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The purpose of this study was to investigate the variables that best predict string students' musical achievement. Five independent variables—grit, socioeconomic status, race, gender, and private lessons—were examined. Sixty string players (30 undergraduates and 30 precollege students) completed a demographic questionnaire and Duckworth's Grit-S Scale (Duckworth & Quinn, 2009). Music performance achievement was measured on a continuous 11-point scale. Participants self-reported the most recent solo pieces they had studied, and the researcher grouped the participants into one of the eleven performance achievement levels based on the graded repertoire list found in the American String Teachers Association's *String Syllabus: Volume One, 2009 Edition*.

Analysis revealed significant correlations between musical achievement and years of experience, musical achievement and years of private lessons, and musical achievement and socioeconomic status. Correlations between gender, race, grit, and musical achievement were not significant. An exploratory multiple regression analysis was conducted to determine which variables best predicted string students' musical achievement. The initial five independent variables (grit, socioeconomic status, race, gender, and years of private lessons) plus one additional independent variable (years of experience) were tested. Four predictor variables (years of experience, years of lessons, socioeconomic status, and gender) were chosen for the final regression model, which significantly predicted musical achievement. This model accounted for 53.0% of the variance in musical achievement among the participants in this sample.

AN INVESTIGATION OF VARIABLES THAT PREDICT
STRING STUDENTS' MUSICAL ACHIEVEMENT

by

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TABLE OF CONTENTS

LIST OF TABLES	viii
LIST OF FIGURES	ix
CHAPTER I: INTRODUCTION.....	1
Foundational Research on Musical Achievement	1
Measuring Musical Achievement	1
Need for the Study	3
Purpose Statement and Research Questions	3
Definition of Terms	4
Musical Achievement	4
Grit	4
Socioeconomic Status	5
Race and Ethnicity	5
Gender Identity	6
Private Instruction.....	6
Limitations	6
CHAPTER II: REVIEW OF LITERATURE	8
Musical Achievement	8
Musical Achievement as a Dependent Measure	9
Measurement of Solo Musical Performance Achievement.....	13
Grit	16
Grit – Passion	18
Grit – Perseverance	19
Grit and Achievement	20
Critiques of Grit	24
Socioeconomic Status.....	25
Socioeconomic Status and Achievement	30
Socioeconomic Status and Musical Achievement	32
Race and Ethnicity	35
Race, Ethnicity, and Achievement.....	36

Race, Ethnicity, and Musical Achievement	43
Gender Identity	45
Gender Identity and Achievement	45
Gender Identity and Musical Achievement	47
Private Instruction.....	49
Private Instruction and Achievement.....	49
Private Instruction and Musical Achievement.....	50
Summary.....	51
CHAPTER III: METHOD	52
Participants.....	52
Grit-S Scale Description	55
Demographic Questionnaire Description.....	57
Measurement of Musical Achievement	57
Pilot Study.....	58
CHAPTER IV: RESULTS.....	60
Descriptive Statistics.....	61
Grit	61
Socioeconomic Status	62
Race and Ethnicity	62
Gender Identity	63
Private Instruction	63
Years of Experience	64
Musical Achievement	65
Correlations.....	66
Multiple Regression Analysis.....	67
CHAPTER V: DISCUSSION.....	70
Purpose Statement.....	70
Summary of the Results	70
Grit and Musical Achievement	70
Socioeconomic Status and Musical Achievement	70

Race, Ethnicity, and Musical Achievement	71
Gender Identity and Musical Achievement	71
Private Instruction and Musical Achievement	71
Years of Experience and Musical Achievement	72
Additional Significant Correlations	72
Implications of the Findings	73
Grit	73
Socioeconomic Status	74
Race and Ethnicity	75
Gender Identity	76
Private Instruction	77
Years of Experience	77
Additional Significant Correlations	77
Limitations	78
Applications and Recommendations for Future Practice and Research	79
REFERENCES	82
APPENDIX A: SHORT GRIT SCALE.....	127
APPENDIX B: DEMOGRAPHIC QUESTIONNAIRE	129
APPENDIX C: IRB APPROVAL NOTICE.....	131
APPENDIX D: CONSENT FOR A MINOR TO ACT AS A HUMAN PARTICIPANT	132
APPENDIX E: ASSENT TEMPLATE FOR MINORS 12-17.....	135
APPENDIX F: CONSENT TO ACT AS A HUMAN PARTICIPANT.....	138

LIST OF TABLES

Table 1. Overview of Participant Characteristics	53
Table 2. Sample Grit-S Scale Scores	61
Table 3. Sample Socioeconomic Status (SES).....	62
Table 4. Sample Race and Ethnicity	63
Table 5. Sample Gender Identity	63
Table 6. Pearson Product-Moment Correlations Between Variables	67
Table 7. Final Model Summary	68
Table 8. Regression Coefficients for Final Model.....	69

LIST OF FIGURES

Figure 1. Sample Years of Private Lessons	64
Figure 2. Sample Years of Experience	65
Figure 3. Sample Musical Achievement Level.....	66

CHAPTER I: INTRODUCTION

Helping students achieve musical success is a central goal of string teachers. Competent teachers can identify high or low levels of musical achievement, but understanding the variables that contribute to a student's musical success and how the teacher could best interact with these variables for the benefit of the student is a complex task. Countless factors—both genetic and environmental—can influence a young person's musical development. For those who are interested in making string instruction accessible, sustainable, and effective, investigating and applying musical achievement research is essential.

Foundational Research on Musical Achievement

A combination of genetic and environmental factors has likely helped successful musicians reach a high level of musical achievement. Musical aptitude—a combination of one's genetic talent for music and musical skills that develop without formal training (Radocy & Boyle, 1979)—has been measured for decades. Twentieth-century scholars such as Bentley (1969), Gordon (1965), Seashore et al. (1960), and Wing (1962) developed a variety of measures of musical aptitude. Other scholars have used these measures to support a positive relationship between musical aptitude and achievement (Hambrick & Tucker-Drob, 2015; Schleuter, 1978; Zdzinski, 1992). Alternatively, research on deliberate practice has supported the argument that many people have reached high levels of musical achievement by investing in mindful, consistent, goal-directed practice behaviors (Bonneville-Roussy & Bouffard, 2015; Ericsson & Charness, 1994; Ericsson et al., 1993; Miksza, 2007).

Measuring Musical Achievement

Measuring musical achievement gained popularity in the mid-1900s. During this early stage of research, scholars often defined musical success in terms of auditory-visual

discrimination skills (Colwell, 1963; Stecklein & Aliferis, 1957). They used instruments like the *Aliferis Musical Achievement Test* (Aliferis, 1954), *Farnum Music Notation Test* (Farnum, 1950), and *Knuth Achievement Tests* (Knuth, 1967), which required participants to be able to read Western music notation.

Researchers also began measuring music performance achievement in the mid-1900s, but they often focused on the performance of individual musical elements. In one study, Hodges (1975) examined the effect of recorded aural models on the performance achievement of beginning band students; tone, pitch, rhythm, pulse, and dynamics were measured to determine degree of performance achievement. Suchor (1977) and Schleuter (1978) approached the measurement of musical achievement somewhat more generally. They examined broad categories of expressive and technical performance skills (Suchor, 1977) and tonal, rhythmic, physical, and general performance skills (Schleuter, 1978).

This trend of measuring individual elements of musical achievement has continued across time. Zdzinski (1993) examined the effect of parental involvement, music aptitude, grade level, and gender on music performance achievement. More recently, Miksza (2007) investigated the relationship among observed and self-reported practice behaviors and the performance achievement of high school wind players. Both researchers used the *Watkins-Farnum Performance Scale* (Watkins & Farnum, 1954) and *Performance Rating Scale Supplement* (Zdzinski, 1993) to measure individual objective and subjective elements of musical performance, respectively (Miksza, 2007; Zdzinski, 1993).

Although musical achievement has regularly been operationalized in terms of individual elements of musical performance, this definition was too narrow for the purpose of the present study. It did not account for the difficulty level of the repertoire that students were capable of

performing. To accommodate for the wide range of ability and experience levels of the participants in this study, a measure that took repertoire level into account was necessary.

Need for the Study

Grit has been identified as an important skill related to student success, but some researchers have also questioned the impact of this noncognitive skill on achievement. Many scholars have criticized the teaching and reinforcement of student grit arguing that teaching students to develop grit has dismissed issues related to systemic racism, poverty, and gender inequality (Love, 2019; Mehta, 2015; Strauss, 2016). In a world where these barriers have supported inequity and injustice across time, developing grit has not automatically led to student achievement. People have not been able to erase societal barriers simply by being gritty. Alternatively, McCall (2015) found that grit was one of the tools that people from marginalized populations used to help them achieve success.

Demographic variables have also been related to student achievement. Researchers have continued to add to a large body of work related to the achievement gap among students of various demographic groups. Most notably, researchers have studied differences in achievement between students of different races, genders, and socioeconomic backgrounds (e.g., Baird, 2012; Bergen et al., 2016; Gordon, 2018; Guiso et al., 2008; Hyde et al., 2008; Muller et al., 2010). To better serve their students, design instruction, and advocate for increased access to instruction, teachers have had to learn more about how these demographic and noncognitive variables have impacted student achievement.

Purpose Statement and Research Questions

The purpose of this quasi-experimental study was to investigate the variables that best predict string students' musical achievement. Which of the following variables included in the

study predicted string students' musical achievement: grit, private lessons, socioeconomic status, race, or gender?

Five independent variables—grit, socioeconomic status, race, gender, and private lessons—were isolated for the purpose of this study. Music performance achievement was measured by comparing participants' self-reports of the most recent solo pieces they had studied to the graded repertoire list found in the American String Teachers Association's *String Syllabus: Volume One, 2009 Edition*. Possible relationships between musical achievement and the five independent variables were examined.

Definition of Terms

Musical Achievement

Musical achievement within the Western classical tradition has been defined as “general musical knowledge, knowledge of notation, aural-visual skills, and composition as well as performance” (Boyle & Radocy, 1987, p. 157). The focus of the present study was string instrument music performance achievement, specifically. Music performance achievement was defined by the level of solo repertoire (1-11) most recently performed by the participant and was measured using an 11-point Likert-type scale. Musical achievement as a dependent variable is described on p. 8.

Grit

Duckworth et al. (2007) defined grit as “perseverance and passion for long-term goals” (p. 1087). Perseverance has referred to persistently working toward a goal, despite challenges and setbacks. Passion has been defined as consistency of interest over time (Duckworth, 2016). In the present investigation, grit, grit-passion, and grit-perseverance scores were measured using

the 8-Item Grit Scale (Duckworth & Quinn, 2009). Grit as an independent variable is described on p. 16.

Socioeconomic Status

Socioeconomic status (SES), as defined by the American Psychological Association (2020, p. 147), “encompasses not only income but also educational attainment, occupational prestige, and subjective perceptions of social status and social class.”. In this study, socioeconomic status was a categorical variable with two levels: low SES and high SES. At the undergraduate level, low-SES participants were those who qualified for a Federal Pell Grant, while high-SES participants were those who did not. Federal Pell Grants have been historically awarded to “undergraduate students who display exceptional financial need” and “[do] not have to be repaid, except under certain circumstances” (Federal Student Aid, n.d.). At the middle and high school level, low-SES participants were those who qualified for free or reduced-price meals, while high-SES participants were those who did not. Students were eligible for free meals or reduced-price meals if their annual household income was less than 130% or 185% of the 2022 Federal Income Poverty Guidelines, respectively (United States Department of Agriculture, 2022). Socioeconomic status as an independent variable is described on p. 25.

Race and Ethnicity

Race has been defined as “physical differences that groups and cultures consider socially significant” (American Psychological Association, 2020, p. 142). Ethnicity has referred “to shared cultural characteristics such as language, ancestry, practices, and beliefs” (American Psychological Association, 2020, p. 142). In the present study, participants selected their race or ethnicity from the list of categories included in the United States census questionnaire (White, Black/African American, American Indian/Native Alaskan, Asian, Native Hawaiian/Other

Pacific Islander, Hispanic/Latinx) or had the option to write in their own race or ethnicity. Race and ethnicity as independent variables are described on p. 35.

Gender Identity

The American Psychological Association (2020) defined gender identity as “a component of gender that describes a person’s psychological sense of their gender” (p. 138). In the present inquiry, participants were asked to choose the gender with which they most closely identified (female or male) or to write in their gender identity. Gender identity as an independent variable is described on p. 45.

Private Instruction

In the present study, private instruction referred to weekly one-on-one violin, viola, cello, or double bass lessons with an applied teacher. The researcher found the number of months or years that each participant had received private instruction on their primary instrument through a self-report survey. Private instruction as an independent variable is described on p. 49.

Limitations

The following limitations should be considered when interpreting the results of this investigation. First, the sample ($N = 60$) was limited to middle school, high school, and university students living in Greensboro, North Carolina and enrolled in one of three organizations: (a) the Peck Alumni Leadership Program, (b) the Greensboro Symphony Youth Orchestras, or (c) The University of North Carolina Greensboro. Results of this study may not be generalizable beyond this sample. Second, as noted earlier in this manuscript, there are many variables that could predict the music performance achievement of string students, but only a select few were examined in this study. Other variables that were not included in this study could be stronger predictors of musical achievement.

Finally, the measurement tools employed in this investigation were imperfect. The measure of music performance achievement only accounted for the level of repertoire the participants were studying, not how well they were playing that repertoire. Some participants may have been learning solos that were either too difficult or too easy for them and did not accurately reflect their level of competence on their instrument. All data collected were also self-reported. There has always been danger of social desirability bias with self-report data (Duckworth et al., 2007). Participants may have reported more socially acceptable rather than honest responses on the 8-Item Grit Scale or demographic questionnaire in an attempt to be viewed more favorably by the researcher.

CHAPTER II: REVIEW OF LITERATURE

Researchers have examined the relationships between achievement and numerous variables to help explain why two equally talented or intelligent people have achieved different levels of success. Duckworth, et al. (2007) conducted a series of studies investigating the relationship between grit and the success of various populations (i.e., Ivy League undergraduates, West Point cadets, and children participating in the National Spelling Bee); the researchers found that grit, a noncognitive trait, accounted for a significant portion of the variance in achievement among cognitively similar individuals. Demographic variables and individualized instruction have also influenced achievement, but findings have been mixed (Buckhalt, 2011; Gordon, 2018; Lorah et al., 2014; Madura, 1996; Wright, 2001; Zdzinski, 1992).

Musical Achievement

Outstanding musicians have captivated audiences throughout history. Understanding how these elite performers attained such high levels of musical prowess is interesting, especially for music teachers who want students to be successful and audiences to have positive experiences during student performances. Though not all music students will go on to become professional musicians, they should leave the music classroom with the requisite skills to be successful in any musical setting they choose.

Boyle and Radocy (1987) defined musical achievement within the Western classical music tradition as having five components: “general musical knowledge, knowledge of notation, aural-visual skills, and composition as well as performance” (p. 157). Between these five components and the myriad factors that have been shown to impact musical achievement, studying students’ musical success has been a complex task (Nogaj & Ossowski, 2015). To

narrow the scope of the current manuscript, the researcher focused specifically on string instrument performance achievement.

Musical Achievement as a Dependent Measure

One of the most influential theories related to string instrument performance achievement has been the deliberate practice theory. K. Anders Ericsson and colleagues proposed this theory in the early 1990s, stating that differences in achievement correlated with differences in deliberate practice (Ericsson & Charness, 1994; Ericsson et al., 1993; Ericsson & Pool, 2016; Ericsson & Smith, 1991; Ericsson & Ward, 2007; Feltovich et al., 2018). They defined deliberate practice as the use of specific, effortful, goal-directed strategies to improve performance. Numerous researchers also noted that this type of practice was not inherently enjoyable and needed to be monitored by a knowledgeable teacher or coach (Ericsson et al., 1993; Ericsson & Pool, 2016; Ericsson & Ward, 2007).

