, when affective and cognitive subscales were isolated in the model, empathy was no longer a significant predictor of performance outcomes (see tables 5.14 and 5.15).

Observation was a significant predictor in all three models with performance scores at posttest being significantly higher than performance scores on the pretest for both performance conditions. Condition and the interaction between condition and observation were not significant factors indicating that the performance outcomes for the improvising dyads and the notated duets were not statistically different at pre-and-posttest observations. The interactions between empathy and observation were not significant in any of the models indicating that although there was a significant difference in pre-and-posttest performance outcomes, empathy was not significantly associated with this variation for any of the three empathy domains. The three-way interaction of condition, observation, and empathy was not significant in any of the models. Although empathy was a predictor of performance outcomes across both observations, empathy change was not a significant predictor of changes in performance from pre- to posttest.

Instrumental playing experience and affective valence were utilized as control variables to minimize omitted variable bias resulting from the shared association of these variables with empathy and performance outcomes. Instrumental playing experience and affective valence consistently demonstrated positive associations with performance achievement. Composite empathy, instrumental playing experience, and affective valence were positive predictors of performance outcomes with increases in each factor being associated with increases in performance outcomes while holding all other factors in the models constant.

Empathy Pairs

One of the drawbacks to the models used in the previous analyses was the loss of signal from different combinations of empathy pairs. Empathy levels were treated as a single continuous variable for each ensemble dyad by averaging empathy responses on the Basic Empathy Scale between co-performers. This could have resulted in two performers in an ensemble with midrange empathy levels generating a similar group empathy score as co-performers with high and low empathy levels. Although the averages of empathy scores for these different co-performer pairs may have produced a similar continuous variable, their musical interactions based on performer empathy differences may have had a different association with performance outcomes.

To regain signal from different combinations of co-performer empathy pairs, I used gender weighted medians from pretest empathy scores on the BES to categorize participants as having dispositions of high or low empathy. Female identifying particpants (*Mdn* = 76) and male identifying participants (*Mdn* = 71) were categorized with high and low levels of empathy based on whether they fell above or below median within their gender category. Table 5.16 shows the distribution of participants categorized as high and low empathy by gender identity.

Table 5.16

Participants Categorized with High and Low Empathy by Gender

Gender ID	High Empathy (*n*)	Low Empathy (*n*)	Total (*n*)
Female	47	41	88
Male	21	17	38
Full Sample	68	58	126

Note. Participants were categorized with high and low empathy if they responded above or below the median at pretest on the BES (F.I.P., *Mdn* = 76; M.I.P., *Mdn* = 71).

Based on participant categorizations, ensemble pairs were categorized as being High-High, High-Low, and Low-Low empathy pairs. Table 5.17 shows the distribution of the three different combinations of ensemble pairs by performance condition.

Table 5.17

Ensemble Empathy Pairs by Performance Condition

Condition	High-High (*n*)	High-Low (*n*)	Low-Low (*n*)	Total (*n*)
Improvising Dyads	10	16	6	32
Notated Duets	8	16	7	31
Full Sample	18	32	13	63

Note. Empathy pairs were categorized as High-High, High-Low, and Low-Low empathy pairs based on co-performer categorizations (i.e., High-Low empathy pairs included one participant categorized as High empathy and one participant categorized as Low empathy based on median empathy scores from the BES).

Table 5.18 shows the means of performance ratings for the improving dyads and notated duets at pre-and-posttest as well as the mean of performance gains for each category of empathy pairs and the full sample.

Table 5.18

Mean Performance Achievement and Gains for Empathy Pairs

Empathy Pairs	Dyads (*n*)	Pretest *M* (*SD*)	Posttest *M* (*SD*)	Gains *M* (*SD*)
High-High Empathy	18	71.56 (19.40)	80.06 (19.92)	8.50 (17.82)
High-Low Empathy	32	56.32 (16.54)	78.91 (19.62)	16.63 (13.76)
Low-Low Empathy	13	53.15 (19.02)	64.69 (21.86)	11.54 (15.19)
Full Sample	63	63.05 (18.76)	76.30 (20.73)	13.25 (15.47)

Note. Performance ratings for the CIM and SEAF were scored using 5-point Likert-type scales on six items. Performance scores were the aggregate of ratings by a panel of 4 judges.

Analyses of variance (ANOVAs) were used to examine whether there were significant differences in performance achievement between different empathy pairs (High-High, High-Low, and Low-Low) and performance conditions (Improvising Dyads, Notated Duets) and to determine if there were any significant interactions between performance condition and empathy pairing. The following questions guided this section of analysis:

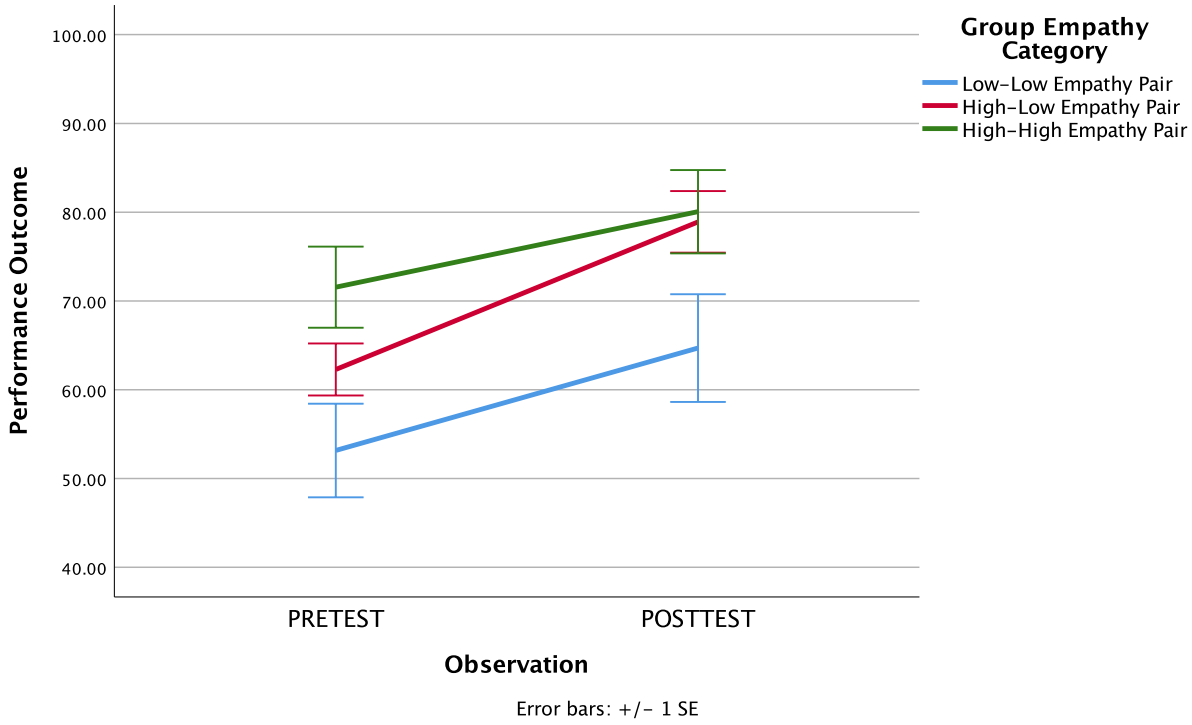
1. Are there differences in performance achievement between High-High, High-Low, and Low-Low empathy pairs at pre- and posttest? Do different performance conditions shape the associations between empathy pairings and performance outcomes?

2. Do different empathy pairs demonstrate different levels of change in performance achievement from pre- to posttest? Are rates of change associated with performance condition?

Figure 5.2 shows pre-to-posttest performance achievement associated with the three empathy pair categories. The figure shows that all empathy pairs demonstrated growth in performance outcomes from pre- to posttest. The figure also suggests that different empathy pairs demonstrated different levels of performance achievement and gains. This section of analysis examines whether these relationships and interactions were significant.

Figure 5.2

Performance Achievement at Pre-and-Posttest for Empathy Pairs

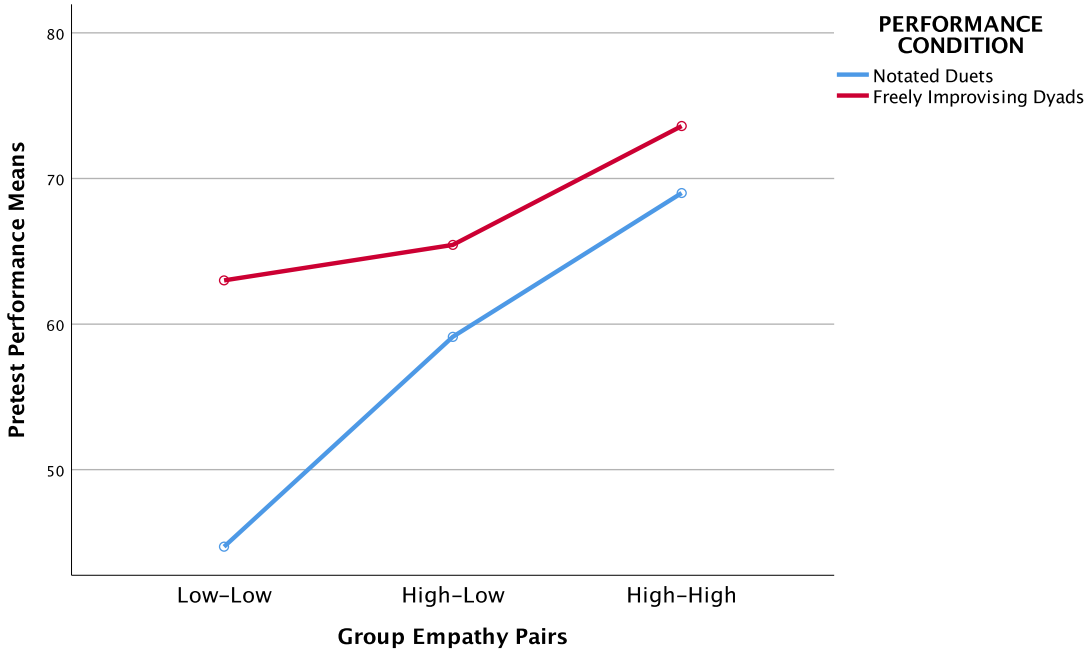


Empathy Pairs and Performance Achievement

Figure 5.3 shows the relationships of pretest performance outcomes between empathy pairs and performance conditions. A 3x2 ANOVA with empathy pairs (Low-Low, High-Low, High-High) and performance condition (Improvising Dyads, Notated Duets) as between-subjects factors were used in the analysis. The main effects of empathy pair categorization, $F(2, 57) = 3.73$, $p < .05$, $\eta_p^2 = .116$, and performance condition, $F(1, 57) = 4.16$, $p < .05$, $\eta_p^2 = .068$, were both significant factors of pretest performance outcomes. However, the interaction between empathy pairing and performance condition was not significant, $F(2, 57) = 0.67$, $p = .517$, $\eta_p^2 = .068$. This lack of interaction indicates that although there were significant differences in pretest performance outcomes between empathy pairs and performance conditions, neither factor demonstrated a significant association with the other.

Figure 5.3

Pretest Performance Achievement and Empathy Pairs

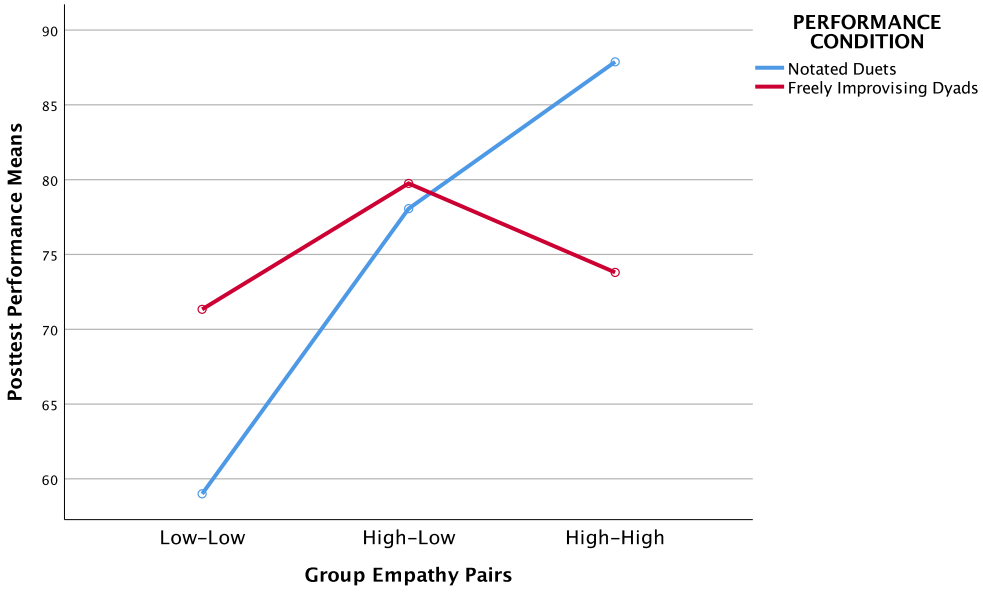


Post-hoc pairwise comparisons showed that, on average, the freely improvising dyads (M = 67.53, SD = 19.55) demonstrated higher levels of performance achievement than the notated duets (M = 57.61, SD = 16.99) during the pretest performance task ($p < .05$, $d = .466$). Tukey HSD post-hoc pairwise comparisons showed that High-High (M = 71.56, SD = 19.40) and Low-Low (M = 53.15, SD = 19.02) empathy pairs were significantly different ($p < .05$) with High-High empathy pairs demonstrating higher levels of performance achievement than Low-Low empathy pairs ($d = .958$). There were no significant differences in pretest performance outcomes between Low-Low and High-Low empathy pairs ($p = .275$) or between High-Low and High-High empathy pairs ($p = .192$).

Figure 5.4 shows the relationships of posttest performance means between the empathy pairs and performance conditions. Using posttest performance achievement as the outcome variable, a 3x2 ANOVA with empathy pairs (High-High, High-Low, Low-Low) and performance condition (Improvising Dyads, Notated Duets) as the between-subjects factors was used in the analysis. The results showed that the main effects of performance condition, $F(1, 57) < .001$, $p = .997$, $\eta_p^2 < .001$, and group empathy pairs, $F(2, 57) = 2.70$, $p = .076$, $\eta_p^2 = .086$, were not significant and the interaction of performance condition and group empathy paring was not significant, $F(2, 57) = 1.72$, $p = .188$, $\eta_p^2 = .057$. Although there were significant differences between the main effects during pretesting, the significant differences between performance condition and empathy pairs had been eliminated by the posttest.

Figure 5.4

Posttest Performance Achievement and Empathy Pairs

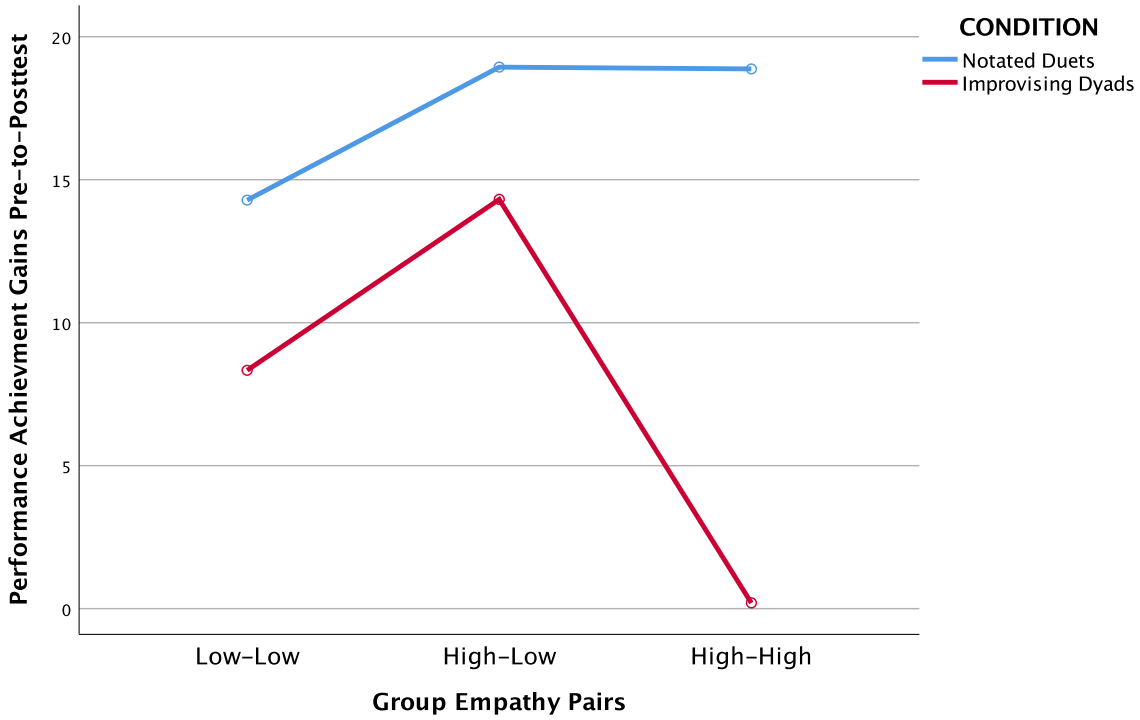


Empathy Pairs and Performance Change

In this section of analysis, I examined the amount of change in performance achievement from pre- to posttest for empathy pairs. Performance gains were used as the dependent variable in a 3x2 ANOVA with empathy pairs (High-High, High-Low, Low-Low) and performance condition (Improvising Dyads, Notated Duets) serving as between-subjects factors. Figure 5.5 shows the relationships of performance gains from pre- to posttest between the empathy pairs and performance conditions.

Figure 5.5

Performance Achievement Change and Empathy Pairs



The results showed that the main effect of performance condition was significant with a small effect size, $F(1, 57) = 6.06$, $p < .05$, $\eta_p^2 = .096$. Notated duets ($M = 17.81$, $SD = 12.49$) demonstrated higher performance gains from pre- to posttest than the improvising dyads ($M = 8.79$, $SD = 16.91$). The main effect of empathy pair categorization on performance gains was not significant, $F(2, 57) = 1.53$, $p = .226$, $\eta_p^2 = .051$, nor was the interaction between condition assignment and empathy pairing, $F(2, 57) = 1.40$, $p = .255$, $\eta_p^2 = .047$.

Although empathy pairs did not demonstrate statistically significant differences in raw gain scores, I completed a final level of analysis to examine the overall achievement of empathy pairs to determine if there were any interactions between observations and performance conditions. Pre-and-posttest performance achievement was the dependent variable in a 3x2

repeated-measures ANOVA with empathy pairs (High-High, High-Low, Low-Low) and performance condition (Improvising Dyads, Notated Duets) serving as the between-subjects factors and observation (Pretest, Posttest) serving as the within subjects factor.

The results showed a significant interaction between observation and performance condition, $F(1, 57) = 6.06$, $p < .05$, $\eta_p^2 = .096$. This result is reflective of the findings in the previous analysis which showed a significant difference in performance gains between the performance conditions with the notated duets demonstrating a higher level of performance gains than the improvising dyads. The main effect of observation was also significant, $F(1, 57) = 39.79$, $p < .001$, $\eta_p^2 = .411$, and showed that on average, performance outcomes increased by 13.25 ($SD = 15.47$) points from pre- to posttest across all performance conditions and empathy pairs. There was no significant interaction between observation and empathy pairs, $F(1, 57) = 1.53$, $p = 226$, $\eta_p^2 = .051$, nor was there a three-way interaction between observation, empathy pairs, and performance condition, $F(2, 57) = 1.40$, $p = .255$, $\eta_p^2 = .047$. These findings support results in previous analyses which showed that although there were significant changes in performance achievement from pre- to posttest, these changes were not significantly different between the different empathy pairs or associated with different empathy pairs in different performance conditions.

Group empathy was a significant factor on both pre-and-posttest performance outcomes with a moderate effect size, $F(2, 57) = 3.43$, $p < .05$, $\eta_p^2 = .107$. Tukey HSD post-hoc pairwise comparisons indicated that there were significant differences between High-High ($M = 76.07$, $SD = 17.54$) and Low-Low ($M = 59.51$, $SD = 17.49$) empathy pairs with strong effect sizes ($p < .05$, $d = .945$). There were no statistically significant differences in performance outcomes between

Low-Low and High-Low empathy pairs (p = .113) or between High-Low and High-High empathy pairs (p = .571). There were no significant differences between performance conditions, $F(1, 57) = 1.06$, p = .308, η_p^2 = .107. The interaction between empathy pairing and performance condition was not significant, $F(2, 57) = 1.24$, p = 298, η_p^2 = .042.

The overall findings from the repeated measures ANOVA show that participants in all performance conditions made significant gains in performance achievement over the intervention period. The results also show that the overall performance outcomes for High-High empathy pairs was significantly higher than the performance outcomes for Low-Low empathy pairs. The differences in performance outcomes were not significant between the mixed empathy pair (High-Low) and the other two empathy pairings (High-High, Low-Low). There were no significant interactions with empathy pairing and observation and performance condition. Although High-High and Low-Low empathy pairs demonstrated different levels of overall performance achievement, they did not demonstrate statistically different levels of performance change nor did the different performance conditions demonstrate any differences in performance outcomes associated with empathy pairing.

Summary of Empathy Pair Comparisons

The results in this section showed that the overall performance achievement at both pre- and posttest was higher for High-High empathy pairs when compared with Low-Low empathy pairs. The statistical differences between pairs were only significant when both performers in a group were categorized as a contrasting pair group. In other words, the High-Low empathy pairs did not demonstrate statistical differences in performance achievement from either the High-High or the Low-Low empathy pairs in any analyses. Although High-High empathy pairs

demonstrated higher levels of performance achievement than Low-Low empathy pairs, these differences were most evident in pretest observations and were no longer significant when posttest observations were isolated. This finding along with the lack of differences between empathy pairs on performance gains or the interaction with observation in the repeated measures ANOVA showed that changes in performance achievement were not associated with co-performer empathy categories.

There was no evidence of an interaction between empathy pair categorization and performance condition on performance achievement outcomes. It appears that performance achievement differences between High-High and Low-Low empathy pairs were consistent for both freely improvising dyads and notated duets. Although the notated duets demonstrated slightly more gains in performance achievement from pre- to posttest than the freely improvising dyads, these differences were not associated with different empathy pair categorizations.

Chapter Conclusion

Analyses in this chapter examined the relationships between group empathy levels and performance achievement for freely improvising dyads and notated duets. In the first section, I used a series of regression analyses to determine whether aggregated co-performer empathy levels predicted pre-and-posttest performance outcomes as well as performance change while controlling for group instrumental playing experience and affective valence. In the second section of analysis, I used median empathy scores on the BES to categorize participants as having high and low dispositional of empathy. Performing dyads were then categorized as High-High, High-Low, and Low-Low empathy pairs. I used a series of ANOVAs to investigate

whether different categories of empathy pairs demonstrated different performance outcomes on pre-and-posttests and different levels of performance change from pre- to posttest.

Regression analysis revealed that composite empathy and affective empathy were significant predictors of pretest performance outcomes for both freely improvising dyads and notated duets. Cognitive empathy was not a significant predictor of pretest performance outcomes. There were no significant relationships between pretest performance outcomes and the interaction of empathy and performance condition. This finding indicates that when empathy was a significant predictor of performance outcomes, it was not shaped by performance condition.

Although composite and affective empathy levels were significant predictors of pretest performance outcomes, none of the empathic processing domains (composite, affective, cognitive) demonstrated significant relationships with posttest performance outcomes. Rather, the control variables of instrumental playing experience and affective valence were the strongest predictors of posttest performance outcomes.

In an interesting reversal from pre-and-posttest findings, cognitive empathy had a negative association with performance change while affective and cognitive empathy did not demonstrate significant relationships with performance gains. Although there were significant differences in the amount of performance change between the performance conditions, the interaction between empathy and condition was not significant. This result indicates that performance changes associated with cognitive empathy were not significantly different between the performance conditions.

A difference-in-difference regression estimator was utilized to examine the relationships between changes in group empathy levels and performance achievement. The findings from this

analysis revealed that only composite empathy was statistically predictive of pre-and-posttest performance achievement. Not surprisingly, observation was the strongest predictor of performance outcomes, affirming that there were significant differences between pre-and-posttest performance achievement. There were no significant interactions between observation, empathy, and performance condition. This finding affirmed that although empathy was a significant predictor of overall performance achievement, changes in empathy did not predict changes in performance from pre- to posttest nor were there significant differences in performance outcomes between music-making conditions associated with group empathy levels.

I conducted an additional level of analysis to determine if High-High, High-Low, and Low-Low empathy pairs differed in performance outcomes at pre-and-posttest or in performance change. In addition, I examined whether the different music-making conditions demonstrated different associations with performance outcomes based on empathy pairing. The findings showed that there were significant differences between High-High and Low-Low empathy pairs at pretest and when pre-and-posttest performance outcomes were aggregated in a repeated measures analysis. When posttest achievement and performance change were isolated as outcome factors, there were no statistical differences between the empathy pairs.

The interaction between empathy paring and performance condition was not significant in any of the analyses. These results indicate that even when there were significant differences in performance achievement between music-making conditions (performance change), these differences were not statistically associated with empathy categorization. The differences in performance achievement between music-making conditions was not statistically significant.

The compendium of findings from multiple levels of analysis indicate that co-performer empathy levels demonstrated a positive association with performance achievement, but different empathic response processes seemed to influence performance outcomes at different phases of co-performer interaction. Affective empathy demonstrated a positive relationship with pretest performance outcomes while cognitive empathy demonstrated a negative relationship with performance change. Composite empathy was a significant predictor of aggregated pre-and-posttest performance outcomes. Although co-performer empathy levels demonstrated a positive relationship with performance outcomes, these outcomes did not show significant differences based on performance modality. Whether improvising or using notation, co-performer empathy was positively associated with performance achievement. In the next chapter, I will discuss these findings and their implications on the field of music education in the context of existing literature.