Reaching a high level of music performance achievement (or superior levels of expertise in any domain) takes time. Ericsson and colleagues proposed that the time needed for experts to develop their skills was at least 10,000 hours of deliberate practice over the course of a decade (Ericsson & Crutcher, 1990; Ericsson et al., 1993). For string players who aspire to pursue music as a career, researchers have suggested that music instruction should begin early so a student can accumulate these 10,000 hours by the time they are teenagers (Lehmann et al., 2018).

Other researchers have also found relationships between deliberate practice and music performance achievement. Sloboda et al. (1996) examined the practice behaviors and musical achievement of 257 beginning and intermediate instrumental music students and found a strong relationship between deliberate practice and performance achievement. Miksza (2007) and Bonneville-Roussy and Bouffard (2015) found similar results in studies of the practice behaviors

of music students; though no significant relationship was found between amount of time practiced and performance achievement, performance achievement was significantly related to the use of deliberate practice strategies in both studies.

Platz et al. (2014) conducted a meta-analysis of the influence of deliberate practice on musical achievement. They examined 13 studies that investigated the practice behaviors of beginning through professional musicians ($N = 788$). These studies were selected because they reported durations of deliberate practice and objective assessments of musical achievement. Platz et al. (2014) found an aggregated medium-large effect size of $r_c = 0.61$; 95% CI [0.54, 0.67] for the relationship between deliberate practice and musical achievement. These results supported the notion of deliberate practice as an important predictor of music performance achievement.

Despite the evidence supporting Ericsson's theory of deliberate practice, researchers examining musical achievement found that a single factor theory of expertise was insufficient (Ullén et al., 2016; Ullén et al., 2017; Wesseldijk et al. 2019). Researchers have investigated many independent variables as they related to the dependent variable of musical achievement. Though the following list is not exhaustive, some of these independent variables have included: (a) genetic and environmental factors (Hambrick & Tucker-Drob, 2015; Wesseldijk et al., 2019); (b) music aptitude (Schleuter, 1978); (c) family and social support (Csikszentmihalyi et al., 1993; Manturzevska, 1990; Nogaj & Ossowski, 2015; Zdzinski, 1996); (d) self-regulation and motivation (Bonneville-Roussy & Bouffard, 2015; Evans & Bonneville-Roussy, 2016); and (e) self-efficacy (McPherson & McCormick, 2006).

The debate between nature and nurture is not novel, but it certainly does relate to musical achievement. Are children born with a genetic predisposition for musical success, or do they become successful musicians because of their training and environment? How do environment

and genetics correlate or interact in the context of musical achievement? These were some of the questions that Hambrick and Tucker-Drob (2015) investigated using a sample of twins ($N = 850$). The researchers found that both genetics and environment were significant predictors of musical achievement and music practice ($p < .001$). Just less than 25% of the genetic effect on musical achievement was explained by the genetic effect on music practice. These findings suggested that other genetically influenced variables accounted for a substantial percentage of musical achievement. Wesseldijk et al. (2019) found similar results.

One of the genetically influenced variables that may have accounted for some of the variance in musical achievement was musical aptitude (Hambrick & Tucker-Drob, 2015). “Radocy and Boyle (1979, p. 263) define[d] aptitude as including the result of genetic endowment and maturation plus whatever musical skills may develop without formal musical education” (Boyle & Radocy, 1987, p. 139). Many measures of music aptitude were developed during the middle of the 20th century (Bentley, 1969; Gordon, 1965; Seashore et al., 1960; Wing, 1962), and researchers across time have studied the music aptitude of various populations. For example, Schleuter (1978) found a significant effect ($p < .01$) of music aptitude on instrumental musical achievement, rhythmic skills, and tonal skills among elementary instrumental music students. Dregalla (1983) and Brokaw (1983) substantiated these findings. Zdzinski (1992) also found a strong relationship between music aptitude and both musical achievement and music performance achievement among middle school wind players.

Beyond genetics, many researchers have investigated the relationship between family and social support and musical achievement. Commonalities among families of successful young musicians have included emotional stability, task-orientation, and strong support of and willingness to change their lifestyles to support the child’s musical endeavors (Csikszentmihalyi

et al., 1993; Manturzevska, 1990). Alternatively, results from research on the relationship between parental involvement and musical achievement have been mixed. Zdzinski (1996) found a significant difference between parental involvement and musical achievement at the elementary level, but not at the secondary level ($p < .01$). Nogaj & Ossowski (2015) found no relationship between parental support and musical achievement among music school students; instead, the student's primary instrumental music teacher played an important role in predicting musical achievement for these students.

Noncognitive skills such as self-regulation, motivation, self-efficacy, and grit have also been shown to influence aspects of musical achievement (Bonneville-Roussy & Bouffard, 2015; Evans & Bonneville-Roussy, 2016; McPherson & McCormick, 2006; Miksza & Tan, 2015). Grit will be discussed in greater detail later in this manuscript. Research on self-regulation, motivation, and self-efficacy as they relate to musical achievement are discussed here.

Scholars have defined self-regulated learning as active, thoughtful, and behavioral participation in one's own learning and have found a positive relationship between self-regulated learning and academic achievement (Pintrich & de Groot, 1990; Zimmerman, 2002). Bonneville-Roussy and Bouffard (2015) found this same relationship among adolescent and young adult musicians. They also found deliberate practice to be significantly correlated with musical achievement ($p < .01$), supporting the work of Ericsson and colleagues (Ericsson & Charness, 1994; Ericsson et al., 1993; Ericsson & Pool, 2016; Ericsson & Smith, 1991; Ericsson & Ward, 2007; Feltovich et al., 2018).

Evans and Bonneville-Roussy (2016) also supported the deliberate practice theory and a possible correlation between motivation and musical achievement. In this study, the researchers examined the motivation and practice behaviors of university music students. They found

motivation was a significant predictor of practice time, time spent on deliberate practice, and a higher preference for difficult tasks ($p < .001$). If deliberate practice has predicted musical achievement and motivation has predicted deliberate practice, then future research should investigate the relationship between motivation and musical achievement.

Self-efficacy is another noncognitive skill that has gained popularity in recent research. Bandura (1997) defined self-efficacy as “the conviction that one can successfully execute the behaviour required to produce the outcome” (p. 79). Jinks and Lorsback (2003) identified self-efficacy as an “antecedent to academic success because it motivates behavior (primarily perseverance) that leads to success” (p. 113). Scholars have corroborated these definitions through research in which they found self-efficacy to be a consistent predictor of students’ musical achievement.

Measurement of Solo Musical Performance Achievement

The measurement of musical performance achievement is inherently subjective and imperfect. Though there are some elements of performance that can be measured objectively with the assistance of technology (i.e., pitch or volume), most elements of performance are interpreted differently by different listeners—and even pitch and volume can be perceived and interpreted differently by different people. Musical decisions about phrasing, tempi, and tone are also subjective and difficult to measure. “While one may structure a performance measurement process to enhance objectivity and minimize nonmusical aspects, it can never be as objective as a multiple-choice test” (Boyle & Radocy, 1987, p. 171).

Because of the subjectivity of the measurement of music performance achievement, researchers have approached this challenge in many ways. Some have sought to measure individual musical factors such as tone or pitch (Brick, 1984; Gordon, 1960; Lanier, 1960), while

others have tried to use more global measures of music performance achievement (Miksza, 2007; Schleuter, 1978; Zdzinski, 1993). Many researchers have developed performance rating scales (Abeles, 1973; Bergee, 1987; Russell, 2007; Watkins, 1942; Watkins & Farnum, 1954; Zdzinski & Barnes, 2002). Some have used grades in performance-based courses (Bonneville-Roussy & Bouffard, 2015; Nogaj & Ossowski, 2015), ensemble placement (Geringer et al., 2015), or scores on national music examinations (Elpus, 2022; McPherson & McCormick, 2016; Sloboda et al. 1996) as measures of music performance achievement. Coon and Carey (1989) also noted that expertise researchers have commonly used self-report measures of creative achievement. Clearly, there have been as many ways to measure music performance achievement as there have been people to do the measuring.

The first known systematic inquiry related to solo instrumental music performance measurement was conducted by Watkins (1942). Watkins developed a rating scale for cornet performance that consisted of written cornet exercises arranged in increasing order of difficulty. In 1954, Watkins and Farnum designed the *Watkins-Farnum Performance Scale* by transposing the exercises from the cornet rating scale for all wind and percussion instruments and snare drum. Farnum created the *Farnum String Scale* (a similar measure for orchestral string instruments) in 1969. All three of these measures require musicians to be able to read Western music notation and are scored in similar ways.

The Watkins and Farnum measures of music performance achievement are scored by subtracting points for errors within each measure of music. Russell (2007) explained that:

[p]oints are deducted for errors in pitch and rhythm as well as tempo, dynamics, articulations, and other written musical directions. Only one error can be scored in any

one measure. This binary state of correctness, present or not present, does not account for the intensity of an error within a measure. (p. 57)

Some have criticized the Watkins and Farnum measures for their inability to account for the frequency of errors in one measure and the inability to measure the expressive elements of music like phrasing or tone (Bergee, 1987; Zdzinski, 1991). These measurement scales have produced high reliability coefficients, but their validity has been low to moderate (Stivers, 1972). To combat these validity problems, some have suggested supplementing the Watkins and Farnum rating scales with other measures to obtain a more complete picture of music performance achievement (Miksza, 2007; Stivers, 1972; Zdzinski, 1993).

To obtain greater accuracy in the measurement of music performance achievement, scholars began developing facet-factorial rating scales. The facet-factorial approach involves systematically identifying common assessment criteria for a given instrument or instruments. Abeles (1973) conducted a seminal study in which he developed the first facet-factorial scale to measure instrumental music performance. The *Clarinet Performance Rating Scale* (Abeles, 1973) included five categories related to successful clarinet performance and served as a model for the construction of facet-factorial rating scales that have been used to measure vocal (Jones, 1986), tuba and euphonium (Bergee, 1987), snare drum (Nichols, 1985), string instrument (Zdzinski & Barnes, 2002), and guitar (Russell, 2007) performance, among others. The reliability and validity coefficients for the scales by Bergee (1987) and Abeles (1973) have been calculated and found to be greater than .80, providing support for the use of facet-factorial scales to measure music performance achievement.

The *String Performance Rating Scale* (Zdzinski & Barnes, 2002) and *Aural Music Performance Quality Measure* (Russell, 2010) are particularly interesting to consider in

relationship to the present study. The *String Performance Rating Scale* is a facet-factorial rating scale that was specifically designed to measure string instrument performance. The five factors included in the *String Performance Rating Scale* are: (a) interpretation/musical effect, (b) articulation/tone, (c) intonation, (d) rhythm/tempo, and (e) vibrato. Also a facet-factorial scale, the *Aural Music Performance Quality Measure* was developed to measure the music performance of vocalists and brass, woodwind, and string players. Though both the *String Performance Rating Scale* and *Aural Music Performance Quality Measure* seem like promising measures of musical achievement worthy of further study, the purpose of both is to measure the quality of a given performance; neither account for the level of the repertoire being performed (Russell, 2010; Zdzinski & Barnes, 2002).

Another popular type of measurement of music performance achievement is the criteria-specific rating scale. When using a criteria-specific rating scale, the goal is to objectively measure music performance while also providing specific feedback to the student and teacher. Criteria-specific rating scales include descriptions of the ratings and skills being assessed so that students can more easily use the assessment tool to help them improve (Whitcomb, 1999). One of the first criteria-specific rating scales was developed by Kruth (1973) for use with clarinetists. Unfortunately, the criteria were so specific that the resulting 10-page rating scale was too long to use efficiently. Since then, other researchers have successfully developed and used criteria-specific rating scales with vocal (Levinowitz, 1989) and band (Azzara, 1993; Saunders & Holahan, 1997) students.

Grit

Psychologists and researchers have found that grit, a noncognitive trait defined as “perseverance and passion for long-term goals” (Duckworth et al., 2007, p. 1087), has been an

important factor related to student achievement and engagement in various domains (Cosgrove et al., 2018; Duckworth & Quinn, 2009). Students who worked diligently toward a specific goal (like learning to play a string instrument) over a long period of time were more likely to overcome setbacks and be successful (Dweck et al., 2014).

Researchers and scholars have challenged the construct of grit and questioned its relationship to achievement and systemic issues in society. Grit has been shown to account for an average of only 3-6% of the variance in achievement outcomes across domains and ages (Duckworth et al., 2007; Steinmayr et al., 2018). Some researchers have also found only low-to-moderate correlations between grit and achievement (Cousins et al., 2020; Silvia et al., 2013; Ueno et al., 2018). Other scholars have questioned the importance of grit because simply being gritty has not erased systemic barriers to success related to racism, poverty, or gender inequality (Love, 2019; Mehta, 2015; Nathan, 2017; Thomas, 2015).

Duckworth (2016) found that grit was a malleable trait that could change throughout a person's life and in different contexts. Park et al. (2018) substantiated Duckworth's claim through a longitudinal study in which they found that changes in students' perceptions of the goals of their school (mastery vs. performance) predicted changes in students' grit levels. Cupitt and Golshan (2015) found that grit correlated with age; people generally became grittier as they got older. Duckworth (2016) also suggested that both psychological and social factors contributed to the development of grit. The four psychological factors Duckworth cited were: (a) interest, (b) practice, (c) purpose, and (d) hope. The social factors included: (a) parenting, (b) extracurricular activities, and (c) culture.

More broadly, researchers found that grit was comprised of two component parts: perseverance and passion. Both components have been measured using the 12-Item (Duckworth

et al., 2007) or 8-Item (Duckworth et al., 2007; Duckworth & Quinn, 2009) Grit Scale. Most people have exhibited scores for perseverance that were higher than those for passion (Duckworth, 2016). This has been particularly true for children and adolescents, perhaps because young people are still exploring various interests and have not yet had enough autonomy to make their own decisions about their engagement with these interests (Duckworth, 2016; Flunger et al., 2016). Though perseverance and passion have been positively correlated, these discrete components of grit have been shown to account for unique variance in achievement (Eskreis-Winkler et al., 2014; Hochanadel & Finamore, 2015).

Grit – Passion

Maintaining interest in a single goal over time is one component of grit (Duckworth, 2016). Unlike the familiar definition of passion as “a strong liking or desire for or devotion to some activity, object, or concept” (Merriam-Webster, Incorporated, n.d.), Duckworth’s (2016) definition involves staying loyal to something for enough time to achieve excellence. Passion begins with enjoying what one does and eventually leads to the belief that one’s work matters to others (Duckworth, 2016). Two psychological factors related to passion—interest and purpose—are discussed in the following paragraphs.

Interest, the first psychological factor related to passion, develops through experimentation and discovery over time. Interests flourish with the support of a community—parents, teachers, friends. Young people developing an interest require encouragement, autonomy to play and explore, and only small amounts of corrective feedback. Too much criticism too soon could quickly extinguish a budding interest (Bloom, 1985; Côté et al., 2013; Duckworth, 2016; Renninger & Hidi, 2016).

The second psychological factor related to passion is purpose: “the intention to contribute to the well-being of others” (Duckworth, 2016, p. 143). Though purpose often develops after interest and practice (which will be discussed in the next section), sometimes purpose comes first. Those cultivating a sense of purpose may benefit from the following: (a) reflecting on how they could make a positive impact on society through their interests (Yeager et al., 2014); (b) reflecting on how they could transform their work to increase its meaning and connection to their values (Wrzesniewski & Dutton, 2001); and (c) finding a role model who is purposeful (Damon, 2008). Young people discovering their purpose might also benefit from opportunities to help others (Duckworth, 2016).