CHAPTER 6: SUMMARY, DISCUSSION, AND CONCLUSION

Introduction

In their discussion about supporting the development of music improvisers in educational settings, MacDonald and Wilson assert (2020):

> Encouraging and supporting learners to consider how well they are able to predict what those around them are doing, even as those people change and develop, should be a priority for arts education. This requires that teaching supports the development of musical relationships rather than simply playing music. (p. 170)

The capacity of music learners to attune to and predict the psychological states and actions of others during socio-musical interactions is a function of empathy development (Batson, 2009; Hoffman, 2000). Given theoretical assertions that empathy informs social understanding and interactive response and given the assertion that music improvisation is a socially constructed creative experience (Sawyer, 2006; Sawyer & Dezutter, 2009; Wilson & MacDonald, 2016, 2017), the broad interest of this research was to examine the relationship between dispositional empathy development and music improvisation in adolescent instrumental music students to determine how these social phenomena shape each other.

To better understand this relationship, I developed an experimental and concurrent correlational research design to determine if music improvisation impacted empathy development when compared with other forms of collective music making (i.e., traditional performance ensemble and notated duet experiences) and to determine if empathy was associated with performance outcomes of interacting adolescent musicians. Results showed that none of the

collective music-making conditions, including the freely improvising dyads, impacted dispositional empathy development from pre- to posttest nor were there significant differences in dispositional empathy levels between groups. Although the musical interventions did not influence empathy change, gender and affective valence toward collective music-making experiences were significant predictors of individual empathy levels.

Group empathy levels and empathy pairings were positively associated with performance outcomes for both the improvising dyads and the notated duet conditions. Although group empathy was a significant predictor of overall performance outcomes, it was not a significant predictor of performance development from pre- to posttest. Results and implications will be discussed throughout the remainder of this chapter.

The purpose of this chapter is to summarize the research and discuss how the findings expand our empirical understanding about the relationship between empathy and music. First, I will summarize the methodological approaches and discuss the findings as they relate to each of the research questions and the existing literature. Then I will articulate how the findings inform implications for music teaching and learning. This will be followed by a discussion of limitations and directions for future research. Finally, I will conclude with some remarks about the mutual benefits of musical and social development and the importance of enhancing both developmental facets in music learning environments.

Discussion of Empathy Development and Collaborative Improvisation

I used an experimental intervention to examine how different musical experiences impacted dispositional empathy development. Adolescent instrumental music students ($N = 185$) were randomly assigned to interactive music-making experiences in either freely improvising

dyads (n = 64), notated duets (n = 62), or traditional band and orchestra rehearsals (n = 59). The traditional large ensemble rehearsals served as the control condition for small ensemble experiences. All participants interacted with each other musically using either traditional notation or free improvisation for 20 minutes a week for a period of eight weeks. Pre-and-posttest measures of dispositional empathy were collected to determine if either of the small group interactive music-making experiences induced changes in empathy that were significantly different from the control condition (i.e., traditional band and orchestra rehearsals). I used experimental methodology to answer the first research question.

Research Question 1

Do adolescent instrumental music students that participate in small group free improvisation music-making experiences demonstrate different levels of dispositional empathy change when compared with participants that engage with small or large group music-making experiences using traditional notation?

Changes in dispositional empathy were examined by comparing pre-and-posttest responses on the Basic Empathy Scale (BES). Comparisons were made between groups of participants that engaged in one of the three music-making conditions during the experimental treatment period. Results for the first question were generated using stepwise ordinary least squares difference-in-differences (DID) multiple regression analyses. The purpose of using these analyses was to determine whether experiences related to any of the music-making conditions caused changes in dispositional empathy and whether there were any differences in changes between conditions while controlling for variables that may have influenced empathy

development (e.g., gender, instrumental playing experience, affective valence). I completed this analytic procedure for composite empathy and for affective and cognitive empathy subscales.

After completing multiple levels of DID analysis, I completed two levels of post-hoc ordinary least squares (OLS) multiple regression analyses to determine whether the preexisting characteristic of instrumental music experience in the participant sample may have been associated with empathy levels prior to the musical interventions. Although conclusions based on these findings are correlational rather than causal, they provide some speculative insights about the strength of empathy response shown in the findings as a result of the experimental interventions. These insights provided a basis for recommended design and sampling modifications in future research.

Results from DID analysis revealed that there were no significant differences in empathy change between groups during the eight-week intervention period. Not only were there no significant differences in empathy change between groups, but there were no significant changes within any of the music-making conditions from pre-to-posttest. A lack of change from pre- to posttest within and between groups was consistent for composite empathy and both cognitive and affective empathy subscales.

The aim of this experiment was to determine whether different types of musical interactions have different influences on empathy development based on assumptions that collective music-making enhances empathy development and prosocial response, which has been found in previous research (Cirelli et al., 2014; Cook et al., 2019; Good & Russo, 2016; Hietolahti-Ansten & Kalliopuska, 1990; Kalliopuska & Ruókonen, 1986, 1993; Kirschner & Tomasello, 2010; Rabinowitch et al., 2012; Rabinowitch & Meltzoff, 2017; Trainor & Cirelli,

2015). It seems that the findings in the current study contrast this previous research; however, there are some notable differences in the research design, sampling procedure, and measures used in this study when compared with previous research that may explain some of these disparities.

Interactive Music Making

A few studies have examined the impact of music-making interventions on empathy development directly (Kalliopuska & Ruókonen, 1986, 1993; Rabinowitch et al., 2012). The musical experiences utilized as interventions in these studies consisted of a variety of interactive performance, composition, improvisation, and response activities that were specifically designed to induce group interactions and empathic responsiveness. In contrast, the musical experiences utilized as interventions in the current study focused on one specific type of musical interaction within groups (free improvisations, small ensemble rehearsals using notation, large ensemble rehearsals using notation). Although the musical activities in the current study represent ecologically valid forms of music making that students are likely to experience in high school instrumental music programs, it is possible that a wider variety of socio-musical interactions may provide more efficacy as an empathy intervention than a single experience, regardless of how socially interactive participants are during singular activities. This may be especially true given that numerous opportunities to observe and interact with peers in diverse contexts are critical antecedents for empathy development (Barnett, 1987; Eisenberg et al., 1997). Future researchers interested in the effects of specific music learning experiences on empathy development may consider including an intervention group where participants engage in numerous forms of socio-

musical activities alongside conditions where participants engage in only one form of musical interaction to make between group comparisons.

Intervention Dosage

One of the other key differences between the current study and previous research examining the effects of musical interventions on empathy development was the amount of treatment dosage. Participants in the current study engaged in musical interventions for 20-minutes once a week for a period of eight weeks resulting in a total of 160 minutes of treatment. In their study of an empathy inducing collective music-making intervention, Kalliopuska and Ruókenon (1986) had participants engage in musical activities for one hour a week for three months for a total of 720 minutes of treatment. Rabinowitch et al. (2012) administered their interventions once a week for nine months for approximately 2,160 minutes of treatment. Both of these studies found a statistically significant but rather small effect from musical treatments on empathy change using larger amounts and longer applications of interventions than those administered in the current study.

The differences in empathic outcomes between this study and previous music intervention studies suggest that more robust musical treatments may yield significant results. Once again, the interventions administered during this study were ecologically valid: they were musical experiences that are frequently or easily facilitated within the context of traditional high school orchestra and band classes. If improvisation and chamber music experiences are intended to not only augment musical development, but also support interpersonal connections and empathy development in the context of large performance ensemble classes, then these activities

may need to be embedded throughout the curricular sequence with a substantive investment of time and energy dedicated to these activities to induce the intended effect.

Measuring Prosocial Response

There are examples from the literature that have examined prosocial behavior as an immediate empathic response resulting from short-term musical interactions (Good & Russo, 2016; Kirschner & Tomasello, 2010). These studies had participants engage in collective music making and then measured participant response through helping or cooperative behaviors. Kirschner and Tomasello (2010) found that 4-year-old children demonstrated more cooperative and helping behaviors toward other children after they engaged in collective music making when compared with children that engaged in a collective non-musical analog. Similarly, Good and Russo (2016) found that children that participated in group singing showed higher levels of cooperation with each other when compared with children that participated in collective art making and competitive games conditions.

Although both of the aforementioned studies indicated an increased level of prosocial response as a result of music participation, prosocial behavior is not always analogous to empathy development. Empathy often guides prosocial response, but prosocial behavior is also enacted out of egoistic and practical concerns related to self-interest rather than empathic and altruistic responsiveness (Eisenberg, Fabes, & Spinrad, 2007). Collective music making may incite group affiliation or catalyze existing empathic capacities that support prosocial response more so than non-musical activities (Buren, Degé, & Schwarzer, 2019; Cook et al., 2019; Good & Russo, 2016; Ilari et al., 2018; Kirschner & Tomasello, 2010; Schellenberg et al., 2015), but this does not necessarily mean that the capacity to empathize with others increases through

exposure to collective music making. In other words, empathy may often be a component of prosocial behavior, but it is important not to conflate the two constructs (Eisenberg et al., 2015). The capacity to resonate with the emotions or psychological states of others is developed over prolonged periods of time and through numerous social interactions (Eisenberg et al., 1997; Ickes, 2009); the current study suggests that the effects of socio-musical interactions on dispositional empathy adhere to similar developmental trajectories.

Participant Selection and Characteristics

The current study diverged from previous research through the selection and characteristics of the participants. Previous research has generally examined the effects of musical interactions on either prosocial response or empathy development in preadolescent (ages 18-months to 12-years) children (Cook et al., 2019; Good & Russo, 2016; Hietolahti-Ansten & Kalliopuska, 1990; Ilari et al., 2018; Kalliopuska & Ruókonen, 1986, 1993; Kirschner & Tomasello, 2010; Rabinowitch et al., 2012; Schellenberg et al., 2015), while the sample in the current study consisted of adolescents (ages 13-18). Theorists and researchers assert that empathic capacities develop and change along with other cognitive, sociological, and psychophysiological factors (Barnett, 1987; Eisenberg et al., 2015; Eisenberg et al., 2007; Eisenberg et al., 1997; Hoffman, 2000). Although previous research has shown an increase in prosocial response and empathic development as a result of group musical interactions in younger children, developmental factors in adolescents may mediate the effects of collective music making on empathy change.

The other sampling distinction between this study and previous research was the exclusive use of participants that were enrolled in school instrumental music programs. The

intent of selecting participants with this characteristic was to minimize omitted variable bias associated with making comparisons between students that participate in school music and those that don't (Elpus, 2013). Although previous research using matched groups for comparisons has shown that music participation enhances prosocial response and empathy development (Hietolahti-Ansten & Kalliopuska, 1990; Ilari et al., 2018; Schellenberg et al., 2015), these results may have been caused by other variables that were associated with elective music participation rather than from the effects of music participation itself.

Although selecting a musically homogenous sample may have minimized omitted variable bias, the significant amount of previous instrumental playing experience (M_{years} = 6.41, *SD* = 2.15) found in this sample may have also mediated the effects of the musical interventions. Despite the lack of striking differences in BES scores between participants in this sample and those of socially typical adolescents in other studies (see table 4.8), and despite the lack of predictive significance of instrumental playing experience on empathy development found in the post-hoc analysis of Chapter 4, it is still possible that the participants in this study had reached the ceiling for the effects of interactive music making on dispositional empathy change. Future researchers may want to consider replicating this study with participants that are not involved with school music programs or have little to no formal collective music-making experience to determine if previous music learning impacts the efficacy of different types of music-making interventions on empathy development.

Predictive Characteristics of Dispositional Empathy

My primary interest in the first research question was to determine if the musical interactions during small group free improvisation influenced empathy development differently

than musical interactions during small and large ensemble experiences using traditional notation. In an effort to better understand the causal signal between musical interventions and empathy development, I controlled for the between-subjects factors of gender, instrumental playing experience, and affective valence. Although there were no significant differences in empathy development between music-making conditions, there were notable differences in between-subjects predictors of empathy that align with previous literature.

Given previous research linking music participation with enhanced empathy and prosocial development (Good & Russo, 2016; Hietolahti-Ansten & Kalliopuska, 1990; Ilari et al., 2018; Schellenberg et al., 2015), it was assumed that previous instrumental learning experience would influence the variation in dispositional empathy between participants and within groups in conjunction with the musical interventions. For this reason, I included previous instrumental playing experience as a control variable for dispositional empathy development. After initial modeling, it appeared that instrumental playing experience was positively predictive of empathy differences; however, when age was included as a covariate in post-hoc regression modeling, instrumental playing experience was no longer a significant predictor of empathy variation between participants.

Gender was included in regression modeling to control for its association with empathy variation. Previous research has shown that female participants demonstrate higher levels of empathic response than male participants (Ang & Goh, 2010; Davis, 1983; Garaigordobil, 2009; Jolliffe & Farrington, 2006, 2011; Schulte-Rüther et al., 2008; Schwenck et al., 2014). Consistent with previous research, female identifying participants generated higher empathy response scores than male identifying participants for both the composite scale and affective and cognitive

empathy subscales on the BES. This finding not only aligns with previous research but also reinforces the need to control for gender variation when examining empathy outcomes as a result of musical interactions.

Affective valence was included as a variable in the regression models to control for positive and negative associations with the experiences during musical interventions. Given that environmental factors such as secure, emotionally stable, and positive social conditions are important antecedents for empathy development (Barnett, 1987; Eisenberg et al., 2015; Ickes, 2009), I included affective valence as a control variable because I was concerned about the possibility that affective associations with the musical interventions would influence empathy development more than the socio-musical interactions encountered during musical experiences. Although the musical interactions did not induce any significant change in dispositional empathy, affective valence was a significant predictor of dispositional empathy response on the BES. Since there were no significant changes in dispositional empathy between performance conditions or within performance conditions from pre- to posttest, it stands to reason that a reverse association is possible: those with higher predispositions to empathize with others demonstrated higher levels of positive response to the socio-musical interactions during the interventions. Given the social nature of the performance tasks in all the music-making conditions, it is not surprising that participants that exhibited higher empathy levels also responded with higher positivity levels to making music with others.

When examining the control variables as predictors of empathy response, it appears that gender and affective valence were strongly associated with dispositional empathy levels. Upon initial analyses, it seemed that instrumental playing experience was also a significant, although

weak, predictor of empathy response; however, after including age in post-hoc analysis, instrumental playing experience was no longer a significant factor. Although the relationships between the significantly predictive control variables and empathy outcomes should be conceived of as correlational rather than causal, these relationships provide insights about the characteristics of adolescent instrumental music students and how those characteristics shape their empathy response. An understanding about these relationships is informative for supporting implications from the null result in the current study and for appropriately examining data in future research on empathy response to musical experiences.

Summary of Discussion for Research Question 1

Analyses related to the first question concerning the influence of collaborative free improvisation on empathy development when compared with small and large group interactive music-making experiences using traditional notation revealed that there were no significant differences between the groups. Not only were there no differences between the music-making conditions, but there were no significant differences within any of the groups following the intervention period. It appears that an eight-week intervention may not have been robust enough for participants in any condition to demonstrate dispositional empathy change.

Although there were no between or within group differences as a result of the experimental interventions, there were significant predictors of between participant empathy variation. Gender and affective valence were both factors positively associated with dispositional empathy response on the BES. These strong associations suggest that gender and affect must be considered in statistical models of the influence of musical experiences on empathy development.

Despite the null result from this experiment, the findings do not disqualify the possibility that musical experiences shape empathy development; however, they point to the need for longer and more substantive interventions. Disentangling the effects of longitudinal musical interventions from other social and developmental factors such as age, affective response, and gender will be critical as future researchers endeavor to clarify the causal signal between musical experiences and empathy development. In the next section, I discuss the methodological approaches and findings for queries about the relationship between empathy development and performance outcomes and change for the freely improvising dyads and notated duets.

Research Question 2

What is the relationship between pre-and-posttest empathy levels and performance achievement for interacting musicians? Are there any differences in the relationship between empathy and performance achievement when comparing freely improvising dyads and notated duets?

In addition to my interest in examining whether small group free improvisation was uniquely situated to support dispositional empathy development when compared with more traditional music-making modalities in formal learning environments, I was also interested in determining whether dispositional empathy was related to performance outcomes and whether that relationship was impacted by performance modality. I collected pre-and-posttest performance achievement and empathy response data for the notated duets and freely improvising dyads to investigate these associations. The current study is, to my knowledge, the first to directly examine the relationship between group performance achievement and dispositional empathy using different performance modalities.

In the primary analysis for research question two, I used ordinary least squares (OLS) regression modeling to examine the relationship between group empathy levels and performance outcomes at concurrent collection periods while controlling for affective valence and instrumental playing experience. The analysis produced three OLS models for each empathy response domain as measured by the BES (composite, affective, cognitive) for both pre-and-posttest collection periods. Using this systematic approach, I was able to disentangle whether different music-making conditions demonstrated diverging relationships with affective, cognitive, or composite empathic response systems while controlling for group variation in affective valence and instrumental playing experience.

Findings revealed that composite and affective empathy were significant predictors of pretest performance outcomes. The differences in pretest performance outcomes between performance conditions were not significant nor was the interaction of performance condition and empathy level. The lack of significant interactions between condition and empathy suggests that although empathy was predictive of pretest performance outcomes, this association was not significantly different between notated duets and freely improvising dyads. In other words, composite and affective empathy were both positively associated with performance achievement, but it did not seem to matter whether co-performers were interacting as improvisers or with traditional notation.

Although only serving as control variables to enhance the predictive signal between empathy levels and performance outcomes, affective valence was a significant factor of pretest performance achievement while prior instrumental playing experience was not significantly related. These findings do not contribute to the primary interest of the research question, but they

provide insights about how participants responded to the pretest performance tasks and they offer some speculative clarity about how recurrent interactions during musical engagements shift the significance of these variables. For example, it appears, not surprisingly, that co-performers that expressed positive feelings to the interactive music-making tasks also demonstrated higher levels of performance achievement.

In a secondary analysis, I sought to determine if there were differences in pretest performance outcomes between different dispositional empathy pairs (High-High, High-Low, Low-Low) using a 3x2 ANOVA. Findings revealed that there were significant differences between the empathy pairs on performance outcomes but only between the High-High and Low-Low categories with High-High empathy pairs producing higher performance ratings. In concordance with findings from regression analysis, there was no empathy pair and performance condition interaction. This finding confirms that although within group empathy levels were positively related to performance achievement, it did not seem to matter whether participants were engaging in free improvisation or reading notation: empathy levels were positively associated with higher pretest performance outcomes in both conditions and there were no significant differences in performance outcomes between conditions associated with empathy levels or pairings.

The relationship between posttest performance achievement and posttest group empathy levels were examined using the same analytic approach as the pretest analysis. Posttest performance outcomes were regressed on the composite empathy scale and the cognitive and affective empathy subscales. I used a 3x2 ANOVA to compare the performance outcomes of the different empathy pairs (High-High, High-Low, and Low-Low) for the freely improvising dyads

and notated duets. In a contrast to pretest results, dispositional empathy was not a significant predictor of performance outcomes nor were there any significant differences in performance achievement between the music-making conditions. Affective valence continued to be a significant predictor, and unlike results from the pretest analysis, instrumental playing experience was a significant predictor of posttest performance achievement.

The secondary analysis of empathy pair comparisons revealed that there were no significant differences between empathy pairs or performance conditions at posttest. Although pretest empathy was positively associated with performance achievement, this relationship seems to have been mediated by other factors upon the conclusion of the intervention sequence. Findings related to the third research question provide some insight into these outcomes.

Research Question 3

What is the relationship between baseline (pretest) empathy levels and performance change for interacting musicians? Are there any differences in the relationship between empathy response and performance change when comparing freely improvising dyads and notated duets?

Once again, I used a series of OLS regression analyses to examine the relationship between performance gains and co-performer empathy with group empathy operationalized as a continuous variable. I completed a secondary analysis using ANOVAs with group empathy pair categorizations as independent variables to determine if there were any significant differences between empathy pairs and performance gains for the freely improvising dyads and notated duets. Aligning with posttest outcomes, composite and affective empathy levels were not significant predictors of performance change. Interestingly, there was a small negative relationship between cognitive empathy and performance change. This negative association

might be attributed to a lack of reliance on communicative and perspective taking skills to generate cooperative performances after successive attempts. Co-performers may have become more reliant on musical understanding and emotional congruence to coordinate musical actions as they became more familiar with each other and their musical tendencies through recurrent interactions. In other words, performance change and development might be better explained by increased amounts of technical and expressive understanding rather than interpersonal understanding.

Although group empathy level was a significant predictor of pretest performance outcomes, the variation in performance achievement change seems to have been shaped by other factors. Findings show that there were significant differences between the performance conditions with the notated duets demonstrating greater amounts of change than the freely improvising dyads; however, much like findings from pre-and-posttest performance outcomes, the differences in change between the performance conditions were not associated with group empathy levels. It seems that empathy levels prior to the musical interventions were not predictive of performance development between co-performers as they interacted and learned with each other through both improvisation and repertoire mastery.

I used a 3x2 ANOVA with empathy gains as the outcome variable and a 3x2 repeated-measures ANOVA with pre-and-posttest performance ratings as the outcome variable to examine the relationship between empathy pairs and changes in performance achievement. Findings from the ANOVA using performance gains as the outcome variable showed that there were significant differences in gains between the music-making conditions, but there were no significant differences between empathy pairs or the interaction of condition and empathy categorization.

The repeated measures ANOVA showed that there was a significant interaction between performance condition and observation, indicating higher gains for the notated duets than the freely improvising dyads. The repeated measures analysis also showed that there was a significant main effect of empathy on performance outcomes for both pre-and-posttest observations with the High-High empathy pairs demonstrating higher performance outcomes at both testing periods when compared with Low-Low empathy pairs.

Although there were significant gains in performance achievement from pre- to posttest for both the freely improvising dyads and notated duets, and although there were significant differences in gains between the two performance conditions, neither within group nor between group performance gains were significantly associated with empathy levels. The lack of interaction between observation, empathy pairing, and performance condition indicates that the variation in performance gains between conditions was not associated with empathy pairing.

Instrumental playing experience was a significant predictor of gains in performance achievement. Interestingly, affective valence—a strong predictor of both pre-and-posttest performance outcomes—was not a significant predictor of performance change. The predictive significance of instrumental playing experience and lack of significance from both affective valence and empathy levels on performance gains implies that participants advanced their performance achievement through preexisting musical skills and other factors rather than from their levels of positivity toward the music-making experiences or dispositions to connect with others empathically.

Despite the null relationship between group empathy and performance gains and the lack of predictive significance between group empathy levels and posttest performance outcomes, a

positive relationship between empathy and performance during the pretest performance tasks and significant differences between High-High and Low-Low empathy pairs on overall performance achievement suggests that empathy may provide a communicative and interactive foundation for co-performers to engage in collaborative music making. This empathic foundation may run in the background as other factors such as affective valence and instrumental playing experience explained more of the variation in performance outcomes as co-performers gained collaborative experience through successive musical interactions.

To determine whether empathy had a foundational influence on performance outcomes at early and late stages of development during the intervention protocol, I examined the achievement outcomes from both pre-and-posttest performance tasks as they related to group empathy pairs. Indeed, the results from the repeated-measures ANOVA showed that there were significant differences in overall performance achievement based on empathy paring. The analysis used to address research question four provides additional support for speculation that group empathy serves as an interactive foundation that impacts performance outcomes throughout co-performer development, but that its effects are mediated by other factors as co-performers interact and develop their performance capacities. Among other associations, the analysis addressing question four examined the predictive relationship of group empathy on overall performance outcomes.

Research Question 4

What is the relationship between changes in empathy and changes in performance achievement for interacting musicians? Are there any differences in this relationship when comparing freely improvising dyads and notated duets?

I examined the relationship between changes in group empathy and performance achievement using a difference-in-differences (DID) regression estimator. Pre-and-posttest performance ratings were regressed on observation, music-making condition, pre-and-posttest group empathy response, and the interaction of these main effects. I controlled for the group characteristics of affective valence and instrumental playing experience. Findings from this analysis showed that while holding variables such as affective valence and instrumental playing experience constant, only composite dispositional empathy was significantly predictive of overall performance outcomes. When the analysis was restricted to either affective or cognitive empathy subscales, the relationship between dispositional empathy and overall performance outcome was no longer significant. This result indicates that co-performer achievement was associated with a *combination* of affective and cognitive empathic capacities as they engaged in both pre-and-posttest interactive performance tasks.

The DID analysis showed that there was a significant difference in performance outcomes from pre- to posttest, but that there were no interactions with empathy or with performance condition. This result is not surprising given that previous analyses showed little change in empathy, no statistically significant relationship between performance change and baseline empathy levels, and no significant differences between performance conditions while holding factors such as affective valence and instrumental playing experience constant.

Empathy was a significant predictor of overall performance outcomes, but changes in empathy and changes in performance achievement were unrelated; however, this may be an artifact from a lack of variation in empathy levels from pre- to posttest measurements. The null relationship between empathy change and performance gains confirms previous findings that

there was a lack of predictive significance from group empathy levels on changes in performance achievement over the treatment period. This result supports speculation that dispositional empathy established an interactive basis or an intersubjective foundation for co-performer achievement while other factors mediated the effect from an empathic foundation to account for more of the variation in longitudinal performance development.

It is notable that there were no statistically significant differences in the association between dispositional empathy and performance outcomes for the freely improvising dyads and notated duets. As mentioned earlier, to my knowledge this is the first study to quantitatively examine the relationship between the dispositional empathy development of co-performers and their levels of performance achievement. Despite being the first study of its kind, there are several aspects of the findings that both align with and diverge from the extant literature examining the interactions of improvisers and the relationship between empathy and music making.

Performance and Empathy Discussed in the Context of Prior Literature

Co-performers in collaboratively generative ensemble settings innately engage with and rely on social interactions to reconcile differences and generate mutually creative and emotionally congruent performances (D'Ausilio et al., 2015; Keller, 2014). Prior research of co-performer interactions in both a jazz combo and a classical string quartet found that performers leveraged their capacities to empathically attune to each other to communicate nonverbally and stretch their performance creativity (Seddon, 2005; Seddon & Biasutti, 2009). Findings from the current study quantitatively support this observation by showing that there was a positive relationship between the empathic capacities of co-performers and their performance outcomes.

The strong predictive relationship between group empathy levels and performance outcomes in high school instrumentalists is concordant with and provides some speculative insights for findings from two previous correlational studies conducted by Babiloni et al. (2012) and Cho (2019). Babiloni et al. (2012) found strong correlations between musician trait empathy, empathic brain activity, and brain activations during ensemble performance, suggesting that ensemble musicians enact, exercise, and develop empathic response systems during interactive performances. Cho (2019) found a predictive relationship between the breadth and depth of participation in small ensembles and empathy levels in college musicians. Given the predictive relationship between co-performer empathy and performance achievement, it should not be surprising that previous research has shown that professional musicians and collegiate musicians with a breadth of music-making experiences exhibited higher levels of empathic response as this characteristic may, in part, contribute to musicians' ability to succeed in collaborative music-making environments. Findings from this study support the possibility that musicians gravitate toward and demonstrate success in collective music-making experiences as a result of higher empathic dispositions.