Grit – Perseverance

Persistently working toward a goal, despite difficulties and setbacks, is the second component of grit (Duckworth, 2016). This definition of perseverance is common and has been studied by various scholars. Specifically in the field of music education, researchers have found that participation in instrumental music programs and increased teacher approval correlated with increased task perseverance (Devroop, 2012; Scott, 1987). Perseverance involves deliberate practice and hope for the future (Duckworth, 2016). Two psychological factors related to perseverance—practice and hope—are discussed in the following paragraphs.

Practice is the first psychological factor related to perseverance and generally follows an initial interest in a particular domain (Bloom, 1985; Duckworth, 2016). Deliberate practice specifically involves: (a) defining a clear and specific stretch goal, (b) devoting full concentration and effort to the task, (c) receiving immediate and specific feedback, and (d) repeating the task with reflection and improvement (Ericsson et al., 1993). Young people engaging in deliberate practice should incorporate their practice into their daily routines

(Ouellette & Wood, 1998). If possible, they should also find a teacher or mentor who can guide their practice and model objective responses to failure (Duckworth, 2016).

Hope, the second psychological factor related to perseverance, “rests on the expectation that our own efforts can improve our future” (Duckworth, 2016, p. 169). This definition relates to attribution theory, the idea that people want to know why specific events occurred (Weiner, 2018); if one believes their hard work yields positive results, they may be more hopeful and grittier. Unfortunately, young people who have experienced adversity with no way to improve their situation (i.e., those from low socioeconomic backgrounds) have often developed inappropriate beliefs about attribution (Maier & Seligman, 1976), which could eventually lead to decreased hope and grit. Young people looking to learn hope should first know that many cognitive and noncognitive traits (including talent and intelligence) have been shown to be malleable, not fixed (Vukasović & Bratko, 2015). They should also practice positive self-talk (Gillham et al., 1995) and ask for help and support when they need it (Duckworth, 2016).

Grit and Achievement

Psychologist, former teacher, and leading grit scholar Dr. Angela Lee Duckworth stated that she aims to “[u]se psychological science to help kids thrive” (Duckworth, 2016, p. 159). This goal, along with her questions about why two equally talented or intelligent people may reach very different levels of achievement, led to her grit research. The construct of grit has been widely researched since its introduction in the field of psychology, but further research is necessary to determine exactly how grit functions in relation to achievement longitudinally and in various domains and cultures (Cousins et al., 2020; Tang et al., 2019).

Duckworth et al. (2007) developed the hypothesis that grit had a strong positive relationship with achievement during interviews with leaders in various professional fields.

These leaders noted that some of the most successful people in their fields did not initially seem competent and that some of the most talented people were not the most successful. In their first studies, Duckworth et al. (2007) developed and validated the Grit-O Scale that they would use to measure grit across a variety of populations and found that grittier adults attained higher degrees of education and made fewer career changes than less gritty people of the same age. The Grit-O Scale consists of 12 items – six related to passion and consistency of interest (i.e., “I often set a goal but later choose to pursue a different one”) and six related to perseverance (i.e., “I have achieved a goal that took years of work”). Subjects respond to each item on the Grit-O Scale using a five-point Likert scale ranging from 1 = “not at all like me” to 5 = “very much like me” (p. 1090).

Following these initial studies and the development of the Grit-O Scale, Duckworth et al. (2007) measured grit among undergraduates at an elite university, students at the West Point Military Academy, and children and adolescents in the Scripps National Spelling Bee finals. Consistent with their previous research, Duckworth et al. (2007) found that grittier undergraduates had higher GPAs than less gritty undergraduates with higher SAT scores. They found that grit was a better predictor of retention during the first summer at West Point than was self-control or West Point’s Whole Candidate Score, the metric for entrance into the Military Academy. Finally, they found that the grittiest finalists in the Scripps National Spelling Bee studied and practiced the hardest and longest and performed better than their less gritty peers (Duckworth et al., 2011). Duckworth et al. (2007) synthesized the results of the previous studies and concluded that achievement was the result of both talent and grit.

Since these initial grit studies, Duckworth and many other scholars have investigated the relationship between grit and achievement in academics, athletics, music, and other domains.

Some researchers have examined grit as a single construct, while others have differentiated between grit-passion and grit-perseverance. Research findings have been inconsistent.

Researchers have posited grit as highly influential in predicting academic achievement in some settings. Alhadabi & Karpinski (2020) found that grit-passion and grit-perseverance were positively and significantly ($p < .05$) correlated with GPA among graduate and undergraduate students at a large, public, Midwestern university in the United States. Many other empirical studies have also shown that grit played an important role in an individual's academic achievement throughout adolescence and early adulthood (Akos & Kretchmar, 2017; Cosgrove et al., 2018; Duckworth & Quinn, 2009; Hodge et al., 2018; Pate et al., 2017; Tang et al., 2019). Al-Mutawah & Fateel (2018) found a positive and significant ($p < .01$) correlation between Grit-O Scale scores and mathematics exam scores among secondary-school students in Bahrain; however, they did not find a significant correlation between Grit-O Scale and science exam scores. Some researchers have not found any positive correlations between grit and academic achievement (Bazelais et al., 2016; Cross, 2014; Rojas, 2015).

Because of the inconsistencies in the extant literature, Lam and Zhou (2019) conducted a meta-analysis of empirical findings from 44 articles focused on the relationship between grit and academic achievement. They thoroughly examined relevant literature on grit and its component parts (passion and perseverance) in relation to academic achievement of K-12 and higher education students. Lam and Zhou (2019) found that grit had a greater impact on the achievement of K-12 students than that of university students. They also found that perseverance was more strongly associated with achievement than was passion. Since they found no significant differences between grit and academic achievement across different types of

achievement measures, they suggested this as strong evidence of the positive relationship between grit and academic achievement.

Within the field of athletics, empirical investigations have also yielded mixed results but provided stronger evidence for a correlation between grit and athletic achievement. For example, Cazayoux and DeBeliso (2019) examined grit scores of CrossFit athletes and found that advanced CrossFit athletes scored significantly higher ($p < .05$) than novice CrossFit athletes on the Grit-O Scale and the grit-passion subscale; the effect size was moderate ($d = .57-.59$). Other researchers have also found positive relationships between grit and athletic performance (Ansah & Apaak, 2019; Elumaro, 2016; Larkin et al., 2016; Sigmundsson et al., 2020). Results of other studies showed that grit and athletic achievement were unrelated (Criticos et al., 2020; Joseph, 2009; Sakamoto et al., 2018; Ueno et al., 2018).

Cormier et al. (2021) conducted a scoping review of the literature related to grit and athletics. A scoping review involves “map[ping] the literature on a particular topic or research area [to] provide an opportunity to identify key concepts, gaps in the research; and types and sources of evidence to inform practice, policymaking, and research” (Daudt et al., 2013, p. 8). No statistical analyses were conducted in this review, but Cormier et al. (2021) did find evidence to support the continued investigation of grit as a predictor of athletic achievement. Of the 29 studies included in this review that focused on grit and athletic achievement, 19 showed that grit and athletic achievement were positively related in some way.

Few researchers have examined the possible relationships between grit and musical achievement. Miksza and Tan (2015) conducted the first known study of grit and music education and found that grit significantly predicted efficiency, flow, and self-efficacy for self-regulation in practice. Though these were not specifically achievement outcomes, research has

shown that quality of deliberate practice has predicted achievement (Ericsson et al., 1993; McPherson, 2005; Williamon & Valentine, 2000). Taken together, these findings suggested that if grit may have led to more deliberate practice (Miszka & Tan, 2015) and deliberate practice may have led to higher performance achievement (Ericsson et al., 1993; McPherson, 2005; Williamon & Valentine, 2000), then grit may be able to predict musical achievement. Future research related to grit and musical achievement is needed to investigate this possibility.

Critiques of Grit

In addition to critiquing the mixed findings related to grit and achievement in the research literature, many scholars have criticized the teaching and reinforcement of student grit. They have stated that teaching students to develop grit is dismissive of issues related to systemic racism, poverty, and gender inequality (Kohn, 2014; Love, 2019; Mehta, 2015; Nathan, 2017; Thomas, 2015). In a world where these barriers have historically supported inequity and injustice, developing grit will not automatically lead to student achievement. One cannot erase societal barriers simply by being gritty.

In one study supporting the opinion pieces mentioned above, Dixson et al. (2017) examined the relationship between academic achievement, grit, socioeconomic status, and other demographic and noncognitive variables in a sample of high-achieving African American high school students. Their purpose was to determine if any of the noncognitive variables predicted student achievement beyond the contribution of the demographic variables. The researchers found that SES significantly predicted about 17% of the variance in academic achievement, while grit and the other noncognitive variables decreased the prediction of the regression model by 1-2% ($p < .001$).

On the other hand, researchers have shown that grit has been one of many tools that people from marginalized populations used to help them achieve success. McCall (2015) used Duckworth's Grit-S Scale (8-Item Grit Scale) and a series of interviews to measure degree perseverance among African American graduate students at Predominantly White Institutions who had attended Historically Black Colleges or Universities for their undergraduate degrees. She compared Grit-S Scale scores with interview data to learn more about how participants' past experiences helped them develop their perseverance skills and grit, how they perceived their own grit and perseverance, and what types of experiences they had at both their undergraduate and graduate institutions. McCall found that participants may have developed their grit by observing others early in life, through their own life experiences, and through their access to capital (i.e., community cultural wealth). Participants also identified parents, teachers, peers, counselors, and other school, church, and home environments as influential in their development of grit.

Further research in grit scholarship is warranted. Scholars in the field of psychology have not presented the construct of grit as a magic bullet to solve all variation in achievement or “[blame] youth for failing in racist systems designed to block their success” (Perry, 2016, np). Instead, grit has been described as a noncognitive trait that could help people increase their chances of success across domains (Cosgrove et al., 2018; Duckworth, 2016; Duckworth & Quinn, 2009) as did the participants in McCall's (2015) study. As Dixson et al. (2017) found, though, grit may not be as impactful as scholars once believed.

Socioeconomic Status

Learning to play a string instrument is often an expensive endeavor. Instruments, rosin, strings, method books, lessons, dues associated with string programs, travel to and from rehearsals, and other costs can add up quickly (Albert, 2006). Children who come from affluent

families may not have to contend with these financial barriers associated with string playing, but students from low-socioeconomic backgrounds may not always be able to afford to enroll or persist with string instruction due to its cost.

Socioeconomic status (SES) is a complex construct that “broadly represents an individual’s or family’s ranking or accumulated capital within a cultural system of social class” (Korous et al., 2022, p. 57). SES encompasses income, education level, occupational prestige, and other subjective perceptions related to social status (American Psychological Association, 2020; Bradley, 2016; Kraus et al., 2017). Due to the myriad components of SES, scholars have defined and operationalized socioeconomic status in many ways. Some have examined measures of discrete elements of SES as a proxy for overall SES (Abril & Gault, 2008; Entwisle & Astone, 1994; Phillips, 2003). Others have collected measures of income, education, and occupation to obtain a more holistic picture of SES (Ensminger et al., 2000; Guo et al., 2022; Johnson, 2017; Miksza, 2007; Miksza & Austin, 2010). Another group has measured individuals’ perceptions of their own socioeconomic standing (Jebson & Moses, 2012; Johnson et al., 2011; Spencer & Castano, 2007).

Income has arguably been the most commonly measured component of SES in the education literature. In a study examining the impact of socioeconomic status and parental expectations on mathematics achievement, Hascoët et al. (2021) asked each participant to indicate their monthly family income (as well as highest level of parents’ education) as a measure of SES. Guo et al. (2022) asked participants whether their family owned a television, washing machine, refrigerator, computer, or vehicle to measure approximate income and SES. In much of the education literature, eligibility for free or reduced-price meals has served as a proxy for income and socioeconomic status (Abril & Gault, 2008; Destin, 2019; Domina et al., 2018;

Fitzpatrick, 2006; Kinney, 2008, 2010, 2019; Kinney & Forsythe, 2005; Lagenkamp & Carbonaro, 2018; Phillips, 2003). One problem with this measure was that it only identified students on the lowest end of the socioeconomic spectrum and did not differentiate between medium and high levels of SES (Harwell & LeBeau, 2010). Although free or reduced-price meal eligibility has been an imperfect measure, other information related to student income has not always been available (Kinney, 2019).

The annual income of a given family can impact a child's learning in many ways. Most obviously, wealthy families have the financial resources to help their children succeed academically. They can hire tutors; enroll their children in extracurricular activities, test preparation programs, and expensive schools; and purchase books and other educational materials for the home (Aikens & Barbarin, 2008; Elpus, 2022). Hascoët et al. (2021) found that higher income correlated with higher parental expectations of their children and higher levels of children's academic achievement. In relation to the present study, wealthy families have also been shown to have the means to expose their children to various arts activities—a behavior that has been reported to be positively associated with achievement and income (National Endowment for the Arts, 2009).

Education level has been a second commonly recognized and tested element of SES. Destin et al. (2019) examined the relationship between socioeconomic status, mindset, and grades among American adolescents. The researchers chose the highest level of maternal education as the primary measure of SES because research has shown this measure to consistently predict academic achievement (Entwisle & Astone, 1994). Other researchers examined maternal and paternal education levels as indicators of socioeconomic status (Elpus, 2022; Elpus & Abril, 2011; Ersan & Rodriguez, 2020). August B. Hollingshead (1975/2011),

former Professor of Sociology at Yale University, developed a Four Factor Index of Social Status that includes seven levels of education ranging from “Less than seventh grade” to “Graduate professional training (graduate degree)” that scholars have used to estimate an individual’s socioeconomic status (Klinedinst, 1991).

Researchers have found that parental education level has impacted children’s achievement. Doyle (2012) found that students from high SES backgrounds were more likely to be surrounded by a high percentage of college-educated adults (including parents, teachers, and other community members). Observing the successes of educated adults has impacted children’s achievement perceptually by helping them envision themselves reaching high levels of education and success (Destin et al., 2012; Johnson et al., 2011; Oyserman & Lewis, 2017). It also stands to reason that educated parents would be well-equipped to help their children with their schoolwork. Future research could explore the relationship between parental education and student achievement further.

Occupational prestige has been defined as the third component of SES. Though various populations have defined occupational prestige in slightly different ways, the factors often related to this construct have included: (a) the average income level associated with an occupation, (b) the average level of education required to pursue an occupation, and (c) the nature of the tasks performed in an occupation (Duncan, 1961; Ganzeboom, 2010; International Labour Organization, 2012). Sociologists have examined these factors in their development of measures of occupational prestige. Duncan’s (1961) *Socioeconomic Index for All Occupations* was one of the first of these and was based on the average income and education level of a given occupation in 1950. This measure is still used by scholars today (e.g., Doyle, 2012; King & Trinidad, 2021) but has been criticized for its inability to account for nonfinancial benefits of an

occupation (Jencks et al., 1988). Other measures of occupational prestige that educational researchers have continued to use include the *Four Factor Index of Social Status* (Hollingshead, 1975/2011), *International Socio-Economic Index of Occupational Status* (Ganzeboom et al., 1992), and *International Standard Classification of Occupations* (International Labour Organization, 2012).