The lack of predictive significance related to dispositional empathy on posttest performance achievement and changes in performance outcomes between pre-and-posttest observations is a striking finding. Based on the previous literature, one might expect musicians to leverage their empathic capacities during successive interactions to better understand the expressive intent, subtle physical cues, and embodied reactions of co-performers in ways that lead to higher posttest performance outcomes in co-performers with higher empathy levels (Biasutti & Frezza, 2009; Gratier, 2008; Morgan et al., 2015; Seddon & Biasutti, 2009). It

appears, however, that factors such as affective valence, previous musical experience, and other unmeasured variables (e.g., instrumental performance ability, sight-reading ability, traditional notation literacy, aural skills, ensemble instrument combinations, co-performer relationships, etc.) account for more of the variation in performance outcomes over longitudinal interactions than dispositional empathy levels.

As discussed earlier, it is possible that the empathic dispositions of co-performers run in the background of musical interactions with other variables mediating the effects from empathy on performance change and development. It is also possible that musical empathy, or the capacity to understand the expressive and generative intent of co-performers, operates on a parallel empathic response system to the empathic system used for other social interactions, reducing co-performers' dependency on dispositional empathy to engage and interact with each other musically. Waddington's (2017) qualitative examination of collaborating musicians found that empathic connections were formed through a cyclical process of shared interpretation and special connections that fostered mutual responding, flexibility, and spontaneous generation between co-performers. Co-performer empathy may facilitate this type of shared interpretation and special connection in the early stages of group musical interactions, but musical empathy may develop through other interactive mechanisms, making co-performers less reliant on their empathic dispositions to collaboratively perform after repeated interactions.

One might have also expected that co-performer empathy would have had an especially strong relationship with music improvisation achievement given the socially constructed nature of musical interactions and creative development during the improvisation process (Burnard, 2002; MacDonald & Wilson, 2020; Sawyer, 2006; Wilson & MacDonald, 2016, 2017). There

may be similarities in the long-term musical and social interactions of co-performers that work together during improvisation and repertoire mastery. These similarities may make both interactive music-making processes equally responsive to empathic dispositions.

Observations of children participating in group improvisation found that the children generated and socially negotiated musical ideas and performance roles (Beegle, 2006, 2010; Burnard, 2002). In other words, researchers found that improvisations were not always spontaneously and interactively generated, but rather, developed through musical and behavioral patterns, which were learned through repeated interactions. This pattern of development mirrors the ways co-performing musicians coordinate their actions through social and musical patterns as they rehearse and produce collaborative interpretations of traditional notation (Keller, 2014; Keller & Appel, 2010).

Similarities in approaches to improvisational and repertory performance development may explain why group empathy levels demonstrated the same predictive relationships with performance achievement between the freely improvising dyads and notated duets. Participants were randomly assigned to co-performing pairs and were unfamiliar with the performance tasks prior to pretesting in both music-making conditions. These circumstances may have forced performers in both conditions to rely more heavily on their empathic capacities of interpersonal connection and communication as they completed the pretest performance tasks. As co-performing participants engaged in repeated interactions, they may have developed a better understanding of the musical patterns found in the notation and improvisational expectations. This enhanced understanding of musical patterns may have mediated the effects of interpersonal connections on performance development.

Although speculative, the shift away from relying on empathic capacities toward musical understanding may explain why empathy dispositions lost predictive significance in both music-making conditions when examining group performance gains and posttest performance achievement. This may also explain why instrumental playing experience was not predictive of pretest performance achievement but was a significant predictor of performance gains and posttest performance outcomes. Although the processes through which musical content is generated in notated duets and freely improvising dyads diverges considerably, it seems that performance outcomes are associated with empathic capacities in similar ways for both conditions.

Summary of the Discussion for Questions 2-4

Findings from this study showed a positive relationship between co-performer empathy levels and performance achievement. This finding was consistent whether examining the relationship between empathy and performance outcomes as two continuous variables or examining the differences in performance outcomes between High-High and Low-Low empathy pairs. When considering overall performance outcomes at both pre-and-posttest, higher empathy was associated with higher performance achievement. However, when restricting performance outcomes to either performance gains or posttest ratings, group empathy response lacked significance as a predictor of performance variation.

The results seem to indicate that co-performing pairs were more reliant on their empathic capacities to generate musical outcomes at early stages in their musical interactions, but this relationship was mediated over time. In other words, group dispositional empathy was related to performance achievement, but the power of that relationship was reduced as co-performers

worked together and developed other cooperative and musical understandings. The findings also revealed that there were no significant differences in the relationship between empathy and performance outcomes based on performance modality. The next section will address the implications of these findings within the domain of music education.

Implications for Music Education

Music making, music learning, and learning more broadly are social experiences predicated on interpersonal relationships and relationships with cultural/musical content (Hargreaves & North, 1999; Moran & John-Steiner, 2003). Wilson and McDonald (2020) assert that encouraging students to build musical relationships rather than just supporting repertoire mastery and technical development should be a priority in learning environments if one of the aims of music education is to support critical, creative, and cooperative musical learning experiences. Findings from this study showed that pairs of performing students with a greater capacity to connect with each other interpersonally—represented by empathic dispositions—also demonstrated higher levels of performance achievement, especially during early stages of their interactions. This relationship suggests that supporting empathy inducing antecedents such as perspective taking, empathic modeling, emotionally secure and stable developmental environments, reduced interpersonal conflict, and the promotion of positive self-concept may also bolster collaborative performance achievement (Barnett, 1987; Eisenberg et al., 2015; Eisenberg et al., 1997).

Given that the results from this study showed that co-performer empathy levels were predictive of collective performance achievement, perhaps music educators can enhance students' collaborative musical achievement in instrumental learning environments by breaking

away from the sometimes, strict adherence to competitively based hierarchies often found in instrumental performance ensembles (i.e., auditioned chair, part, and ensemble placements and performance competitions). Rather, instrumental music learning environments could be reframed to include more opportunities for students to engage in diverse socio-musical learning experiences where cooperation, critical reflection, and creativity are encouraged. These learning environments will not only support empathic development, but collective musical achievement as well.

The results from this study showed that collective performance achievement in both improvisation and notation conditions was significantly associated with co-performer empathy levels. This finding indicates that the relationship between empathy development and performance achievement crosses musical boundaries and impacts the different ways students are likely to engage with collective music making in instrumental music settings. Supporting empathy inducing musical learning may foster the social, emotional, and musical wellbeing of student musicians. Previous research has shown that long-term musical group interactions using a variety of musical games and activities intended to promote entrainment, imitation, and flexibility through performing, improvising, composing, and responding over the course of a full school year had a small but significant effect on empathy change (Rabinowitch et al., 2012). If the goals of music learning include fostering both collaborative music making and interpersonal skills, then providing students with a variety of collective musical engagements may be essential for both facets of development.

One of the objectives for conducting this study was to expand on previous research that has found a link between music participation and empathy development and prosocial response

to determine if small group collective improvisation was particularly conducive for advancing empathy development. As Rabinowitch (2015a) states:

> According to the music-empathy theory, *how* music is used is probably much more important than what type of music is used. The theory postulates that the most effective way to implicitly train individuals to become better empathizers through music is to engage them in musical group interaction. (p. 98, emphasis in original)

According to theory, the collective generation of musical ideas during improvisation through interpersonal sensitivity, turn taking, and temporal coordination creates environments that scaffold the development of social intelligence and empathy (Krueger, 2013).

On the surface, findings from this study seem to disconfirm previous research and theoretical assertions by showing a null result for empathy development in response to not only the improvisation experiences, but to all the musical experiences implemented during study interventions. But there are some important implications for music teaching and learning that can be gleaned from these results. If, as Krueger (2013) articulates, interactive music making serves as scaffolding for empathy development and social intelligence, then it is worth considering what that means. Scaffolding is the staging or temporary framework used to support the modification or development of more rigid and permanent structures. Using this line of metaphorical thinking, dispositional empathy is a structure that is continuously formed by cognitive, social, and biological factors (Eisenberg et al., 2007; Eisenberg et al., 1997). In other words, the capacity to empathize with others is developed over prolonged periods of time and shaped by a wide range of social influences and personal characteristics. Dispositional empathy is a complex and dense social response system that demands robust and multifaceted interventions to affect change.

If there is a wish to advance the social and emotional development of students in band and orchestra environments through music learning, then the ways interactive music making is embedded within curricula will impact the effectiveness of students' learning experiences. The current research shows that short excursions into one type of musical group interaction is not sufficient to shape the empathic trajectories of adolescent music students. To induce empathic change through music, students need long-term and recurrent opportunities to engage in interactive music making through a wide variety of musical forms and social encounters. A small dose of free improvisation interspersed within traditional large ensemble rehearsals is not a panacea for interpersonal development. Curricular scaffolding designed to support empathy development needs to match the complexity and scale of empathic structures. Developing these curricula will not only support empathy development, but as this study indicates, mutually support collective musical achievement and an interpersonal foundation for cooperative learning.

Limitations

There are several limitations that should be considered when interpreting the results from this study. The first major limitation of this study is the lack of generalizability of findings to broader human populations. I purposefully selected adolescent (ages 13-18) band and orchestra students to examine the effect of different types of group musical interactions on empathy development within ecologically valid high school instrumental learning environments. Although there wasn't a predictive relationship between prior instrumental learning experience and empathy development, it is possible that the rather extensive amount of previous musical experience within this sample may have created a ceiling effect for any amount of empathy change that could have possibly been caused by study interventions. Adolescents with less

musical experience may demonstrate a different amount of empathy change in response to the collective music-making conditions used in the interventions for this study.

A second limitation of this study was my inability to monitor and verify the fidelity of intervention protocols. Participants received written instructions concerning the activities that they were to complete during each intervention period. In addition, I attended each research site for the first two interventions to provide directions and answer questions that the cooperating teacher or student participants might have had about implementing the interventions. Despite measures to ensure that the treatment procedures were uniformly applied, I was not able to monitor each ensemble's intervention experiences to ensure that they were engaging in the specified activity for the designated period of time. It is possible that some of the groups in each condition did not complete the intervention protocols as intended.

The reliability of the measures of dispositional empathy (BES) and performance achievement (CIM and SEAF) was adequate but not high when using Cronbach's alpha as the calculation of internal and interrater consistency. Future researchers should continue to develop measures that accurately assess dispositional empathy and both improvisation and repertoire performance outcomes. Given the possibility that musical empathy and dispositional empathy are parallel rather than unified social mechanisms that operate on similar response systems (cognitive response and affective resonance), future theorists and researchers may consider exploring musical empathy as an independent construct and develop valid and reliable instruments that measure the capacity of co-performers to engage in the imaginative or reactive process of understanding or resonating with the expressive intent and emotional content generated during interactive musical experiences.

Finally, there are some potential limitations to the conception of performance achievement as an outcome variable and the application instrumental playing experience as a control variable. I used instrumental playing experience to not only control for previous experience when empathy was the outcome variable, but to also serve as a proxy for instrumental playing ability when performance achievement was the outcome variable; however, instrumental playing experience may not be an accurate representation of playing ability.

The measures of performance achievement were restricted to the interactive generation of fluid, technically proficient, and musically expressive performances as co-performers engaged with notated repertoire or free improvisation. In the context of music education, however, this is a rather restrictive conception of performance achievement. Performance achievement could be reframed to include constructs such as the development of self-concept, positive affect, and conceptual understanding toward performance tasks. In other words, in music learning environments, criteria-based evaluations of musical products may not always be the most accurate indicator of student development and achievement as related to social intelligence and empathy development.

Directions for Future Research

The findings from this study suggest several directions for future research. The null result from the musical interventions on empathy change could be explained by participants' previous musical experience mediating the impact of the interventions, by the lack of social diversity during the musical interactions, or by the dosage of small ensemble music-making experiences used in the interventions. The high level of performance achievement for high empathy pairs across both pre-and-posttest measures could be explained by an association between empathy

and performance ability or by the socio-communicative interactions of high empathy pairs. The following suggestions for future research would explore these speculative explanations.

To address the mediating impact of previous musical experience on empathy change, this study should be replicated with a sample of participants that have little to no preexisting instrumental playing experience. This type of study might be implemented by selecting adolescent participants in beginning level ensembles to engage in the three different music-making conditions. Alternatively, participants could be assigned to large ensembles, freely improvising dyads, and notated duets using electronic instruments such as an iPad or Skoog, where instrumental proficiency and musical fluency could be attained without the requisite years of technical practice and development needed for musical group interactions while using traditional band and orchestra instruments. Empathy change in response to musical engagements for these samples would support the possibility that preexisting musical experiences mediate the impact of new forms of collaborative music making.

In order to examine the association between group dispositional empathy and performance achievement, and to maintain the continuity of ensemble pairs throughout the study, participants interacted with the same individuals during the full sequence of musical interventions for this study. This lack of social diversity during collective musical interactions may have contributed to the null finding for empathy change from pre-to-posttest in all music-making conditions. Future research should examine the impact of small ensemble music-making experiences on empathy change using free improvisation and traditional notation with diverse social interactions to determine if the socio-communicative exchanges from a variety of people shapes empathy differently as a result of participating in each music-making condition. Different

musical experiences may afford more fluid socio-communicative exchanges and, in turn, support different levels of empathy development through diverse social interactions.

Findings from this study showed that an eight-week musical intervention did not support significant changes in dispositional empathy development, regardless of the music-making experience. It is possible that the intervention dosage used in this study was too small and too short to support empathy change, and that long-term exposure to different types of collective music making may support different levels of empathy development. Rabinowtich et al. (2012) found significant changes in the empathy development of primary school students that participated in a year-long intervention program, which consisted of a variety of musical group interactions. Future research that examines the impact of specific forms of musical group interactions on empathy change will have to extend the length and the amount of time dedicated to the musical treatments to determine whether dosage impacts the efficacy of interactive music making on changing dispositional empathy in adolescent music students.

Findings from this study showed a strong associated between group empathy levels and performance achievement during both pre-and-posttest performance tasks. It is possible that this strong association may be attributed to the omitted variables of instrumental performance ability and musical aptitude. Future researchers will need to collect more robust data pertaining to performance ability in the form of a playing tests or musical aptitude tests to determine whether these variables reduce the strength of the association between empathy and performance achievement. It is possible that adolescent music students with high levels of empathy are more prone to developing the musical skills that support performance achievement than their less empathic peers. The shared associations between empathy levels, musical aptitude, instrumental

performance ability, and performance achievement may reduce the strength of the direct association between group empathy levels and performance achievement.

Finally, although the findings in this study showed a strong association between group empathy levels and performance achievement, the socio-communicative interactions of different empathy pairs during performance tasks were not examined for similarities and differences. Observational research of the interactions between different empathy pairs while they engage in learning notated repertoire and free improvisation would provide insights into how co-performers leverage their empathic capacities during their musical interactions. This type of research would deepen our understanding about how and why empathy may be positively associated with performance achievement and the differences in interactions between different empathy pairs.

Conclusion

Music making is a social affair that both inspires and is shaped by human connection and emotional understanding (Reimer, 2003; Small, 1998). Collaborative improvisation is a uniquely creative music-making process that is predicated on the social interactions and empathic attunement of co-performing musicians to coordinate musical action and foster shared understanding (MacDonald & Wilson, 2020; Seddon, 2005; Wilson & MacDonald, 2017). Given the role empathy plays in supporting social cohesion and interpersonal understanding, I was interested in better understanding the relationship between dispositional empathy development and improvised performance achievement.

This study showed that adolescents with a robust amount of previous musical experience demonstrated nonsignificant amounts of dispositional empathy change in response to rather

limited musical interventions. These findings suggest that if music educators hope to enact changes in student empathy through music learning, then these experiences need to be frequent, recursive, long-term, and diverse. Providing students with short, one-dimensional approaches to engaging with collaborative music making for a few weeks of every academic year does not seem to support the meaningful development we may be hoping for. Music educators can bolster opportunities for empathic enaction by instating an abundance of interactive music-making activities within the full scope and sequence of their curricula.

Music education philosopher Randall Allsup (2016) argues: "The possibility of a new development, aroused through interactions with others who are different, saves me from endless replication" (p. 127). As music educators facilitate new and collaborative music learning experiences for their students, they will provide students with experiences that arouse their capacities for interpersonal and musical development, creating exciting new musical and social outcomes. Indeed, this research showed a positive relationship between the capacity of co-performers to engage in interpersonal connections and performance achievement.

Whether empathy promoting antecedents are generated through collective music making itself, or through supporting social and emotional learning environments more broadly, it seems that musical achievement is enhanced by a foundation of affective and cognitive interpersonal understanding. By devising and investing in empathy promoting musical activities, music education will fulfill two critical obligations within the broader educative experience: interpersonal wellbeing and musical development. These two developmental facets have the potential to be mutually beneficial if music educators use thoughtful approaches to infuse collaborative music-making in their curricula.

I began this research with a wonderment about the association between free improvisation and empathy development. Given that free improvisations are socially generated between co-performing musicians, I was interested in determining if empathy, a mechanism that supports social interaction and interpersonal understanding, had a particularly strong association with free improvisation experiences when compared with other forms of music making that used music notation to support performer interactions. The findings in this study suggest that collective music making, whether socially generative or mediated by music notation, is a social endeavor that benefits from the capacity of students to attune to one another and engage in interpersonal understanding. Music making and music learning depend upon complex musical and social relationships; forming a better understanding about these relationships and their interactions is critical to fostering both the musical achievement and empathic capacities of adolescent instrumentalists. Providing students with a diverse range of interactive musical experiences in instrumental learning environments may be key to supporting both developmental facets. Free improvisation is one of many musical relationships that students may leverage to form intra-and-interpersonal understandings. I'm excited to explore the interactions of diverse musical relationships and how those relationships shape musical learning experiences and student development.

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APPENDIX A: Institutional Review Board Approval Letter

Northwestern | RESEARCH

Northwestern University
Institutional Review Board
Biomedical IRB
750 N. Lake Shore Dr., 7th Fl.
Chicago, Illinois 60611

irb@northwestern.edu
Office 312. 503. 9338

Social & Behavorial Sciences IRB
600 Foster St., 2nd Floor
Evanston, Illinois 60208

sbsirb@northwestern.edu
Office 847. 467. 1723

APPROVAL OF NEW STUDY

DATE: April 2, 2019

TO: Dr. Maud Hickey
FROM: Office of the IRB

DETERMINATION DATE: 4/2/2019
APPROVAL DATE: 3/21/2019

The Northwestern University IRB reviewed and approved the submission described below:

Type of Submission:	Initial Study
Review Level:	Expedited
Expedited Category:	- (6) Voice, video, digital, or image recordings - (7) Behavioral research/social science methods
Title of Study:	Small Group Improvisation Achievement and Empathy Development in Adolescent Instrumental Music Students
Principal Investigator:	Maud Hickey
IRB ID:	STU00209493
Funding Source:	Name: School of Music
Grant ID:	
IND, IDE, or HDE:	None
Documents Reviewed:	• Guardian Recuitment Letter.pdf, Category: Recruitment Materials; • Basic Empathy Scale Posttest.pdf, Category: Questionnaire/Survey; • Adult Consent.pdf, Category: Consent Form; • CIM Rating Scale.pdf, Category: Data Collection Tools; • HRP-583 - TEMPLATE - Social Behavioral Protocol_11222018.pdf, Category: IRB Protocol; • Teacher Recruitment Letter.pdf, Category: Recruitment Materials; • Instructions-Control Group Large Ensemble.pdf, Category: Training Documents; • Instructions-Improvisation Intervention .pdf, Category: Training Documents; • Administrator Consent Letter.pdf, Category: Recruitment Materials; • Parent Permission with Child Assent.pdf, Category: Consent Form; • SEAF Rating Scale.pdf, Category: Data Collection Tools; • Basic Empathy Scale Pretest.pdf, Category: Questionnaire/Survey; • Instructions-Notated Duet Intervention.pdf, Category: Training Documents; • PANAS.pdf, Category: Questionnaire/Survey;
Special Determination(s):	Children;

In conducting this study, you are required to follow the requirements listed in the Northwestern University (NU) Investigator Manual (HRP-103), which can be found by navigating to the IRB Library within the eIRB+ system. Additionally, as Principal Investigator (PI), of this research study, you are expected to adhere to the investigator responsibilities outlined in the "What are my obligations as Investigator in order to conduct Human Research" section of the Investigator Manual (HRP-103).

An annual continuing review is not required for this project. The study team must still submit: modifications for project changes; RNIs (reportable new information); and a Continuing Review to close the project once it ends, or when personal identifiers are removed from the data/biospecimens and all codes and keys are destroyed.

NU IRB approval does not constitute or guarantee institutional approval and/or support. Investigators and study team members must comply with all applicable federal, state, and local laws, as well as NU Policies and Procedures, which may include obtaining approval for your research activities from other individuals or entities.

For IRB-related questions, please consult the NU IRB website at http://irb.northwestern.edu. For general research questions, please consult the NU Office for Research website at www.research.northwestern.edu.

Additionally, please note that the analyst who approved your study is not the analyst that is responsible for the review of any subsequent modifications or CR's or RNI (If applicable). As such, please direct any further questions about modifications or CR's or RNI to the analyst assigned to the subsequent submission.

APPENDIX B: Parent Permission with Child Assent to Participate in Research

IRB #: STU00209493 Approved by NU IRB for use on or after 4/2/2019

Title of Research Study: Small Ensemble Improvisation Achievement and Empathy Development in Adolescent Instrumental Music Students

Principal Investigator: Maud Hickey

Supported By: This research is supported by the Bienen School of Music at Northwestern University.

Key Information about this research study: The following is a short summary of this study to help you decide whether to permit your child to be a part of this study.

The purpose of this study is to find out more about how musical activities are related to empathy levels. Your child will be asked to participate in an assigned music-making condition where they will either improvise with another student, perform a notated duet with another student, or participate in large ensemble rehearsals as they typically do during their instrumental music class. Your child will complete a survey that asks a bunch of questions about how your child understands other peoples' feelings and emotions. Your child will complete a short performance activity with an assigned partner that will be audio recorded if they are assigned to the improvisation or notated duet conditions. After your child completes those steps, they will participate in improvised dyads, notated duets, or large ensemble rehearsal for 20 minutes a week and complete short surveys about their experience during the 20-minute music-making activities. After eight weeks, your child will complete the same survey and performance task as they did before the 20-minute musical activities started. We expect that your child will be in this research study for 20 minutes a week for a period of 8 weeks. The primary risk of participation is feeling nervous about the music-making activities and being recorded while engaging in music-making activities. We expect about 192 children will be in this research study. You can ask all the questions you want before you decide.

If you say that "Yes, you want your child to be in this research," here is what your child will be asked to do:

If you and your child decide to participate in this study, your child will be issued a study participation number to preserve anonymity during data collection and randomly assigned to one of three music-making groups (improvisation, notated duet, large ensemble).

If your child is assigned to either the improvisation or notated duet groups, your child will be randomly assigned to work with another student to complete a short performance task as a part of a pretest. This task will be audio recorded for data analysis. Your child will then complete a short survey that asks them to provide some background information and asks a series of questions to determine how your child understands other peoples' emotions.

If your child is assigned to the large ensemble group, they will not complete a pretest performance task, but they will complete a survey that asks for some background information and a series of questions to determine how your child understands other peoples' emotions.

Once these pretest tasks are completed, if your child was assigned to either the improvisation or notated duet groups, your child will make music with their randomly assigned partner for 20 minutes a week for eight weeks during their regularly scheduled instrumental music class. The improvisation group will participate in free improvisation and the notated duet group will rehearse notated duets during the music-making activity time. If your child is assigned to the large ensemble group, they will remain in their large ensemble rehearsal setting as they normally would during the class period.

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After completing the 20-minute music-making activity (including the typical large ensemble rehearsal experience) each week, your child will complete an attitudinal survey to gauge their positive or negative reactions to their experience during the 20-minute music-making activity. Your child will be asked to return the attitudinal survey to their teacher after they've been completed so they can be securely stored and picked up by the research team for data analysis.

Following the eight-week music-making activity period, students assigned to either the improvisation or notated duet groups will complete a short performance task as a posttest that will be audio recorded for data analysis. Students in all groups, including the large ensemble group, will complete a survey that asks a series of questions to determine how your child understands other peoples' emotions.

Most of the music-making activities will be guided by your child's instrumental music teacher, but a researcher will be present to audio record the pre-and-post performance tasks and collect the emotional understanding surveys. All performance tasks and music-making experiences will be conducted in your child's school music department practice facilities during regularly scheduled instrumental music classes.

The group your child will be assigned to and the partner your child will be working with will be chosen by chance, like flipping a coin. Neither you nor the study team will choose what intervention your child gets. Your child will have an equal chance of being assigned to any given group and to working with any other student in their instrumental music class.

Is there any way being in this study could be bad for my child?

You child might feel nervous about performing the assigned music-making tasks or being audio recorded while performing music-making activities.

If you say that you do not want your child to be in this research:

Participation in research is voluntary. You and your child can decide not to participate in this research, and it will not be held against you or your child in any way nor will it have any impact on your child's high school class and their performance and participation in that class.

You can say "Yes," but change your mind later:

You or your child can stop and leave the research at any time and it will not be held against you or your child nor will it have any impact on your child's high school class and their performance and participation in that class. Just let me or your child's teacher know if you want to do this. If this happens, all the data related to your child, including audio recordings, will be removed from the research record.

If your child is participating in a randomly assigned dyad, both your child and their randomly assigned partner will resume normal large ensemble activities without contributing to the study data. If your child was assigned to the large ensemble condition, your child will continue their normal large ensemble activities without completing surveys related to this study.

This is what will happen to the information collected for this research:

Efforts will be made to limit the use and disclosure of your child's personal information, including research study records, to people who have a need to review this information. We cannot promise complete secrecy. Organizations that may inspect and copy your information include the IRB and other representatives of this institution.