Researchers have found that parents' occupational prestige has impacted children's achievement. Like parental education level, occupational prestige has been shown to influence a child's belief of their own possible achievement. Seeing their parent in a prestigious or modest job may have caused children to believe that they were capable of a similar occupation (Johnson et al., 2011; Spencer & Castano, 2007). Researchers have found that students from low-SES backgrounds demonstrated higher levels of motivation in school after they were led to believe in the possibility of social mobility and personal advancement, rather than feeling stuck in their current socioeconomic status (Browman et al., 2017; Destin, 2017; Destin & Oyserman, 2009). Occupational prestige has also affected the social resources to which children have had access (Sirin, 2005). Personal connections established or additional social support a child might receive as a result of a parent's occupation could influence their achievement levels.

Because so many factors have been associated with SES and there have been multiple measures for each factor, the magnitude of the relationship between socioeconomic status and a variety of dependent variables has been ambiguous. The operationalization of SES has caused the most variance in results and interpretation of findings related to socioeconomic status (Sirin, 2005; White, 1982). The next section of this manuscript will focus on the relationship between SES and academic and musical achievement.

Socioeconomic Status and Achievement

All children in the United States are required to attend school between the ages of seven and 16, at a minimum. Some states (e.g., Arkansas, Hawaii, Maryland, New Mexico, and South Carolina) mandate school attendance beginning at age five, and some states (e.g., California, Indiana, Michigan, Ohio, and Tennessee) require children to attend school until age 18 (National Center for Education Statistics, 2017). In Fall 2021, approximately 49.5 million prekindergarten through twelfth-grade students were enrolled in public schools. Although all American children must legally receive a “free and equitable education” (PL 94–142, 1975), close examinations of public schools in various socioeconomic areas have revealed inequities related to access, resources, and instruction (Costa-Giomi & Chappell, 2007; Elpus, 2017). These inequities can exacerbate individual differences in SES and can impact achievement.

In 1966, James S. Coleman et al. published a landmark report in which they claimed that family characteristics (including elements of socioeconomic status) were the most important predictors of achievement in the United States. Released just a year later, the *Children and their Primary Schools* report in the United Kingdom cited socioeconomic issues in need of attention in the public schools (Crown, 1967). Since then, many researchers have investigated the relationship between socioeconomic status and academic achievement in the United States (Bornstein & Bradley, 2003; Bradley & Corwyn, 2002; Duncan et al., 2017) and abroad (de Waal & Pienaar, 2020; Kim, 2019; von Stumm et al., 2019).

Socioeconomic status has been shown to impact student achievement in many ways. Some researchers have simply found a positive relationship between SES and academic achievement in various domains—mathematics (Baird, 2012; Cascella, 2020), language (Bergen et al., 2016; Reardon, 2013), science (Doerschuk et al., 2016), and technology (Murphy, 2020),

for example. Others have found a positive relationship between SES and standard measures of achievement like GPA or standardized test scores (de Waal & Pienaar, 2020; Dixson et al., 2018; Elpus & Abril, 2011). Still others have investigated the relationships between SES, specific mediating or moderating variables, and achievement. Some of these variables have included: (a) sleep (Buckhalt, 2011; Elder et al., 2020); (b) behavior and discipline issues (Blair & Scott, 2002; Dodge et al., 1994); (c) teacher or parent expectations (Doyle, 2012; Hascoët et al., 2021; Love & Kruger, 2005); and (d) psychological variables such as motivation, goal orientation, hope, and mindset (Berger & Archer, 2018; Destin et al., 2019; Dixson et al., 2018; Kraus et al., 2012). Findings related to these mediating and moderating variables have been mixed.

Though the construct of socioeconomic status has usually been applied to individuals, some scholars have studied and described the SES of neighborhoods, schools, and larger communities. In relation to the present study, examining how socioeconomic status has impacted schools and how school SES has impacted children was important. Because schools have been largely funded through property taxes, schools located in areas where property values were low have often received less funding per pupil than schools located in areas where property values were high. Students from low socioeconomic backgrounds have typically attended the schools receiving less funding, while students from high socioeconomic backgrounds have attended the schools receiving more funding per pupil (Kozol, 2005). Researchers have shown that school SES has played an important role in student achievement (de Waal & Pienaar, 2020), sometimes even counteracting the effects of an individual child's SES (Casella, 2020).

Despite the extensive literature that has supported a meaningful relationship between socioeconomic status and academic achievement, some scholars have found no association between SES and achievement (Ripple & Luthar, 2000; Seyfried, 1998). Others have conducted

recent meta-analyses that demonstrated that the correlation between SES and achievement was weak to moderate. Sirin (2005) found that the correlation between SES and achievement ranged from 0.25 to 0.47, depending on how both variables were operationalized. Harwell et al. (2017) also found a weak to moderate correlation of 0.22 between SES and achievement in their meta-analysis. In 2022, Korous et al. substantiated the findings of Sirin (2005) and Harwell et al. (2017) in an overview of meta-analyses in which the researchers found an average correlation of about 0.20. Korous et al. (2022) advocated for future meta-analysts to investigate individual components of SES to help identify which elements of SES led to specific achievement outcomes.

Socioeconomic Status and Musical Achievement

Instrumental music education is expensive. To support an instrumental music program, public schools must be able to afford instruments, music, uniforms, sound equipment, and other items necessary for that specific program. School districts must also hire an instrumental music teacher—another faculty member who must receive a salary. To participate in an instrumental music program, a student’s family must have sufficient financial capital. In many cases, they must be able to buy or rent an instrument, drive a car that allows the student to transport the instrument to and from school, pay dues or registration fees, and pay for private lessons or summer camps. The costs associated with instrumental music education directly impact equitable access, particularly for students from low socioeconomic backgrounds. Students cannot demonstrate musical achievement if they are unable to enroll in music instruction in the first place. Even if they can enroll, they may be unable to persist or they may not have the resources to reach the same levels of achievement as their high-SES peers.

The first way SES may impact students' musical achievement relates directly to access in the public schools. In 2005, Illinois Creates: The Illinois Arts Education Initiative (2006) conducted a survey of superintendents and principals across the state. The researchers found that rural students received the least amount of arts instruction; participating administrators identified budget constraints as one of the primary barriers to offering arts courses. Rural areas traditionally have had a high percentage of low-SES residents (United States Department of Agriculture, 2022). Researchers have also found that high-SES schools offered more music (Parsad & Spiegelman, 2012) and arts (Abril & Gault, 2008) courses than low-SES schools, regardless of urbanicity. String orchestra classes have been particularly underrepresented in low-SES schools. Smith (1997) found that of 14,183 districts offering string instruction across the United States, only 4% of those districts served primarily a low-SES population.

Secondly, SES may impact students'—or their parents'—decisions to enroll or persist in an instrumental music program. Researchers have consistently identified an underrepresentation of students from low-SES backgrounds enrolled in music courses in the public schools (Elpus, 2015, 2022; Elpus & Abril 2011, 2019; Feldman & Matjasko, 2007). Many students have not participated in instrumental music because their families could not afford it (Abril & Gault, 2006). Aside from financial barriers, factors related to the home environment (Phillips, 2003) and perceived parental support (Corenblum & Marshall, 1998) may have deterred students from low-SES homes from enrolling in band or orchestra. In addition, researchers have found SES to be a salient predictor of retention in music programs (Kinney, 2010; Klinedinst, 1991; McCarthy, 1980). This finding raises questions about equity in music education. Do students from low-SES backgrounds discontinue study because of new, increasing, or compounding costs associated with studying music across time? Do they feel unwelcome or undervalued in music classes? Do

they become discouraged because “they start[ed] so much further back than others” (Taebel & Coker, 1980, p. 261)?

The quality of the instrumental music program, often impacted by SES, can also impact students’ musical achievement. Costa-Giomi & Chappell (2007) examined the characteristics of band programs in a large district in Texas and found that low-SES schools had fewer resources allocated for music than high-SES schools. Researchers have also identified great disparities between the financial resources of urban and suburban schools (Costa-Giomi & Chappell, 2007; Peske & Haycock, 2006). Urban public schools tended to have a high percentage of students from low-SES backgrounds (Reardon & Bischoff, 2011; Siwatu, 2011). Elpus and Grisé (2019) found that booster organizations only exacerbated the funding gap between music programs in high- and low-SES schools. In 2015, when the average household income in the United States was \$55,775, Elpus and Grisé (2019) found that the average household income for communities that supported music booster organizations was \$63,198—significantly higher than the national average ($p < .0001$); their findings indicated that booster organizations primarily served music programs that were already well-funded. Lack of resources and lack of support from booster organizations can impact the quality of instruments available for students to use, access to method books and instructional technology, access to coaching and lessons, and many other per-pupil expenditures that could increase students’ music performance achievement.

Extant literature identifying musical achievement as a dependent measure has revealed relationships between socioeconomic status and musical achievement in a variety of contexts. McCarthy (1980) examined the influence of SES and other variables on the music performance achievement of fifth- and sixth-grade students and found that SES consistently accounted for much of the variance in performance achievement. Dell et al. (2014) measured musical

achievement using students' music course grades, scores on Colwell's (1968) *Music Achievement Tests (MAT)*, and scores on Fortney's (1992) *Music Attitude Scale (MAS)*. They found that SES was a significant predictor of musical achievement ($p < .001$). In a study examining "the demographic characteristics and music achievement of eighth-grade students in the United States using evidence from the 2016 National Assessment of Educational Progress in the Arts (NAEP)" (p. 248), Elpus (2022) found that three distinct measures of SES (parents' educational attainment, eligibility for free or reduced-price meals, and number of books in the home) were significantly associated with students' Music NAEP scores ($p < .01$).

Though the results of the studies by McCarthy (1980), Dell et al. (2014), and Elpus (2022) presented data supporting a salient relationship between SES and musical achievement, other researchers have found conflicting evidence. For example, Jarjisan (1983) and Klinedinst (1991), did not find any significant relationships between socioeconomic status and musical achievement among first-grade singers and fifth-grade instrumental music students, respectively. Further research in this area is needed to allow for a better understanding of how SES and its discrete components relate to musical achievement.

Race and Ethnicity

Professional string players and string teachers in the United States have not yet represented the increasing racial and ethnic diversity of this country. Smith et al. (2018) recently found that 91% of string teachers were White, Non-Hispanic; 2% were Black, Non-Hispanic; 2% were Asian; 0.9% were Hispanic; and 0.3% were American Indian. String students have reflected greater diversity but still have only represented a selected subset of the population. In the same study, Smith et al. (2018) asked string teachers to estimate the percentages of students in their classes by race and ethnicity. The resulting means were: 56.4% White, Non-Hispanic; 15.3%

Hispanic; 13.5% Asian; 11.6% Black, Non-Hispanic; and 1.2% American Indian (Smith et al., 2018). Elpus (2022) found similar racial and ethnic proportions using demographic data from the 2016 National Assessment of Educational Progress in the Arts (NAEP). Though string students (and to a small degree, string teachers) have become increasingly diverse with respect to race and ethnicity, string playing and teaching has remained predominantly White (Gillespie & Hamann, 1998; Smith et al., 2018).

Like socioeconomic status, race and ethnicity are social constructs that underscore differences between groups of people. Race refers to “physical differences that groups and cultures consider significant” (American Psychological Association, 2020, p. 142), while ethnicity refers to “shared cultural characteristics such as language, ancestry, practices, and beliefs” (American Psychological Association, 2020, p. 142). An individual might identify their race as Asian, Black or African American, Native American, Native Hawaiian or Pacific Islander, White, or another race. One could identify their ethnicity as Hispanic or Latinx or another ethnicity.

Race, Ethnicity, and Achievement

Originally, public schools in the United States only served White students. Though schools were integrated in 1954, students of color have not had many of the same opportunities as their White peers throughout the history of American education (Gollnick & Chinn, 2006; Lind & McKoy, 2016). As a result, many students of color have continued to lag behind their White classmates in terms of academic achievement (Ferguson, 2002; Ferguson & Mehta, 2004; Gordon & Cui, 2018). Even those non-White students who have surpassed their White peers in measures of academic achievement—often children from East Asian families—have not

necessarily received equal educational opportunities in American schools (Gillborn & Youdell, 2000).

The achievement gap between White students and their peers of other racial and ethnic backgrounds has been documented for decades. Shortly after desegregation, teachers began observing differences in academic achievement among students of various races, ethnicities, and social classes (Banks, 2004). The cultural deficit model was one of the first theories developed to explain these differences in achievement. Developed in the 1960s, the cultural deficit model suggested that the home culture of students of color or students from low socioeconomic backgrounds led to their lack of success in the classroom (Gollnick & Chinn, 2006; Lind & McKoy, 2016). Schools were then charged with the responsibility of helping struggling students overcome the deficits they inherited from their families and communities and learn the behaviors of the dominant culture (Bereiter & Engelmann, 1966; Bloom et al., 1965; Crow et al., 1966; Reissman, 1962; Sleeter & Grant, 2009).

Challenges to the cultural deficit model came in the 1970s and 1980s. Paolo Friere (1970), for example, suggested that students came to the classroom full of knowledge and experiences and the teacher's job was to work with the students to think critically about what was taught and how it was taught so that students felt free from oppression. Scholars also developed new pedagogies in response to the cultural deficit model.

Now education has moved toward a more culturally responsive model (Cazden & Leggett, 1981; Erickson & Mohatt, 1982; Ladson-Billings, 1995), but the gaps in achievement have remained. Researchers have found that students of color received lower grades and test scores, were underrepresented in advanced courses, and were less likely to enroll in post-secondary education than their White classmates (Gordon, 2018; Muller et al., 2010; Quinn et

al., 2016). In addition, scholars have observed that the experiences of people of color have not been monolithic; there has been notable heterogeneity among people of color and even among people of the same race or ethnicity (Albritton, 2015; Bonilla-Silva, 2004).

By the time children have entered kindergarten, achievement gaps have already been established (Fryer & Levitt, 2004). Multiple studies examining national longitudinal data have shown considerable gaps in achievement between Black and White students at kindergarten entry, with Black students falling .40 - .76 standard deviations below the achievement levels of their White peers (Burchinal et al., 2011; Fryer & Levitt, 2004; Murnane et al., 2006; Reardon & Portilla, 2016). Fewer researchers have examined the achievement gap between young Hispanic and White students. Reardon et al. (2008) found that Hispanic students fell approximately .70 standard deviations below their White peers in math and .50 standard deviations below their White peers in reading at kindergarten entry. On the other hand, the achievement gap between White and Asian students has historically favored Asians. Quinn (2015) found that, in a nationally representative sample of children entering kindergarten in America, White students fell .19 and .24 standard deviations below their Asian peers in math and reading, respectively.

Research has shown that the Asian-White achievement gap has narrowed during the K-12 years (Choi et al., 2015; Fryer & Levitt, 2004; Han, 2008; Yoon & Merry, 2018) while the Black-White gap has grown (Fryer & Levitt, 2006; Phillips et al., 1998). Findings regarding the Hispanic-White achievement gap have been mixed. Reardon and Galindo (2009) found that Hispanic-White gaps in reading and math narrowed by one-third during the first two years of school. Hemphill and Vanneman (2011) suggested that math gaps increased while reading gaps remained essentially unchanged between the fourth and eighth grades. Further research is needed to better understand trends in the Hispanic-White achievement gap.

Though differences in achievement among students from various racial and ethnic groups have been evident historically, they have not been easily understood. Researchers have investigated parenting behaviors, socioeconomic status, excessive discipline issues, teachers' unconscious bias, and the racial hierarchy of public schools as possible causes for these achievement gaps. In all likelihood, multiple factors have contributed to the achievement gaps between White students and their peers of color.