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Each participant will be assigned a study participation number that will be used on all the data collected including surveys and audio recordings. All surveys and audio files will be kept in secure locations and on password protected computers for a period of seven years and only research team members will have access to these materials. Anonymized audio recordings will be distributed to a panel of outside raters for data analysis. Recordings will not be heard by anybody outside the rating panel or the research team.

Here is some other information that is useful for you and your child to know:

Parents please be aware that under the Protection of Pupils Right Act 20 U.S.C. Section 1232 (c)(1)(A), you have the right to review a copy of the questions asked of or materials that will be used with your students. If you would like to do so, you should contact Maud Hickey at mhickey@northwestern.edu or Casey Schmidt at caseyschmidt2010@u.northwestern.edu to obtain a copy of the questions or materials.

Audio recording your child's performances of the music-making tasks is mandatory for participating in this study. In addition, your child will be randomly assigned to participate in a music-making condition with at least one other student in their instrumental music class.

Here is who you and your child can talk to:

If you have questions, concerns, or complaints, you can talk to the Principal Investigator Maud Hickey at mhickey@northwestern.edu or Casey Schmidt at caseyschmidt2010@u.northwestern.edu. This research has been reviewed and approved by an Institutional Review Board ("IRB"). You may talk to them at (312) 503-9338 or irb@northwestern.edu if:

- Your questions, concerns, or complaints are not being answered by the research team.
- You cannot reach the research team.
- You want to talk to someone besides the research team.
- You have questions about your rights as a research participant.
- You want to get information or provide input about this research.

Your signature documents your permission for the named child to take part in this research.

Signature of child	Date
Printed name of child	
Printed name of parent [ ] or individual legally authorized [ ] to consent for the child to participate	Date
Signature of parent [ ] or individual legally authorized [ ] to consent for the child to participate	Date

APPENDIX C: Adult Consent to Participate in Research

IRB #: STU00209493 Approved by NU IRB for use on or after 4/2/2019

Consent to Participate in Research

Title of Research Study: Small Ensemble Improvisation Achievement and Empathy Development in Adolescent Instrumental Music Students

Principal Investigator: Maud Hickey

Supported By: This research is supported by the Bienen School of Music at Northwestern University.

Key Information about this research study: The following is a short summary of this study to help you decide whether to be a part of this study.

The purpose of this study is to find out more about how musical activities are related to empathy levels. You will participate in an assigned music-making condition where you will either improvise with another student, perform a notated duet with another student, or participate in large ensemble rehesarsal as you typically do during your instrumental music class. You will complete a survey that asks a bunch of questions about how you understand other peopoles' feelings and emotions. You will complete a short performance activity with an assigned partner that will be audio recorded if you are assigned to the improvisation or notated duet conditions. After you complete those steps, you will participate in improvised dyads, notated duets, or large ensemble rehearsals for 20 minutes a week and complete short surveys about your experience during the 20-minute music-making activities. After eight weeks, you will complete the same survey and performance task as you did before the 20-minute musical activities started. We expect that you will be in this research study for 20 minutes a week for a period of 8 weeks. The primary risk of participation is feeling nervous about the music-making activities and being recorded while engaging in music-making activities. We expect about 192 participants will be in this research study. You can ask all the questions you want before you decide.

Why am I being asked to take part in this research study?

You are being asked to take part in this research study because you are a student in your high school's instrumental music program.

How many people will be in this study?

We expect about 48 people here will be in this research study out of 192 people in the entire study nationally.

What should I know about participating in a research study?

- Whether or not you take part is up to you.
- You can choose not to take part.
- You can agree to take part and later change your mind.
- Your decision will not be held against you.
- You can ask all the questions you want before you decide.

What happens if I say, "Yes, I want to be in this research"?

If you decide to participate in this study you will be issued a study participation number to preserve anonymity during data collection and randomly assigned one of three music-making groups (improvisation, notated duet, large ensemble).

If you are assigned to either the improvisation or notated duet groups, you will be randomly assigned to work with another student to work with another student to complete a short performance task as a part of a pretest. This task will be audio recorded for data analysis. You will then complete a short survey that asks you for some

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background information and asks a series of questions to determine how you understand other peoples' emotions.

If you are assigned to the large ensemble group, you will not complete a pretest performance task, but you will complete a survey that asks for some background information and a series of questions to determine how you understand other peoples' emotions.

Once these tasks are completed, you will make music in your assigned group with your partner for 20 minutes a week for eight weeks. After completing your assigned performance task, you will complete the emotion survey and if you're assigned to the improvisation or notated duet group, you will complete a short performance task which will be audio recorded for data analysis.

Most of the music-making activities will be guided by your instrumental music teacher, but a researcher will be present to audio record the pre-and-post performance tasks. All performance tasks and music-making experiences will be conducted in your music department's practice facilities during your regularly scheduled instrumental music class. The group you will be assigned to and the partner you'll be working with will be chosen by chance, like flipping a coin. Neither you nor the study team will choose what intervention you get. You will have an equal chance of being assigned to any given group and to working with any other student in your instrumental music class.

Is there any way being in this study could be bad for me?

There is nothing bad that will happen to you although you may feel nervous about completing the performance tasks if you're not used to playing music with just one other person or you might get nervous about being recorded while you make music. You can stop at any time if your experience becomes unpleasant. If you decide to stop participating in this study, all of your data, including audio recordings, will be removed from the research record.

What happens if I do not want to be in this research?

Participation in research is voluntary. You can decide to participate or not to participate. You can decide not to participate and it will not be held against you in any way nor will it have any impact on your high school class and your performance and participation in that class.

What happens if I say "Yes", but I change my mind later?

You can leave the research at any time and it will not be held against you nor will it have any impact on your high school class and your performance and participation in that class. If this happens, all the data related to your participation, including audio recordings, will be removed from the research record.

If you are participating in a randomly assigned dyad, both you and your randomly assigned partner will resume normal large ensemble activities without contributing to the study data. If you are participating in the large ensemble condition, you will continue your normal large ensemble activities without completing surveys related to this study.

What happens to the information collected for the research?

Efforts will be made to limit the use of your personal information, including research study records, to people who have a need to review this information. We cannot promise complete secrecy, but we will work to keep your name and other information private.

Consent to Participate in Research

Each participant will be assigned a study participation number that will be used on all the data collected including surveys and audio recordings. All surveys and audio files will be kept in secure locations and on password protected computers for a period of seven years and only research team members will have access to these materials. Anonymized audio recordings will be distributed to a panel of outside raters for data analysis. Recordings will not be heard by anybody outside the rating panel or the research team.

Data Sharing

De-identified data from this study may be shared with the research community at large to advance science and health. We will remove or code any personal information that could identify you before files are shared with other researchers to ensure that, by current scientific standards and known methods, no one will be able to identify you from the information we share. Despite these measures, we cannot guarantee anonymity of your personal data.

What else do I need to know?

Audio recording your performances of the music-making tasks is mandatory for participating in this study. In addition, you will be randomly assigned to participate in a music-making condition with at least one other student in your instrumental music class.

Who can I talk to?

If you have questions, concerns, or complaints talk to the Principal Investigator Maud Hickey, mhickey@northwestern.edu or Casey Schmidt, caseyschmidt2010@u.northwestern.edu.

This research has been reviewed and approved by an Institutional Review Board ("IRB"). You may talk to them at (312) 503-9338 or irb@northwestern.edu if:

- Your questions, concerns, or complaints are not being answered by the research team.
- You cannot reach the research team.
- You want to talk to someone besides the research team.
- You have questions about your rights as a research participant.
- You want to get information or provide input about this research.

Signature for Adult 18 or older

Your signature documents your permission to take part in this research.

_____ _____

Signature of participant Date

_____

Printed name of participant

_____ _____

Signature of person obtaining consent Date

_____

Printed name of person obtaining consent

APPENDIX D: Teacher Recruitment Letter

Dear (Teacher Name),

My name is Casey Schmidt and I'm a PhD candidate in music education at Northwestern University. I am working on a dissertation study that examines the relationship between collaborative improvisation achievement and empathy development and the effects of musical interventions on empathy gains in adolescent instrumental music students. I am writing to see if you'd be interested in participating in this study.

I'm recruiting high school level instrumental music programs and their students to participate in this study. The study does not require any previous improvisation experience. The procedures will include the random assignment of participating students to three different music experience conditions (improvising dyads, notated duets, traditional large ensemble rehearsal). Student participants will complete an empathy scale pretest along with a short performance task for the students assigned to improvising dyads or notated duets. The performance tasks will be audio recorded for outside raters. The musical interventions will be completed during your regularly scheduled class time for 20 minutes a week for a period of 8 weeks. The study will conclude with students completing an empathy scale posttest and a short performance task for the students assigned to the dyad conditions. Once again, the posttest performance tasks will be audio recorded for outside raters. Both you and your students will remain anonymous during data collection, analysis, and reporting.

If you're interested, I will contact your building's administrative team to request consent to conduct this research at your school. Once I've secured administrative permission, I'll work with you to schedule a time to distribute guardian consent and student assent forms to individuals within your program requesting that they participate in the study. We will schedule a time to complete the pretests and do a brief training session to administer the 20-minute interventions per week. I will work with you to make the process as convenient as possible. Please let me know if you and your students are interested. I greatly appreciate your consideration.

Best regards,
Casey

Casey Schmidt – Primary Research Team Contact
PhD Student, Music Education – Northwestern University
Bienen School of Music
70 Arts Circle Drive
Evanston, IL 60208-2405
Caseyschmidt2010@u.northwestern.edu

APPENDIX E: School Administrator Consent Request

Dear (Principal Name),

My name is Casey Schmidt and I'm a PhD candidate in music education at Northwestern University. I am working on a dissertation study that examines the relationship between collaborative improvisation achievement and empathy development and the effects of musical interventions on empathy gains in adolescent instrumental music students.

I'm contacting you because (Cooperating Teacher's Name) has agreed to include their instrumental music class as participants in this study during the fall of the 2019-20 academic school year. Students will be randomly assigned to one of three music experience conditions and complete measures of empathy, collaborative improvisation, and duet performance achievement. Performance tasks on the collaborative improvisation and duet achievement measures will be audio recorded for outside raters to review. All identifying information connecting students to the measures and audio will be eliminated and the teachers, students, and schools involved in this study will remain anonymous. Guardian consent and student assent will be attained for students to participate in the study.

I will work with (Cooperating Teacher's Name) to make the study as convenient as possible. All students, regardless of participation or condition assignment, will be engaged in musical activities during the study protocol.

Please advise about approval for using (Cooperating Teacher's Name)'s classroom as a research location for this research study. Please let me know if I need to complete additional steps to secure approval or if you have any questions or concerns. I look forward to hearing from you.

Best regards,
Casey Schmidt – Primary Research Team Contact
PhD Candidate, Music Education – Northwestern University
Bienen School of Music
70 Arts Circle Drive
Evanston, IL 60208-2405
caseyschmidt2010@u.northwestern.edu

Dr. Maud Hickey – Principal Investigator
Assistant Professor, Music Education – Northwestern University
Bienen School of Music
70 Arts Circle Drive
Evanston, IL 60208-2405
mhickey@northwestern.edu

APPENDIX F: Guardian Recruitment Letter

Dear Guardian,

I am seeking your permission to allow your dependent enrolled in (Teacher's Name) music class at (School Name) to participate in a music education research study. The study is for my PhD dissertation at Northwestern University and seeks to examine the relationship between collaborative music-making experiences and empathy development and the effects of musical interventions on empathy gains in adolescent instrumental music students. The study will involve audio recording your student interacting with another student during music-making experiences. Your student will remain anonymous and audio will only be used for data analysis.

If you give your dependent permission to participate in this study, they will participate in a pretreatment survey and music task, 20-minute music-making experiences during their regularly scheduled instrumental music class once a week for a period of 8 weeks, and a posttreatment survey and music task.

(Administrator's Name) has approved this research and (Teacher's Name) will supervise audio recording sessions and music-experience treatments. All procedures related to this research will take place during your student's regularly scheduled instrumental music class and will not require any additional involvement from you or your dependent.

Please complete the attached consent form if you are willing to let your student participate in this research study. Consent forms can be submitted to the study collection envelop in the music rehearsal room.

If you have any questions or concerns, please feel free to contact me at any point. My contact information is listed below. This research has also been approved by Northwestern University's institution review board (IRB). You may talk to them at (312) 503-9338 or irb@northwestern.edu if: your questions, concerns, or complaints are not being answered by the research team; you want to talk to someone besides the research team; or you have questions about your dependent's rights as a research participant. Your dependent is not required to participate in this study and is free to discontinue their participation at any time without anything being held against them.

Sincerely,

Casey Schmidt – Primary Research Team Contact
PhD Student, Music Education – Northwestern University
Bienen School of Music
70 Arts Circle Drive
Evanston, IL 60208-2405
Caseyschmidt2010@u.northwestern.edu

APPENDIX G: Collaborative Improvisation Measure (CIM) – Rating Guide and Response Form

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CIM Rating Guide and Definitions

Collaborative Improvisation Measure - Rating Form

Directions: The CIM is a six-item scale that assess freely improvised performances of collective instrumental improvisers. Items of instrumental fluency, musical syntax, creativity, musical quality, and collaborative parameters of shared intentionality and affective congruence are used to produce a composite score of collaborative improvisation achievement.

Please listen to each improvised performance 3 times:

- Rate instrumental fluency and musical syntax during the 1st observation.
- Rate creativity and musical quality during the 2nd observation.
- Rate the musical collaboration (shared intentionality and affective congruence) between the performers during the 3rd observation.

Scoring definitions for each item are provided in the next section.

CIM - Items and Scoring Definitions

Using your expert knowledge about performing and teaching instrumental music improvisation to adolescent music students, please rate each freely conceived collaborative improvisation on the following items.

Instrumental Fluency - The performance can be described on a continuum between hesitant/labored and spontaneous/confident. Instrumental fluency ratings are guided by technical skill, musical expression, and ease of movement between musical ideas. This rating reflects the performers' skills at confidently generating spontaneous and expressive musical ideas together on their instruments.

Scale: 1 (*Hesitant/Labored*), 5 (*Spontaneous/Confident*)

Musical Syntax - The performance can be described on a continuum between illogical and logical. Musical syntax

ratings are guided by the cohesiveness of style and the conception of logical responses to musical ideas. This rating reflects the performers' skills at generating musical ideas that lead to logical phrasing and a form with a coherent beginning, middle, and ending.

Scale: 1 (*Illogical*), 5 (*Logical*)

Creativity - The performance can be described on a continuum between no uniqueness and novel. Creativity ratings are guided by flexibility and originality. Musical flexibility and originality are reflected in the novelty and variety of musical ideas, and the manipulation or elaboration of musical ideas and elements including pitches, rhythms, articulations, dynamics, and timbre.

Scale: 1 (*No Uniqueness*), 5 (*Novel*)

Musical Quality - The performance can be described on a continuum between being unappealing and appealing. This rating reflects the overall musical appeal of the improvised performance. This is a global assessment of how musically meaningful, expressive, and creative the improvisation was performed.

Scale: 1 (*Unappealing*), 5 (*Appealing*)

Shared Intentionality - The performance can be described on a continuum between nonreciprocal and interactive. Performers may respond to the musical ideas of their collaborators or generate musical ideas that inspire musical responses from the co-performers. This rating reflects the combined ability of performers to interact with their co-performers to mutually generate musical ideas.

Scale: 1 (*Nonreciprocal*), 5 (*Interactive*)

Affective Congruence - The performance can be described on a continuum of no emotional connection and emotionally connected between co-performers. Performers may generate musical ideas that expressively reflect or change with the emotional content produced by their co-performers. This rating reflects the combined ability of performers to align their musical expressions with their co-performers to produce an emotionally coherent improvisation.

Scale: 1 (*No Emotional Connection*), 5 (*Emotionally Connected*)

Rater Name:

Performances

Listen to the performance three times: Rate instrumental fluency and musical syntax during the first observation, rate creativity and musical quality during the second observation, and rate shared intentionality and affective congruence during the third observation.

0:00 / 5:24

	1	2	3	4	5
Instrumental Fluency - 1 (*Hesitant and Labored*), 5 (*Spontaneous and Confident*)	○	○	○	○	○
Musical Syntax - 1 (*Illogical*), 5 (*Logical*)	○	○	○	○	○
Creativity - 1 (*No Uniqueness*), 5 (*Novel*)	○	○	○	○	○
Musical Quality - 1 (*Unappealing*), 5 (*Appealing*)	○	○	○	○	○
Shared Intentionality - 1 (*No Interaction*), 5 (*Highly Interactive*)	○	○	○	○	○
Affective Congruence - 1 (*No Emotional Connection*), 5 (*Emotionally Connected*)	○	○	○	○	○

APPENDIX H: Small Ensemble Adjudication Form (SEAF) – Rating Guide and Response Form

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SEAF Rating Guide and Response Form

Small Ensemble Adjudication Form - Rater Directions

Directions: The SEAF is a six-item scale that assess the collective performance achievement of instrumentalists performing traditionally notated small ensemble repertoire. Items of intonation, rhythm, balance and blend, technique, interpretation and musicianship, and articulation and or/ bowing are used to produce a composite score of collaborative small ensemble performance achievement. A copy of the notated score (Recital Duets C.pdf) and an exemplar recording of the repertoire are provided as referents for making assessments. Please refer to these items during the assessment process.

Exemplar Recording:

0:00 / 1:42

Please listen to each small ensemble performance 3 times:

- Rate intonation and rhythm during the 1st observation.
- Rate balance and blend and technique during the 2nd observation.
- Rate interpretation and musicianship and articulation and bowing during the 3rd observation.

Scoring definitions for each item are provided in the next section.

SEAF - Items and Scoring Definitions

Using your expert knowledge about performing and teaching instrumental music ensemble performance to adolescent music students, please rate each small ensemble performance on the following items.

Intonation – The performance can be described on a continuum between poor and superior intonation. Intonation ratings are guided by how well the ensemble members accurately perform the printed pitches and adjust instrumental intonation relative to co-performers.

This rating reflects the ability of performers to play correct pitches and adjust intonation tendencies so that they match each other.

Scale: 1 (*poor intonation*), 5 (*superior intonation*)

Rhythm – The performance can be described on a continuum between poor and superior rhythmic accuracy. Rhythmic accuracy is guided by how well the ensemble members accurately perform note and rest values, and how well they perform with an accurate pulse and steady tempo according to metric markings. This rating reflects the ability of performers to perform accurate rhythmic values using an appropriate and steady tempo.

Scale: 1 (*poor rhythmic accuracy*), 5 (*superior rhythmic accuracy*)

Balance and Blend – The performance can be described on a continuum between poor and superior balance and blend. Balance and blend are guided by how well ensemble members perform with similar qualities, both in style and expression, and how well co-performers demonstrate an awareness of one another to generate a cohesive and blended sound during their performance. This rating reflects the ability of performers to match each other in

tone quality and expression to produce a balanced and blended ensemble sound.

Scale: 1 (*poor balance/blend*), 5 (*superior balance/blend*)

Technique – The performance can be described on a continuum between poor and superior instrumental technique. Technique is guided by how well ensemble members are able to perform with instrumental artistry through musical and/or mechanical skill, attacks, releases, and control of ranges. This rating reflects the skills of performers to execute musical ideas from the repertoire on their instruments with a good sound and instrumental dexterity.

Scale: 1 (*poor technique*), 5 (*superior technique*)

Interpretation and musicianship – The performance can be described on a continuum between poor and superior interpretation and musicianship. Interpretation and musicianship are guided by how well ensemble members perform the repertoire with the appropriate style, phrasing, tempo, dynamics, and expression. This rating reflects the collaborative ability of the performers to interpret and express the musical content of the repertoire with meaning and emotion.

Scale: 1 (*poor interpretation/musicianship*), 5 (*superior interpretation/musicianship*)

Articulation and/or Bowing – The performance can be described on a continuum between poor and superior articulation and/or bowing. Articulation and/or bowing are guided by how well the performers interpret and execute instrumental articulation based on the notation. This rating reflects the ability of performers to interpret and execute appropriate articulations as they perform the repertoire.

Scale: 1 (*poor articulation*), 5 (*superior articulation*)

Rater Name:

Performances

Listen to the performance three times: Rate intonation and rhythm during the first observation, rate balance and blend and technique during the second observation, and rate

interpretation and musicianship and articulation and/or bowing during the third observation.

0:00 / 2:03

	1	2	3	4	5
Intonation - 1 (*poor intonation*), 5 (*superior intonation*)	○	○	○	○	○
Rhythm - 1 (*poor rhythmic accuracy*), 5 (*superior rhythmic accuracy*)	○	○	○	○	○
Balance and Blend - 1 (*poor balance/blend*), 5 (*superior balance/blend*)	○	○	○	○	○
Technique - 1 (*poor technique*), 5 (*superior technique*)	○	○	○	○	○
Interpretation and Musicianship - 1 (poor interpretation/musicianship), 5 (superior interpretation/musicianship)	○	○	○	○	○
Articulation and/or Bowing - 1 (poor articulation), 5 (superior articulation)	○	○	○	○	○

APPENDIX I: Condition Assignment Letters and Instructions

Empathy and Music Participation Packet: **Improvisation Condition**

Dear (XXXXXX) - Study ID Number (XXXXXX):

Thank you for being willing to participate in this research. Remember, you are not required to participate in this study and can withdraw at any time. Please let me - caseyschmidt2010@u.northwestern.edu - or your teacher know if you are no longer willing to participate.

You have been randomly assigned to the improvising dyad experience where you will work with (XXXXXX) for 20 minutes a week on the attached improvisation tasks. Once you have completed your 20-minute improvisation rehearsal each week, complete one of the attached PANAS surveys, put the date at the top of the survey, and place the survey in the data collection envelope your teacher has posted in your music room.

Please feel free to contact me if you have any questions or concerns about the study.

Sincerely,

Casey Schmidt – Primary Research Team Contact
PhD Candidate, Music Education – Northwestern University
Bienen School of Music
70 Arts Circle Drive
Evanston, IL 60208-2405
Caseyschmidt2010@u.northwestern.edu

Group Improvisation Instructions

Please work with your assigned partner in a practice space to complete the following two tasks for 20 minutes.

Warmup task: Perform the attached game from *Improv Duets for Classical Musicians (Agrell, 2013)*. Be sure you are following the sequence of warm up tasks listed in table 1 below.

Primary performance task: Once you have completed the warm up task, use the remaining 20 minutes to perform collaborative improvisation duets together. Depending on the length of your improvisations, you may end up playing a few or many duets.

While you are improvising, you are free to play anything you like, so let your imaginations roam free. Your improvisations don't have to be in any particular key or conform to any set criteria. Just play your most interesting musical ideas through collaboration with each other.

- Remember, you are completely free to do whatever you like musically, you may play each improvisation for as long as you want!

- Use the full 20 minutes to work on improvising with your partner.

Complete the attached PANAS questionnaire after each 20-minute improvisation session and return the questionnaire to your teacher. Be sure to put your participant ID number and date at the top of the questionnaire.

Table 1. Sequence of warm up tasks from *Improv Duets for Classical Musicians*

Week 1	*Warm-Up Long Tones*
Week 2	*Ostinato*
Week 3	*Mirror, Mirror*
Week 4	*Double Your Pleasure*
Week 5	*Drone*
Week 6	*Matching*
Week 7	*KISS Music*
Week 8	*Descending Scale*

Warm-Up Task Reference

Agrell, J. (2013). *Improv duets for classical musicians: A concise collection of musical games for two players*. Chicago, IL: GIA Publications Inc.

Empathy and Music Participation Packet: **Notated Duet Condition**

Dear (XXXXXX) – Study ID Number (XXXXXX):

Thank you for being willing to participate in this research. Remember, you are not required to participate in this study and can withdraw at any time. Please let me - caseyschmidt2010@u.northwestern.edu - or your teacher know if you are no longer willing to participate.

You have been randomly assigned to the notated duet experience where you will work with (XXXXXX) for 20 minutes a week on the attached duets. Once you have completed your 20-minute duet rehearsal each week, complete one of the attached PANAS surveys, put the date at the top of the survey, and place the survey in the data collection envelope your teacher has posted in your music room.

Please feel free to contact me if you have any questions or concerns about the study.

Sincerely,

Casey Schmidt – Primary Research Team Contact
PhD Candidate, Music Education – Northwestern University
Bienen School of Music
70 Arts Circle Drive
Evanston, IL 60208-2405
Caseyschmidt2010@u.northwestern.edu

Notated Duet Group Instructions

Please work with your assigned partner in a practice space to learn the attached *Recital Duets* by Sy Brandon (1981) for 20 minutes. Work together to play with accurate pitch and rhythm. Pay attention to interpretation and articulation. Try and learn the duets so that you can perform them accurately with appropriate musical expression.

- Start with *Mvt. I – Fanfare*. Do not proceed to any of the following movements until you feel that you've mastered your performance on the previous movements. If you master all seven movements, start back with the first movement and switch parts.

- Use the full 20 minutes to work on the music with your partner.

Complete the attached PANAS questionnaire after each 20-minute rehearsal session and return the questionnaire to your teacher. Be sure to put your participant ID number and date at the top of the questionnaire.

Duet Reference

Brandon, S. (1981). Recital Duets. Cottonwood, AZ: Co-op Press.

Empathy and Music Participation Packet: **Large Ensemble Condition**

Dear (XXXXXX) - Study ID Number (XXXXXX):

Thank you for being willing to participate in this research. Remember, you are not required to participate in this study and can withdraw at any time. Please let me - caseyschmidt2010@u.northwestern.edu - or your teacher know if you are no longer willing to participate.

You have been randomly assigned to the large ensemble rehearsal experience where you will work with your teacher in ensemble rehearsals as normal for 20 minutes a week. Once you have completed the 20-minute rehearsal session during each week's intervention period, complete one of the attached PANAS surveys, put the date at the top of the survey, and place the survey in the data collection envelope your teacher has posted in your music room.

Please feel free to contact me if you have any questions or concerns about the study.

Sincerely,

Casey Schmidt – Primary Research Team Contact
PhD Candidate, Music Education – Northwestern University
Bienen School of Music
70 Arts Circle Drive
Evanston, IL 60208-2405
Caseyschmidt2010@u.northwestern.edu

Large Ensemble Group Instructions

Please continue your work and musical learning with your large ensemble for the next 20 minutes.

Complete the attached PANAS questionnaire after this 20-minute rehearsal session and return the questionnaire to your teacher. Be sure to put your participant ID number and date at the top of the questionnaire.