In one study, Bodovski (2010) examined the complex intersections among race, social class, gender, parenting strategies, and academic achievement of American elementary school children. She found that the average SES of Black families was almost one standard deviation below the average SES of White families in her sample; the average level of academic achievement among Black and White students followed the same trend. Parenting practices differed between races, as well, with White parents more likely to engage in the process of concerted cultivation of their children than Black parents. Concerted cultivation involves actively nurturing the development of children's abilities and interests through activities like sports, music lessons, educational trips, and reading books (Lareau, 2011). About 60% of the relationship between race and concerted cultivation was explained by social class in Bodovski's (2010) study, but Black parents were still more likely to encourage natural growth (rather than concerted cultivation) than White parents. Bodovski (2010) suggested that these differences in parenting practices—along with the inequities in resources between predominantly Black and predominantly White schools and communities and the emphasis on middle- to upper-class, White values in public schools—have helped to perpetuate the Black-White achievement gap.

Other researchers have suggested that racial socialization and a family's speech at home have contributed to academic achievement of Non-White students. Racial socialization has been

defined as “the process by which parents teach their children about the significance and meaning of race” (Neblett et al., 2009, p. 246). African American adolescents who were taught to believe in their self-worth (rather than negative views about being African American or pride only in their racial group) achieved higher grades than their African American peers (Neblett et al., 2009). In other studies, researchers have found that though using Black English or a language other than English at home contributed to the preservation of culture, this practice limited the amount of time children spent practicing Standard English that has been essential for success in American public schools (Carter, 2005; Pattillo-McCoy, 1999; Portes & Rumbaut, 2014).

As mentioned above, the relationship between race, socioeconomic status, and achievement has historically been complex. Low-SES neighborhoods have tended to have a high concentration of Black and Hispanic families, while White and Asian families have tended to live in middle- and high-SES neighborhoods (Ferguson & Mehta, 2004; Lee & Maydun, 2009). Due to inadequate resources in their homes and schools, Black and Hispanic students may have been disadvantaged even further (Lee & Maydun, 2009; Muller et al., 2010). In schools, these issues may have included a lack of highly qualified teachers, finances, and academic resources to support learning (Bruenger, 2010; Jerald, 2002; Peske & Haycock, 2006). Black and Hispanic adolescents tended to reach lower levels of academic achievement than their White and Asian peers (Battle & Lewis, 2002; Ferguson, 2002; Martin et al., 2017).

Researchers have found that accounting for SES reduced racial achievement gaps but did not eliminate differences in achievement by race and ethnicity (Han & Palloni, 2009). Various studies have shown that SES explained anywhere from 15% to nearly 100% of the Black-White and Hispanic-White achievement gaps (Fryer & Levitt, 2004, 2006; Murnane et al., 2006). In a study of low-income Black and White families, Burchinal et al. (2011) found a sizeable Black-

White achievement gap as early as age 3; these results suggested that a racial achievement gap was still present among families of similar incomes.

Gordon and Cui (2018) examined the intersection of race, community poverty, and academic achievement among adolescents. They found an interactive effect of race and poverty on achievement. Specifically, they found a greater disparity in achievement between Black and White students in low-poverty communities when compared with high-poverty communities. This meant that Black students in low-poverty neighborhoods were at more of an academic disadvantage than White students in high poverty neighborhoods. Leventhal et al. (2005) and Umaña-Taylor et al. (2012) found similar results. The results of these three studies and others have shown that further research is needed to understand the complex relationship between race, socioeconomic status, and achievement.

Disproportionate discipline issues faced by students of color has been cited as another possible predictor of low achievement in schools. Ibrahim and Johnson (2020) and Morris and Perry (2016) found that Black and Hispanic students were overrepresented among those suspended from school. In one study, Black and Hispanic students made up approximately 28% of the sample but received 45% of in-school suspensions and 43% of out-of-school suspensions. Results of this study also showed that both types of suspensions lowered mathematics achievement—even years after the suspension happened (Ibrahim & Johnson, 2020). Heckman and LaFontaine (2010) found that disparate incarceration rates also contributed to differences in academic achievement among races.

Finally, the unconscious bias of teachers and systemic racism imbedded in the American public school system have undoubtedly contributed to the variation in the Black-White, Hispanic-White, and Asian-White achievement gaps. Bourdieu's (1974, 1986) theory of cultural

capital stated that “possessing certain tastes, styles, manners of speech, skills, and knowledge contributes to a person’s place in the social hierarchy, above and beyond formal education, money, or political power” (Bodovski, 2010, p. 141). In addition, Bourdieu (1974, 1986) believed that the education system rewarded children academically for social behaviors consistent with the dominant White culture. Critical race theorists have acknowledged that race has been an inescapable element of our society, which was set up to support the dominant racial group and marginalize other groups (Carter, 2008; Hylton, 2012)

Scholars have studied racism and unconscious bias in American schools and found evidence of culturally biased tests (Astin, 1994), disproportionately low numbers of students of color in gifted programs and high numbers of students of color in special education programs (Bonner, 2000), and racist microaggressions of teachers (Hatt, 2012). In a yearlong study of kindergarten children, Hatt (2012) found that the teacher was unconcerned with the efforts of the Black students in her class but regularly affirmed the energies and attainment of White, middle-class students. Experiencing racial discrimination may have caused children to disengage with academic subjects in which they were expected to perform poorly (Crocker & Major, 1989) and to perform in accordance with academic stereotypes (Steele & Aronson, 1995).

Even Asian Americans, who have historically been the most highly educated racial group in the United States and often considered the model minority (Kao, 1995; Pew Research Center, 2013), have faced issues related to race and achievement in US schools (Booher-Jennings, 2005). Yoon and Merry (2018) found that though Asian Americans generally reached higher levels of academic achievement than their White peers, the Asian-White achievement gap has been maintained through faster rates of learning during the summer months and decreases during the school year. The researchers suggested that schools benefited White students more than they

benefited Asian students. One explanation may have been that teachers may have stereotyped all Asian students as high achievers who did not need extra support. Scholars studying racial triage have suggested that when teachers have limited resources and must choose which students to help, they have often ignored Asian students who they assumed would be successful without assistance, ignored Black and Hispanic students who they assumed would never be successful, and chosen to help White students who they saw as having the greatest potential for growth (Gillborn & Youdell, 2000).

Race, Ethnicity, and Musical Achievement

The string playing and teaching communities have remained largely White, despite the increasing diversity of the United States and its public schools (Smith et al., 2018). In addition, Asian and White students have outperformed their Black, Hispanic, and multiracial peers on measures of musical achievement (Elpus, 2022). To address these demographic disparities, educators and policy makers must work to remove barriers to music participation and achievement that students from marginalized populations—particularly Black and Hispanic students—may encounter. After all, if Black and Hispanic students are unable to access high quality music instruction, they will not ever reach the performance achievement levels of their White and Asian peers.

Access is the first barrier that has often stood in the way of Black and Hispanic students' musical achievement. Because race, ethnicity, and SES have historically been related, students of color have faced many of the same issues of access faced by students from low-SES backgrounds. These issues have included a lack of music course offerings in schools (Parsad & Spiegelman, 2012; Smith, 1997) and inadequate funding for the programs that do exist (Costa-Giomi & Chappell, 2007). In addition, English Language Learners (ELLs) have often

encountered barriers to participating in school music such as reduced access to elective courses that take place at the same time as their ELL courses (Bradley, 2007; Callahan et al., 2010). Even after students have successfully enrolled and participated in music programs at the P-12 level, students of color have faced additional obstacles in the music school admissions process at the college level (Koza, 2008).

Another barrier to success in music education for marginalized racial and ethnic groups has been the classroom environment. Research has shown that many music teachers felt unprepared to teach diverse styles that may help to attract and engage a diverse population of students (Abril, 2009; Kelly, 2003; Volk, 1998). Other researchers have found that a collaborative music classroom environment was more effective for Black and Hispanic students than an environment that encouraged competition (Lind, 1999; Lind & Butler, 2003). Unfortunately, many American classrooms have remained quite competitive and may have been at direct odds with the cultural values of historically excluded racial and ethnic groups (Hale, 2001).

Finally, researchers have found that unconscious bias of teachers may have negatively impacted the musical achievement scores of marginalized students. Elliott (1996) examined the effects of race on assessments of musical performance among trumpet and flute players. Graduate and undergraduate music education majors assessed video recorded performances of four Black and four White musicians. Though the same high-quality audio recording accompanied each video, Black performers received consistently lower performance assessment ratings than White performers. This finding has important implications for musical success: even if students of color perform as well as their White peers, they may not receive the same musical honors or opportunities.

Gender Identity

Students identifying as male have been historically underrepresented in instrumental music education programs (Elpus & Abril, 2011; Stewart, 1991). On the other hand, those identifying as female have not necessarily reached the same levels of success as their male peers in the music classroom and profession (Gould, 2005; Sheldon & Hartley, 2012). To serve and include all students, string teachers must understand how gender and gender identity may impact students' interest in music education, instrument selection, and achievement.

Gender, unlike sex, is a social construct that includes the behaviors, attitudes, and culture associated with a particular sex. Gender identity refers to “a component of gender that describes a person’s psychological sense of their gender” (American Psychological Association, 2020, p. 138). A person might identify as female, male, nonbinary, transgender, or a number of other genders. The present manuscript focuses on male and female gender identities, as all participants in this study self-identified with one of these two gender identities.

Gender Identity and Achievement

Research findings related to gender and academic achievement have been decidedly mixed. Depending on factors such as the measure of achievement, academic subject being examined, and classroom environment, researchers have found a variety of results. For example, girls have tended to outperform boys in languages (Machin & Pekkarinen, 2008), while boys have performed better in physics (Seyranian et al., 2018). The gender gap results in math have been more mixed (Guiso et al., 2008; Hyde et al., 2008). Other researchers have found that gender did not significantly impact academic achievement at all (Johnson & Engelhard, 1992; Kremer et al., 2016). In this section of the manuscript, research supporting various relationships between gender and achievement will be examined.

Many researchers have found that girls have generally achieved higher levels of academic success than boys in secondary and post-secondary education (King, 2016; Kingdon et al., 2017; Lester, 2016; Marcenaro-Gutierrez et al., 2018; Voyer & Voyer, 2014). In Australia, girls have outperformed boys on standardized literacy tests and school entrance exams for decades (Cortis & Newmarch, 2000; DEST, 2003). Researchers around the world have found similar results (Connell, 1996; Yates, 1997). In addition to performing well on standardized tests, girls have successfully achieved higher grades than boys in many subjects, including mathematics (Borg, 2015; Kenney-Benson et al., 2006).

Alternatively, research has shown that boys have outperformed girls in some situations. For example, scholars examining data from the National Assessment of Education Progress science and mathematics tests found that males performed better than their female peers (Coley, 2001; McGraw et al., 2006). In physics, researchers consistently found that men scored higher on a standardized knowledge test than women (Docktor & Heller, 2008; McCullough, 2011; Traxler et al. 2018).

Still other research has yielded mixed results. Shin et al. (2010) found that American females earned higher test scores than androgynous or male students, while Korean males earned higher test scores than androgynous or female students. In a study of German language and mathematics achievement among fifth-graders, Weis et al. (2013) found that while girls reached higher levels of academic achievement in German, there was no gender difference in mathematics achievement. Seyranian et al. (2018) examined standardized test scores and course grades among college physics students and found that men performed better on the standardized tests; there were no gender disparities for course grades.

Finally, one must consider researchers who have found no gender differences in academic achievement. Around the world, studies of children, adolescents, and adults have shown that academic performance may not have been related to gender (Alavi et al., 2019; Chan, 2001; Goni et al., 2015). These studies supported Hyde's (2005) gender similarities hypothesis, which stated that males and females are more similar than different with respect to psychological variables.

The research related to gender and achievement has been inconsistent. Craske (1985) suggested that some of the gender-related differences and inconsistencies in achievement might have been related to the learning environment. Others have made similar suggestions, positing that teaching style and incorporation of collaborative learning strategies may have enhanced gender disparities in student achievement (Kimball, 1989; Stump et al., 2011). McCullough (2011) attributed gender disparities in achievement to biased measurement tools, while Lavy (2008) and Lindahl (2007) found that teachers tended to assess students who identified with the teacher's gender more strictly than students who identified with a different gender. Considering the overwhelming amount of variable data and the many theories related to gender and achievement, further research in this area is necessary.

Gender Identity and Musical Achievement

As string teachers aim to serve all their students and help them be successful, gender identity is an important variable to consider. Gender research in music education has highlighted the impact of gender on instrument selection. Students identifying as female have historically chosen smaller and higher-pitched instruments, compared to their male peers (Eros, 2008; Zervoudakes & Tanur, 1994). Scholars have also found that male students, who have been generally underrepresented in music classrooms, have been overrepresented in musical

leadership positions (Trollinger, 1993/1994). It is possible that a student's instrument choice and opportunities for musical leadership could impact their musical achievement.

Research specifically related to gender and musical achievement has produced inconsistent results. In a study of music education in a secondary school, Wright (2001) found a correlation between gender and musical achievement (measured by a standardized test in music) in favor of females. Though females did outperform their male peers, the gender gap was not nearly as large as it was on similar standardized tests of other academic subjects. In addition, males did perform better than females in the performing and composing aspects of music between ages 11 and 14. These results indicated strong potential for both male and female students in the music classroom.

In conflicting studies, researchers have found that males performed better on standardized tests of musical achievement. For example, Zdzinski (1992) investigated the relationships between gender, parental involvement, aptitude, and musical achievement of instrumental music students. He found that males scored significantly higher on Colwell's (1968) *Musical Achievement Tests* than females ($p < .05$). He did not find any gender differences related to music performance achievement.

Still other researchers have found no significant gender differences related to students' musical achievement. Madura (1996) explored the relationships among vocal jazz improvisation achievement, experience, creativity, and gender. The researcher found that gender was not a significant predictor of any element of vocal jazz performance achievement. Findings substantiated previous work by Hores (1977) and Bash (1984). In a study examining a variety of predictors of musical achievement for elementary general music students, Hedden (1982) found that gender was not an effective predictor.

As evidenced by the aforementioned scholarship, further research is necessary to better understand the relationship between gender, gender identity, and musical achievement. In addition, music educators should explore a growing body of work that moves beyond the binary perspective of gender and achievement. A better understanding of the complex relationship between gender and music (Green, 1994) will only help teachers better serve their students.

Private Instruction

Music educators would like to believe that private instruction—or instruction of any kind—positively impacts their students’ learning and achievement. Private lessons have been shown to provide many benefits, from improving students’ self-concept (Degé et al., 2014) to helping students develop aural skills (May & Elliot, 1980). Private music lessons have also been shown to impact both academic and musical achievement. On the other hand, some researchers have found few or no benefits associated with private music instruction. This may be difficult to imagine, but the research is important for music educators to consider as they aim to help their students succeed.

Private Instruction and Achievement

Music instruction may have extramusical benefits for students. Researchers have found correlations between ensemble participation and academic achievement (Kinney, 2008; Kinney & Forsythe, 2005; McCrary & Ruffin, 2006). Private music lessons have also been linked to achievement outside of music. For example, Cheek and Smith (1999) examined the relationship between private music lessons and Iowa Test of Basic Skills (ITBS) mathematics scores. They found that music students who took private piano lessons scored higher on the ITBS mathematics test than those who did not take private lessons and those who took lessons that did not involve the keyboard.

Private Instruction and Musical Achievement

Despite the desire for students to do well in all aspects of life and school, music teachers may be more interested in examining the musical outcomes of private music instruction, as opposed to the nonmusical outcomes. These musical outcomes are directly related to students' achievement in the music classroom. Though findings have been mixed, many scholars have pointed to important musical benefits of private instruction.

First, private instruction may have increased the likelihood that students would persist in their school music programs. Stewart (2005) investigated the relationship between students' decisions to continue in band after middle school and their gender, years of experience, private lessons, and other factors. She found that students who took private lessons were more likely to stay in band than students who did not. Of course, the longer a student remains in an instrumental music program, the more they will have the opportunity to achieve.

As students continue with their private instruction, they may experience many other musical benefits. For example, researchers have found that students who studied privately scored higher on music aptitude tests (Pembroke & Taylor, 1986) and demonstrated a more acute awareness of inaccurate intonation (Yarbrough et al., 1997). Broomhead (2001) found a positive relationship between private vocal lessons and high school students' expressive vocal performance, and Lorah et al. (2014) found a positive relationship between private lessons and eighth grade students' scores on the National Association of Educational Progress Arts Assessment music test. Overall, taking private lessons from an experienced teacher has helped many students improve their musical abilities (Duke, 2000).

Some studies have not supported a relationship between private lessons and musical achievement, though. Madura (1996) found that lessons were not a significant predictor of vocal

jazz improvisation achievement; Brand and Burnsed (1981) found no relationship between private lessons and error detection skills; and Nierman (1983) found only a low to moderate relationship between private instruction and music perception abilities. Clearly, further research is required to better understand the impact of private lessons on students' musical achievement.

Summary

Musical achievement may be affected by many variables (i.e., grit, socioeconomic status, race, gender, and private lessons) that have not yet been sufficiently investigated in music education. Inconsistencies in the literature have indicated that additional research is necessary so that teachers can best support their students' achievement in the music classroom. A clearer understanding of the relationships between and among the variables mentioned above will only benefit practicing string teachers. The present study was designed to investigate the variables that best predict string students' musical achievement.

CHAPTER III: METHOD

Participants

Participants (see Table 1) in this study ($N = 60$) included middle and high school ($n = 30$) and undergraduate ($n = 30$) string players ranging from age 12 to 22 ($M = 17.57$). Thirty-two of the participants played the violin, seventeen played viola, seven were cellists, and four played the double bass. The number of years of experience the participants had on their string instrument ranged from less than one year to 17 years ($M = 7.75$ years). The number of years of private lessons they had on their string instrument ranged from zero to 17 years ($M = 4.63$ years). Thirty-seven participants self-identified as female and twenty-three as male. Thirty-two participants indicated they were from a lower socioeconomic background, while twenty-eight participants reported having a higher socioeconomic background. Participants identified their race or ethnicity as: Asian, Native Hawaiian, or Pacific Islander ($n = 14$); Black ($n = 13$); Hispanic or Latinx ($n = 11$); and White ($n = 22$).

Table 1. Overview of Participant Characteristics

Characteristic	<i>n</i>	% of sample	<i>M</i>	<i>SD</i>	Range
School					
Middle/High	30	50			
University	30	50			
Age			17.57	2.85	12-22
Instrument					
Violin	32	53.33			
Viola	17	28.33			
Cello	7	11.67			
Double Bass	4	6.67			
Years of Experience			7.75	3.38	.5-17
Years of Private Lessons			4.63	3.89	0-17
Gender Identity					
Male	23	38.33			
Female	37	61.67			
Socioeconomic Status					
High-SES	28	46.67			
Low-SES	32	53.33			
Race/Ethnicity					
Asian/Pacific Islander	14	23.33			
Black/African American	13	21.67			
Hispanic/Latinx	11	18.33			
White	22	36.67			

Middle and high school participants were volunteers from the Greensboro Symphony Youth Orchestra (GSYO) or Peck Alumni Leadership (PAL) Program. GSYO is a symphonic orchestra for which students audition each year; they rehearse once per week September through May. The PAL Program is a community partnership among the University of North Carolina Greensboro, Greensboro Symphony Orchestra, and Guilford County Schools Lyceum Program.

PAL students were recommended by their current or former orchestra teachers to receive lessons and extracurricular orchestra classes once per week at no cost September through May. To qualify for PAL, students must also have qualified for free or reduced-price meals at their school. The mission of the PAL Program is to increase access to string instruction for underserved students. The Guilford County Schools Lyceum Program offers private and group lessons in various arts disciplines throughout the county and aims to provide supplementary arts instruction that enhances what students learn in their arts classes at school. Lyceum support of the PAL Program has allowed PAL to expand to serve a greater number of students from across the county.

Undergraduate participants were volunteers from the University of North Carolina Greensboro (UNCG). UNCG is a minority-serving institution, and approximately one third of the undergraduate student population has identified as a first-generation college student. Participants either took lessons from an applied faculty member or played in the University Symphony Orchestra or Sinfonia—the two orchestras on campus. The University Symphony Orchestra string players were music majors who auditioned for placement in their ensemble and studied privately with a university violin professor. Sinfonia was a strings-only ensemble comprised of music majors and non-majors. Some students elected to participate in this ensemble, while others were placed in Sinfonia by audition. Some of the Sinfonia students studied privately with university violin faculty members or graduate students, but others did not take lessons.

As noted above, the participants represented a range of socioeconomic backgrounds, genders, races and ethnicities, ages, and years of experience on their instrument. In the present study, students from a lower socioeconomic status were defined as middle and high school students who qualified for free or reduced-price meals (Nierman & Veak, 1997; Phillips, 2003)

or undergraduates who qualified for Federal Pell Grants. Students from a high socioeconomic status were defined as those who did not qualify for free or reduced-price meals or Federal Pell Grants. All demographic data were self-reported by participants in this study.

The 60 participants were invited to take part in this study through a verbal announcement made in their rehearsals and an email or letter for them to take home. Spanish translations of this letter were also provided. In addition, university students were invited to participate through announcements sent via Canvas and announcements made in music education courses. Once the participants completed the required consent and assent forms, they were included in the study. All study participants completed Duckworth's Grit-S Scale and a demographic questionnaire. They completed both measures anonymously using Qualtrics.

Grit-S Scale Description

Dr. Angela Duckworth's Grit-S Scale is an eight-item Likert-type scale including four items related to perseverance and four items related to passion (see Appendix A). Participants self-report as they rank eight descriptions as: (a) "Very much like me," (b) "Mostly like me," (c) "Somewhat like me," (d) "Not much like me," or (e) "Not like me at all" (Duckworth et al., 2007; Duckworth & Quinn, 2009). Each response corresponds to a number from 1 to 5. An individual's Grit-S Scale score is the mean of their eight responses. One can also determine a Grit-Passion score and a Grit-Perseverance score by finding the mean of the four items related to the corresponding facet of grit (Duckworth & Quinn, 2009). In general, perseverance scores tend to be higher than passion scores (Duckworth, 2016). This is particularly true in pre-college individuals, as they have had comparatively fewer experiences and less autonomy—they have not had enough time to make their own decisions and discover their consistent interests (Lam & Zhou, 2019). The two facets of grit are correlated at $r = .45$ (Duckworth et al., 2007).

Duckworth's original grit scale (the Grit-O Scale) contained 12 items related to passion and perseverance and was first published in 2007. Duckworth et al. (2007) initially set out to create and validate a self-report measure of grit that could be used with adolescents and adults. Based on results of previous qualitative studies with highly successful individuals, the researchers developed a list of 27 items related to the construct of grit. They reduced the list to 12 items through a series of statistical tests. Then, they designed six studies to test the Grit-O Scale with different populations: adults, ivy league undergraduates, West Point cadets, and finalists in the Scripps National Spelling Bee (Duckworth et al., 2007).

A few years later, Duckworth sought a more efficient measurement tool with increased psychometric properties. Duckworth and Quinn (2009) designed six studies that were similar to the studies used in the development and validation of the Grit-O Scale but with broader populations; children or adolescents were included in four of these studies. As a result of this research, Duckworth and Quinn (2009) developed the shorter Grit-S Scale, which yielded an increased model fit in confirmatory factor analysis. The internal consistency of the Grit-S Scale fell within the range of $\alpha = .73 - .83$.

The Grit-S Scale was the grit measurement tool for this study because of its validity and usability with the population of adolescents and young adults. Duckworth's Grit-S Scale has been validated as a self-report measure of grit for children as young as ten years old through adults. Researchers found that Grit-S Scale scores accounted for 2.5-8.9% of the variance in success among participants aged 10 to 23 (Duckworth & Quinn, 2009). Lam and Zhou (2019) conducted a meta-analysis in which they found the Grit-S Scale to have higher criterion-related validity than the Grit-O Scale.

The Grit-S Scale does have limitations. First, the Grit-S Scale is a self-report measure. Researchers have outlined the limitations of self-report data in many domains (Lucas & Baird, 2006; Mackay et al., 2007; Paulhus, 1991; Pike, 1996). In the present case, the Grit-S Scale is especially susceptible to social desirability bias— “a distortion of responses in a direction considered desirable by society” (Leite & Cooper, 2010). For example, respondents may rate themselves high on the “I am diligent” item because diligence is generally encouraged in society (Duckworth et al., 2007; Duckworth & Quinn, 2009). An additional limitation of the Grit-S Scale is related to the domain specificity of grit. Some people may be gritty in their professional life but not in their personal life, for example. In cases such as these, respondents may not know how to respond to the items on the Grit-S Scale (Duckworth & Quinn, 2009).

Demographic Questionnaire Description

The demographic questionnaire included items related to the purpose of this study. Participants were asked to provide information about their age, gender, race or ethnicity, socioeconomic status, years of experience and private lessons on their string instrument, and repertoire they studied recently. They were also be asked about other musical training they have received or musical activities in which they participated (see Appendix B).

Measurement of Musical Achievement

The dependent, categorical variable in this study was musical achievement. Participants self-reported the three most recent solo pieces they played. Using the graded repertoire lists from the American String Teachers Association *String Syllabus*, the researcher grouped students into musical achievement categories. The *String Syllabus* ranges from Grade 1 to Grade 6. Because some students reported solo repertoire from multiple grade levels, the researcher organized

responses into eleven levels of musical achievement: Grade 1, Grade 1/2, Grade 2, Grade 2/3, Grade 3, Grade 3/4, Grade 4, Grade 4/5, Grade 5, Grade 5/6, and Grade 6.

Pilot Study

A pilot study was conducted to examine the relationships between private violin, piano, and voice instruction and adolescents' development of grit. Secondary purposes included: (a) assessing the difficulty and timing of a perseverance task and Grit-O Scale and (b) assessing the usability and functionality of the Qualtrics links. Pilot study participants ($N = 19$) included 10 violin students, 5 piano students, and 4 voice students. All participants were between the ages of 12 and 15 and studied privately on only their primary instrument. On average, they had 6.26 years of playing or singing experience. Participants individually met with the researcher on Zoom to complete the pilot study.

Results showed no significant differences in this pilot study. A one-way ANOVA with a Games-Howell procedure to correct for unequal sample sizes between groups showed no significant differences between type of music instruction (violin, piano, or voice) and Grit-O Scale score, $F(2, 16) = 1.06, p = .37, \eta^2_p = .12$. A second one-way ANOVA and Games-Howell procedure showed no significant differences between type of music instruction and time spent on a perseverance task, $F(2, 16) = .82, p = .46, \eta^2_p = .09$.

The perseverance task, Grit-O Scale, and Qualtrics links were also evaluated in this pilot study. Qualtrics links were determined as satisfactory. The perseverance task was eliminated in favor of the Duckworth's Grit Scale as a valid and reliable measure of perseverance. The Grit-O Scale prompted some questions from participants. Upon further research, the researcher decided to use the Grit-S Scale in the present study. The researcher also determined that data collection

for the subsequent study must occur in person so the researcher could control the participant's environment.

CHAPTER IV: RESULTS

The purpose of this quasi-experimental study was to investigate the variables that best predict string students' musical achievement. The researcher aimed to determine which of five variables (grit, private lessons, socioeconomic status, race, and gender) was the strongest predictor of string students' musical achievement.

To answer the original research question, participants completed Duckworth's Grit-S Scale (Duckworth et al., 2007; Duckworth & Quinn, 2009) and a demographic questionnaire that included items related to the purpose of the study. The demographic questionnaire also included items such as: (a) participants' age; (b) their years of experience on their string instrument; (c) other instruments they played; and (d) whether they participated in orchestra at their school. Participants listed the most recent solo pieces they had studied, and these pieces were compared to the graded repertoire list found in the American String Teachers Association's *String Syllabus: Volume One, 2009 Edition* to determine participants' musical achievement level.

Data collected from all participants ($N = 60$) were analyzed using the Statistical Package for the Social Sciences (SPSS Version 28, 2021). First, descriptive statistics were produced for all variables. Next, Pearson product-moment correlation coefficients between all variables were calculated. Finally, an exploratory multiple regression analysis was conducted to determine which variables best predicted string students' musical achievement.

The next section of this chapter will include descriptive results. Results will be summarized for the dependent variable (musical achievement), five original independent variables (grit, private lessons, socioeconomic status, race, and gender), and one additional independent variable (years of experience).

Descriptive Statistics

Grit

Scores on Duckworth's Short Grit Scale (Duckworth et al., 2007; Duckworth & Quinn, 2009) can range from 1.00 (not gritty) to 5.00 (very gritty). In the present study, participants' Grit-S Scale scores ranged from 2.00 to 4.63 with a mean of 3.21 and standard deviation of .58 (see Table 2). These scores ranged from less than the 10th percentile of the population to just over the 90th percentile, with the mean Grit-S Scale score falling just under the 30th percentile (Duckworth, 2016). Consistent with the extant literature (Duckworth, 2016; Lam & Zhou, 2019), Grit-Perseverance scores ($M = 3.73$, $SD = .55$) were higher than Grit-Passion scores ($M = 2.69$, $SD = .82$).

Table 2. Sample Grit-S Scale Scores

Grit-S Scale Items	<i>M</i>	<i>SD</i>
Grit-Passion Items (Total)	2.69	.82
New ideas and projects sometimes distract me from previous ones.	2.43	.83
I have been obsessed with a certain idea or project for a short time but later lost interest.	2.58	1.17
I often set a goal but later choose to pursue a different one.	3.12	1.06
I have difficulty maintaining my focus on projects that take more than a few months to complete.	2.63	1.15
Grit-Perseverance Items (Total)	3.73	.55
Setbacks don't discourage me.	2.95	1.00
I am a hard worker.	4.33	.71
I finish whatever I begin.	3.58	.91
I am diligent.	4.03	.80
Total Grit-S Scale Scores	3.21	.58

Socioeconomic Status

Socioeconomic status was measured by precollege participants' free or reduced-price meal qualification and university participants' Pell Grant qualification. In the present sample, 53.3% of participants ($n = 32$) qualified for one of these two supports and were therefore labeled as low-SES. The remaining participants ($n = 28$, 46.7%) were labeled as high-SES. Precollege participants were divided evenly between low- ($n = 15$; 50%) and high- ($n = 15$; 50%) SES. Among university participants, 56.67% ($n = 17$) came from low-SES backgrounds, while 43.33% ($n = 13$) came from high-SES backgrounds. This relatively even distribution of high- and low-SES students (see Table 3) was not consistent with the distribution of orchestra classes in the United States. Most orchestra students across the country have come from middle- and high-SES backgrounds (Elpus, 2022; Smith, 1997).

Table 3. Sample Socioeconomic Status (SES)

SES Category	<i>n</i>	% of sample
High-SES	28	46.67
Does not qualify for free or reduced-price meals	15	25.00
Does not qualify for a Pell Grant	13	21.67
Low-SES	32	53.33
Qualifies for free or reduced-price meals	15	25.00
Qualifies for a Pell Grant	17	28.33

Race and Ethnicity

The most frequently reported race/ethnicity was White ($n = 22$, 36.7%), followed by Asian/Pacific Islander ($n = 14$, 23.3%), Black/African American ($n = 13$, 21.7%), and Hispanic/Latinx ($n = 11$, 18.3%). There were no American Indian/Native Alaskan responses for race/ethnicity. White students outnumbered students from all other races, which was consistent

with string orchestra enrollment in public schools in the United States (Elpus, 2022; Elpus & Abril, 2011). See Table 4.

Table 4. Sample Race and Ethnicity

Self-Reported Race/Ethnicity	<i>n</i>	% of sample
Asian/Pacific Islander	14	23.33
Black/African American	13	21.67
Hispanic/Latinx	11	18.33
White	22	36.67

Gender Identity

Participants in this study self-identified as male ($n = 23$, 38.3%) and female ($n = 37$, 61.7%). See Table 5. This distribution was consistent with data from Elpus & Abril (2019, 2011) and Stewart (1991), who found that music students in United States high schools were about 60% female and 40% male. Elpus (2022) found a smaller imbalance between genders in eighth-grade orchestra classes, though females were still overrepresented in orchestra classes when compared to the population of all eighth-grade students in the United States.

Table 5. Sample Gender Identity

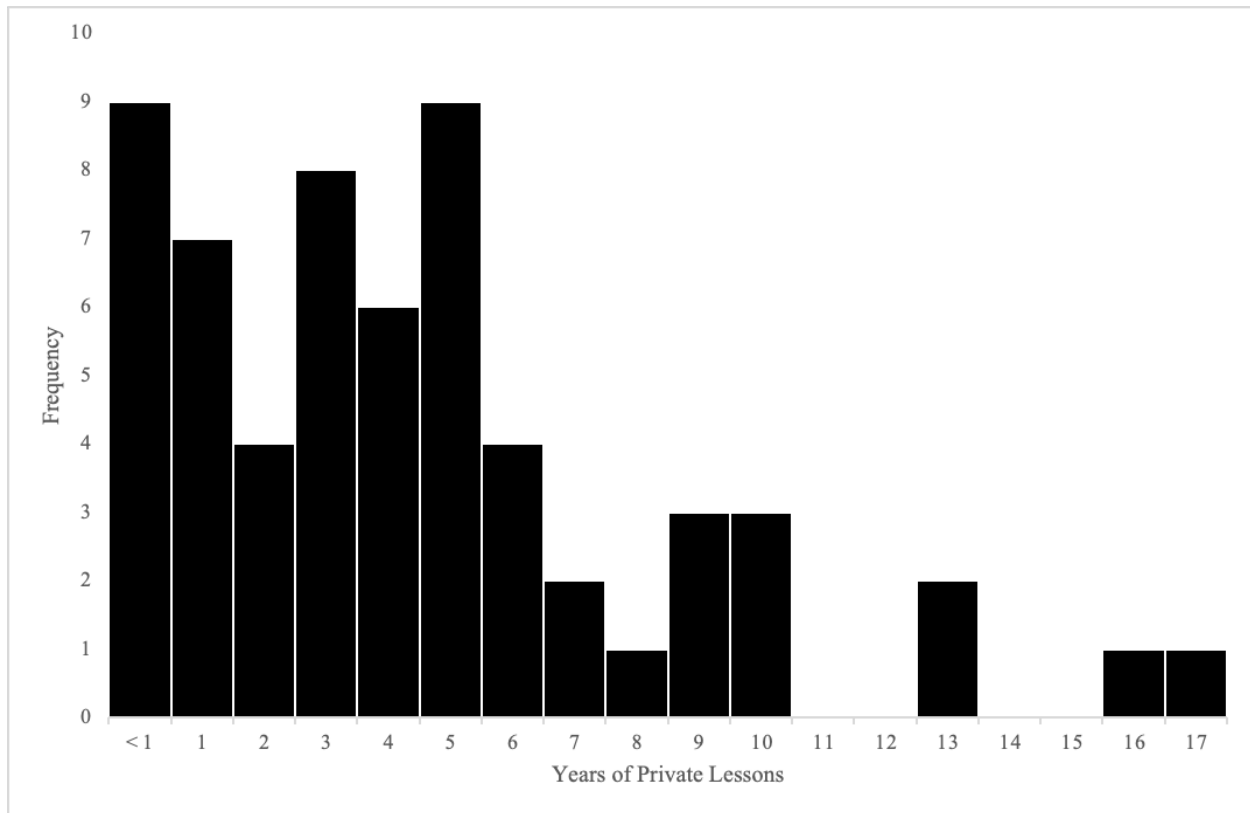
Self-Reported Gender Identity	<i>n</i>	% of sample
Male	23	38.33
Female	37	61.67

Private Instruction

The majority (98.3%) of participants in this study took private lessons on their string instrument. One participant did not take lessons. The remaining 59 participants had studied

privately from between .25 years to 17 years (see Figure 1). The mean number of years of lessons for participants in this study was 4.63 years ($SD = 3.89$).

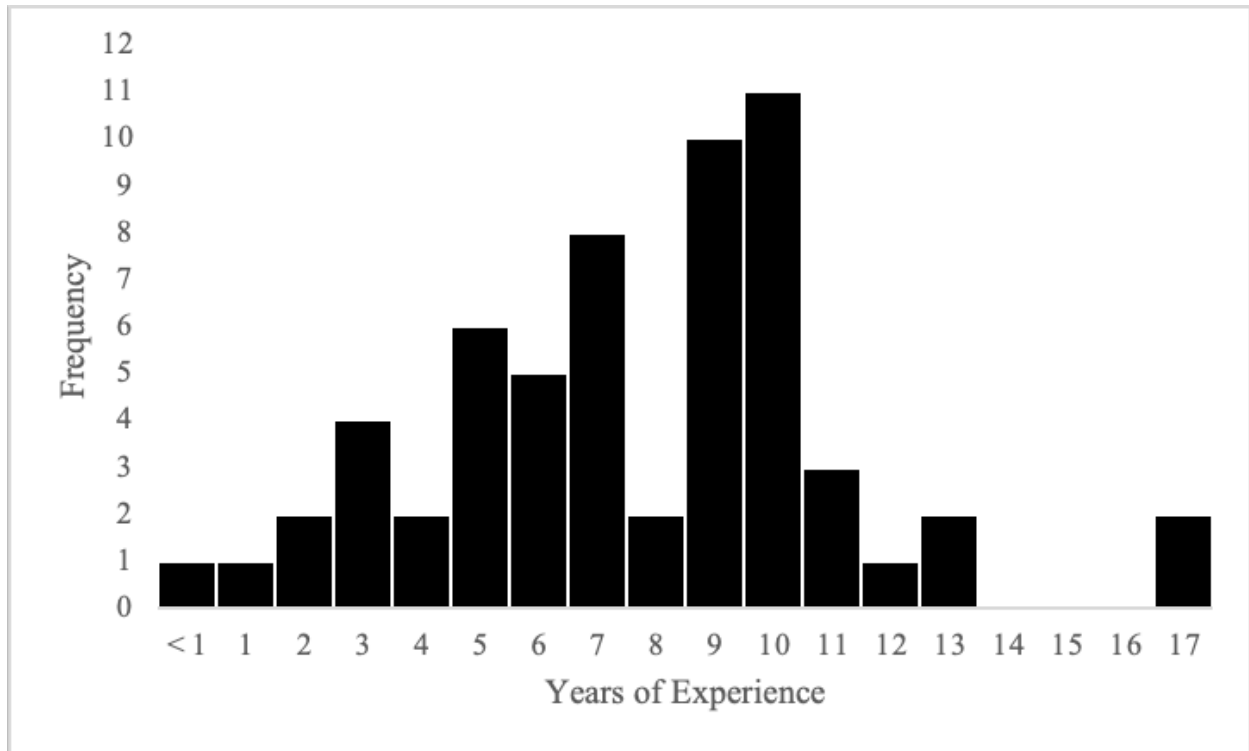
Figure 1. Sample Years of Private Lessons



Years of Experience

Some participants had less than one year of experience on their string instrument, while others had been playing for most of their lives. The years of experience for participants in this study ranged from .50 to 17 years, with a mean of 7.75 and standard deviation of 3.38 years (see Figure 2).

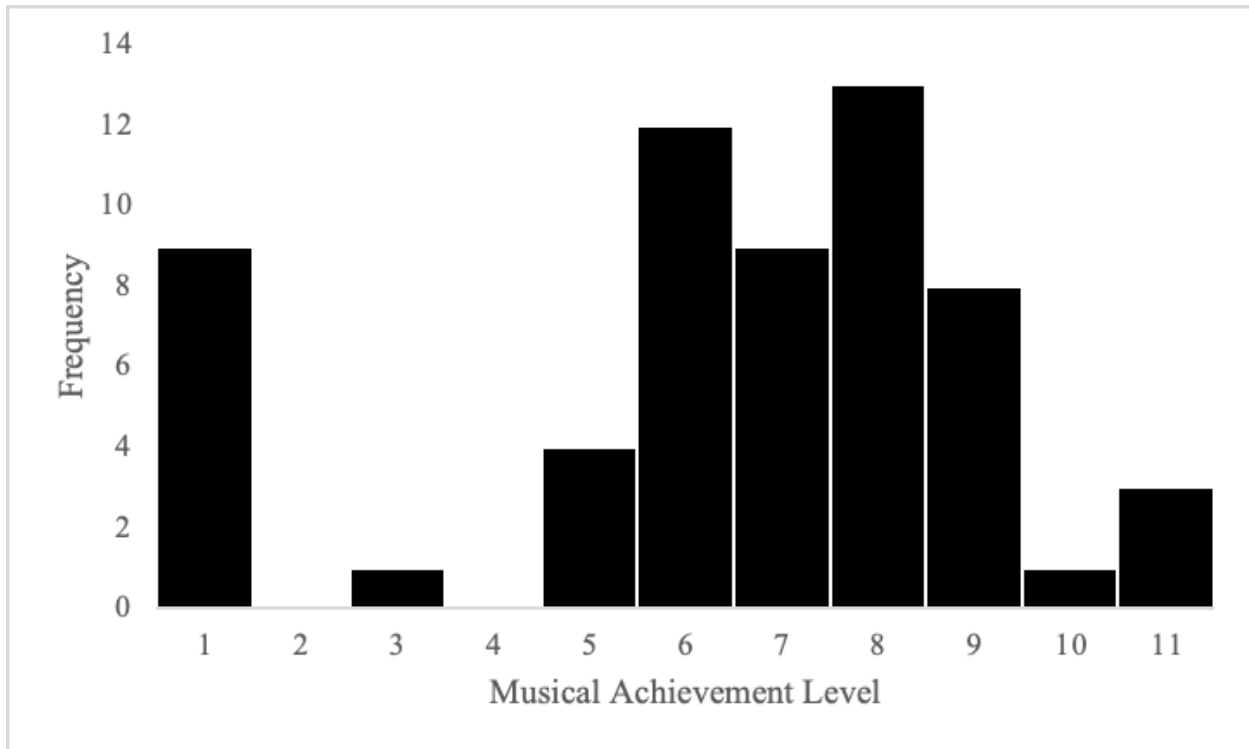
Figure 2. Sample Years of Experience



Musical Achievement

Musical achievement was measured by comparing students' self-reported recently studied repertoire to the graded repertoire lists from the American String Teachers Association *String Syllabus*. The *String Syllabus* includes six categories of repertoire, ranging from Grade 1 to Grade 6. Because some students reported recently learning repertoire from multiple grade levels, the researcher organized responses into eleven levels of musical achievement: Level 1 = Grade 1, Level 2 = Grade 1/2, Level 3 = Grade 2, Level 4 = Grade 2/3, Level 5 = Grade 3, Level 6 = Grade 3/4, Level 7 = Grade 4, Level 8 = Grade 4/5, Level 9 = Grade 5, Level 10 = Grade 5/6, and Level 11 = Grade 6. Participants in this study reported recently playing repertoire from all 11 levels except Level 2 (Grade 1/2) and Level 4 (Grade 2/3). The average level of musical achievement for this sample was 6.43 ($SD = 2.76$).

Figure 3. Sample Musical Achievement Level



Correlations

Pearson product-moment correlations (see Table 6) among the variables revealed significant correlations between musical achievement and years of experience ($r = .63, p < .001$); musical achievement and years of private lessons ($r = .41, p < .001$); and musical achievement and socioeconomic status ($r = .34, p < .01$). Correlations between gender, race, grit, and musical achievement were not significant ($p > .01$). These findings indicated that early access to string instruction (both private lessons and group instruction) and higher financial resources of a family increased the likelihood of higher levels of musical achievement, as it was defined in this study.

Other significant correlations not directly related to the research question included correlations between socioeconomic status and years of private lessons ($r = .49, p < .001$); socioeconomic status and the Asian race ($r = .43, p < .001$); socioeconomic status and the Black

race ($r = -.33, p < .01$); years of experience and years of private lessons ($r = .73, p < .001$); and years of private lessons and the White race ($r = .33, p < .01$). Students from high-SES backgrounds were more likely to have taken more years of private lessons and to identify as Asian; they were less likely to identify as Black. The longer students had played their instruments, the longer they were likely to have taken private lessons. Finally, White students were more likely to have taken private lessons for a longer period of time than their Asian, Black, and Hispanic peers.

Table 6. Pearson Product-Moment Correlations Between Variables

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. Musical Achievement	1.00	-.23	.34**	.63***	.41***	-.02	.20	-.17	-.17	.11
2. Gender		1.00	.19	-.01	.12	.17	.11	-.25	-.07	.17
3. SES			1.00	.24	.49***	.23	.43***	-.33**	-.18	.05
4. Years of Experience				1.00	.73***	-.16	-.14	-.01	-.19	.28
5. Years of Lessons					1.00	.07	.08	-.19	-.30	.33**
6. Grit-S Scale Score						1.00	.23	-.08	.15	-.25
7. Asian (D1)							1.00	-.29	-.26	-.42
8. Black (D2)								1.00	-.25	-.40
9. Hispanic (D3)									1.00	-.36
10. White (D4)										1.00

Note. ** $p < .01$, *** $p < .001$

Multiple Regression Analysis

An exploratory multiple regression analysis was conducted to determine which variables best predicted string students' musical achievement. The initial five independent variables (grit, socioeconomic status, race, gender, and years of private lessons) plus one additional independent variable (years of experience) were tested. Years of experience was added to the model due to its

strong correlation with musical achievement outlined in the previous section of this document. Examinations of histograms and scatterplots indicated that the assumptions for linearity, normality, and homoscedasticity were met. Multicollinearity assumptions were also met, as tolerance for each independent variable was above .1. An alpha level of .01 was established a priori. Due to the size of the sample ($N = 60$), four predictor variables (years of experience, years of lessons, socioeconomic status, and gender) were included in the regression model (Stevens, 2001). These were chosen because they had the strongest correlations with the dependent variable (see Table 6).

Regression results indicated that the overall model significantly predicted musical achievement, $R^2 = .53$, adjusted $R^2 = .50$, $F(4, 55) = 15.51$, $p < .001$ (see Table 7). This model accounted for 53.0% of the variance in musical achievement among the participants in this sample. Falk and Miller (1992) suggested that R^2 should be at least .10 to be considered meaningful. An R^2 value of .53 is very high, particularly when conducting research with people, between whom there is great variability.

Table 7. Final Model Summary

Model	R	R^2	R^2_{adj}	ΔR^2	F_{chg}	p	df_1	df_2
1	.73	.53	.50	.53	15.51	<.001	4	55

There were positive correlations (ranging from .23 to .63) between the four predictor variables and musical achievement. Bivariate and partial correlation coefficients illustrated that years of experience and SES had t values that significantly contributed to the model. Gender also approached a significant contribution to the model ($p = .01$). Years of experience had the highest beta weight (.75) and the highest partial r (.59) followed by socioeconomic status ($\beta = .34$, partial $r = .39$). Regression coefficients for the final model are presented in Table 8.

Table 8. Regression Coefficients for Final Model

Model	<i>B</i>	β	<i>t</i>	Bivariate <i>r</i>	Partial <i>r</i>
SES	1.86	.34	3.12**	.34	.39
Experience	.61	.75	5.38***	.63	.59
Lessons	-.20	-.28	-1.80	.41	-.24
Gender	-1.40	-.25	-2.62	-.23	-.33

Note. ** $p < .01$, *** $p < .001$

CHAPTER V: DISCUSSION

Purpose Statement

The purpose of this study was to investigate the variables that best predict string students' musical achievement. One research question guided the investigation. Which variables best predicted musical achievement: grit, private lessons, socioeconomic status, race, or gender? Based on results of the exploratory multiple regression analysis, one additional independent variable was investigated: years of experience. Possible relationships between musical achievement and the six independent variables were examined.

Summary of the Results

Grit and Musical Achievement

Grit and musical achievement were found to have a weak, negative correlation that was not significant. These two variables had almost no relationship in this study. For this reason, grit was eliminated from the final regression model in favor of other variables that were more highly correlated with musical achievement.

Socioeconomic Status and Musical Achievement

Socioeconomic status and musical achievement were found to have a significant moderate correlation in this study. SES was also found to be a meaningful predictor of string students' musical achievement. Participants from higher socioeconomic backgrounds tended to demonstrate higher levels of musical achievement. Due to this significant moderate correlation, socioeconomic status was included in the final regression model. This final model, which included years of experience, private instruction, and gender in addition to SES, accounted for approximately 53.0% of the variance in musical achievement among the participants in this sample. Socioeconomic status was one of four predictors that contributed to this variance.

Race, Ethnicity, and Musical Achievement

Pearson product-moment correlations between race, ethnicity, and musical achievement were weak and not significant. Some trends did emerge, but further research is necessary to determine whether these trends are meaningful. For example, being Asian ($r = .20$) and being White ($r = .11$) were positively correlated with musical achievement. Being Black ($r = -.17$) and being Hispanic ($r = -.17$) were negatively correlated with musical achievement. This suggests that Asian students in this study may have reached slightly higher levels of musical achievement than White students, who may have reached higher levels of musical achievement than their Black and Hispanic peers. Due to the lack of significance in these findings, though, these trends are only speculation. The race and ethnicity variable was not included in the final regression model for the present study.

Gender Identity and Musical Achievement

The correlation coefficient between gender identity and musical achievement was weak, negative, and not significant. Since participants identifying as male were coded 0 and participants identifying as female were coded as 1, this negative correlation coefficient means males demonstrated a slightly higher level of musical achievement in this study, but results were not significant. Gender identity was included in the final regression model for this study because it had the fourth-highest correlation with musical achievement. The final model accounted for approximately 53.0% of the variance in musical achievement among participants. Gender identity was one of four predictors that contributed to this variance.

Private Instruction and Musical Achievement

Private instruction and musical achievement were found to have a moderate, significant correlation ($r = .41$). The longer a participant had taken private lessons, the higher their musical

achievement level was likely to be. Private instruction was included in the final regression model but was found to have a negative effect on the model despite the positive correlation with musical achievement. This negative impact on the regression results may have been caused by the extremely high correlation (.73) between years of experience and years of lessons (Falk & Miller, 1992). Falk and Miller (1992) suggested that the redundant variable be eliminated from the model in cases like this; therefore, the private instruction variable may be excluded from future analyses in favor of years of experience.

Years of Experience and Musical Achievement

The strongest significant correlation in this study was found between years of experience and musical achievement. Years of experience was also found to be a meaningful predictor of string students' musical achievement. The greater the years of experience a participant had, the higher their musical achievement level was likely to be. This high correlation coefficient supported the addition of years of experience as another independent variable in this study. Years of experience was included in the final regression model that accounted for approximately 53.0% of the variance in musical achievement. Years of experience was one of four predictors that contributed to this variance.

Additional Significant Correlations

Aside from correlations related directly to the research question and dependent variable, the researcher found other significant correlations that could be important for string teachers to consider. The strongest of these was the correlation between years of experience and years of private lessons ($r = .73$); the longer the participants had played their instrument, the longer they were likely to have taken private lessons. The researcher also found moderate correlations between socioeconomic status and years of private instruction ($r = .49$) and the White race and

years of private instruction ($r = .33$). White participants and participants from high-SES backgrounds were more likely to have taken more years of private lessons than their non-White and low-SES peers. Correlations between socioeconomic status and identifying as Asian/Pacific Islander ($r = .43$) and between socioeconomic status and identifying as Black/African American ($r = -.33$) were also moderate and significant. Asian participants were more likely to come from high-SES backgrounds and Black participants were more likely to come from low-SES backgrounds than their peers of other races and ethnicities.

Implications of the Findings

Grit

Though some scholars have found that grit is an important factor related to student achievement in various domains (Cosgrove et al., 2018; Duckworth & Quinn, 2009), others have questioned the construct of grit (Dixson et al., 2017; Love, 2019). Grit has been shown to account for an average of only 3-6% of the variance in achievement outcomes among individuals from many different backgrounds (Duckworth et al., 2007; Steinmayr et al., 2018). In addition, the notion that grit could help students from marginalized populations achieve success has been met with resistance. On one hand, researchers have found that grit is a tool that individuals from marginalized populations can call upon to help them reach high levels of achievement (McCall, 2015). On the other hand, being gritty does not eliminate systemic issues related to race, gender, or socioeconomic status (Dixson et al., 2017).

This study lends support to the findings of Dixson and colleagues (2017). In the present study, there was almost no relationship ($r = -.02$) between grit and musical achievement. Participants' grit scores essentially had no bearing on the level of musical achievement they reached. Further, mean grit scores of the participants were: (a) Grit-Passion Score = 2.69; (b)

Grit-Perseverance Score = 3.73; and (c) Total Grit Score = 3.21. The mean Total Grit Score falls between the 20th and 30th percentiles. Students may be less gritty following the pandemic.

These results should serve to caution teachers against overemphasizing the development of grit in the music classroom. Teachers may still wish to teach their students to work hard, persist with difficult tasks over time, and try again when they fail, but the results of the present study revealed that students can still reach high levels of musical achievement without being exceptionally gritty and might not reach high levels of achievement despite being quite gritty. Other factors seem to matter more when considering how to help students achieve high levels of musical success. Music teachers might best serve their students by focusing on these other variables that have a greater impact on musical achievement.

Socioeconomic Status

Socioeconomic status may impact musical achievement in a variety of ways. Students from lower-SES backgrounds often do not have access to string instruction (Smith, 1997). Even if they do have access, they may not be able to participate due to financial barriers (Abril & Gault, 2006). Instrumental music programs in low-SES districts often have fewer resources than high-SES districts (Costa-Giomi & Chappell, 2007). Additionally, the results of the present study showed that students from high-SES backgrounds were more likely than their low-SES peers to have taken private lesson for a longer period of time. Since years of private instruction was a significant predictor of musical achievement in this study, students from low-SES backgrounds received less of an opportunity to achieve musical success. Students from low-SES backgrounds must overcome many barriers to achieve success as string players.

Researchers have found a salient relationship between socioeconomic status and the dependent measure of musical achievement (Dell et al., 2014; Elpus, 2022). Results of the

present study support these findings and call for more accessible and equitable string instruction offerings throughout the country. The strongest correlation found in this study was between years of experience and musical achievement.

Establishing new string programs in lower-SES neighborhoods, providing instruments and private instruction at low or no cost to students and families, and writing grants to support lower-SES string programs are a few steps that administrators and string teachers could take to support the musical achievement of students from lower-SES backgrounds. Results of this study revealed that students from low-SES backgrounds have the potential to be successful if given early access to string instruction and private lessons.

Race and Ethnicity

The relationship between race, ethnicity, and achievement (in music and outside of music) is complicated. There are many systems in place that have historically supported the achievement of White students and disadvantaged students from other racial and ethnic backgrounds (Gollnick & Chinn, 2006; Lind & McKoy, 2016). From teachers' unconscious bias to the racial hierarchy of public schools, biased assessment practices, and the relationship between race and SES, there have been many reasons why students of color may have reached lower levels of achievement than their White peers or may not have reached their potential in schools (Astin, 1994; Battle & Lewis, 2002; Bourdieu, 1974, 1986; Hatt, 2012).

The results of the present study showed trends that were similar to related research on race, ethnicity, and achievement (Battle & Lewis, 2002; Ferguson, 2002; Martin et al., 2017; Quinn, 2015), though the present results were not significant. In this study, being Asian had the strongest correlation with musical achievement followed by being White. Being Black or Hispanic had a negative correlation with musical achievement. None of these correlations were

significant. This lack of significance is encouraging, and findings suggested that students from all racial and ethnic backgrounds can achieve success in the string orchestra classroom.

Unfortunately, race and SES have historically been related, and students from low-SES backgrounds have tended to be largely Black and Hispanic or Latinx. To ensure that students from all racial and ethnic backgrounds can achieve success on a string instrument, teachers and administrators must often address issues related to socioeconomic status.

Gender Identity

Researchers have found mixed results regarding the relationship between gender identity and musical achievement. Some found that females outperformed males (Wright, 2001); others found that males outperformed females (Zdzinski, 1992); and still others found no significant gender differences related to student achievement (Madura, 1996; Hedden, 1982). This is encouraging because these mixed findings support the idea that males and females can be successful in music. There is also a growing body of work focused on individuals who do not identify as male or female, but that is beyond the scope of this study.

In the present investigation, males performed slightly better than females based on the musical achievement measure, though these results were not significant. It is important to remember that musical achievement in this study was measured in terms of solo level difficulty. The results may indicate that males were likely to attempt more difficult solo repertoire than females, whether or not they were prepared to play those pieces successfully. Future research with a more robust measure of musical achievement is needed to better understand whether students' repertoire choices accurately reflected their abilities. Teachers should be encouraged by the results of the present study, which do seem to indicate that gender does not significantly predict musical achievement; students of all genders can be successful in the music classroom.

Private Instruction

Surprisingly, literature on the relationship between private instruction and achievement is not consistent. Some researchers found a positive relationship between private instruction and musical achievement (Broomhead, 2001; Lorah et al., 2014), while others found no relationship between these two variables (Brand & Burnsed, 1981; Madura, 1996). In the present study, a strong positive correlation between private instruction and musical achievement was found; the longer a participant had studied privately, the more likely they were to be playing advanced repertoire. These findings lend support to increased access to private instruction, particularly at an early age.

Years of Experience

The correlation between years of experience and musical achievement was the strongest correlation found in the present study. Years of experience was also found to be a meaningful predictor of string students' musical achievement. Results of this study showed that (regardless of selected demographic and noncognitive variables) if students have access to string instruction at an early age, they have a better chance of achieving high levels of musical success. This finding supports early and equitable access to string instruction in the public schools. If increased years of experience is a factor that is highly correlated with musical achievement, one of the best decisions an interested administrator or teacher can make is to start a string program for young students.

Additional Significant Correlations

The most important findings unrelated to the research question in this study were: (a) the correlation between years of lessons and SES and (b) the correlation between years of lessons and identifying as White. These findings underscored inequities in access to private string

instruction. Researchers have found that public school string programs have predominantly existed in middle- and high-SES districts (Smith, 1997) and have been populated by primarily White students (Elpus, 2022). In addition, race, ethnicity, and SES have historically been related, so students of color have often attended low-SES schools that lacked music course offerings (Parsad & Spiegelman, 2012). The present study extended the extant literature by identifying issues of access to private string instruction that non-White and low-SES students have faced. For these marginalized students to have a chance of being successful, string teachers must work toward removing barriers to access for non-White and low-SES students.

Limitations

One notable limitation of the present study was the unique population from which the participants came. The sample ($N = 60$) was limited to middle school, high school, and university students enrolled in one of three organizations: (a) the Peck Alumni Leadership Program, (b) the Greensboro Symphony Youth Orchestras, or (c) The University of North Carolina Greensboro. The PAL Program was specifically developed to increase access to private string instruction for marginalized populations; without this program, many of the participants in this study would not have had access to private lessons. Additionally, most young musicians in the GSYO and music students at UNCG who participated in this study took private lessons; only one of the 60 participants did not. Students in the PAL and GSYO programs attended rehearsals and private lessons on the weekends, demonstrating a level of commitment that may not be standard. The majority of university participants had passed an entrance audition to be a music major or to play in an orchestra at the university. This could have caused the data to be skewed because these university participants may not have represented all university-aged string players interested in music; some interested students may have been rejected from the university music programs.

Because of the unique population from which the sample was drawn, results of the present study may not be generalizable beyond this sample.

Two other limitations of the present study are important to consider. First, there are many variables that could predict the music performance achievement of string students, but only a select few were examined in this study. Other variables that were not included in this study (i.e., parental involvement or deliberate practice) could be stronger predictors of musical achievement. Second, the measurement tools used in this study were imperfect. The measure of music performance achievement only accounted for the level of repertoire the participants had recently played, not how well they had performed that repertoire. Some participants may have been learning solos that were either too difficult or too easy for them and did not accurately reflect their level of competence on their instrument. All data collected were also self-reported. Scholars have noted problems with self-report data such as the danger of social desirability bias (Duckworth et al., 2007). It is possible that participants reported more socially acceptable rather than honest responses on the 8-Item Grit Scale or demographic questionnaire to be viewed more favorably by the researcher.

Applications and Recommendations for Future Practice and Research

Years of experience on a string instrument, years of private instruction, and socioeconomic status were the three predictor variables that were the most strongly correlated with the dependent variable in this study. In addition, these three predictor variables (along with gender identity) predicted 53.0% of the variance in music performance achievement in the present sample; this was a remarkably high percentage. Meaningful correlations were also found between socioeconomic status and years of private lessons and between years of private lessons

and identifying as White. Taken together, these results revealed notable issues of equity and access that impacted string students' musical achievement.

Teachers and administrators must respond to these issues of access and equity to best serve their students. Because cost serves as a substantial barrier to entry into the world of string education, they must remove financial barriers associated with public school and private string instruction when they are able. At a fundamental level, policy change is necessary. Music educators must get involved in policymaking. They must also focus their energies on drawing attention to the inequities surrounding string instruction instead of celebrating and rewarding the achievement of programs that are well-funded. They may consider establishing partnerships with other organizations that can help provide funding for music education when policy cannot be changed.

Further research is needed to better understand the complicated relationship between demographic variables, noncognitive variables, and musical achievement. Research including a more robust measure of musical achievement would provide more clarity regarding the relationships between the variables included in this study and students' musical performance achievement. That measure should quantify both the level of repertoire participants play and the level at which they perform the repertoire.

In addition, further research is needed to explain the interaction between race, gender identity, socioeconomic status, and musical achievement. Previous research has identified meaningful relationships between these three demographic variables. A more thorough understanding of how they relate to one another in the music classroom could help teachers address systemic issues related to race, gender, and socioeconomic status in the field of string education. Research that provides additional information on the variables that contribute to string

students' musical achievement is needed to help string teachers best serve their current and future students.

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APPENDIX A: SHORT GRIT SCALE

Short Grit Scale

Directions for taking the Grit Scale: Here are a number of statements that may or may not apply to you. For the most accurate score, when responding, think of how you compare to most people -- not just the people you know well, but most people in the world. There are no right or wrong answers, so just answer honestly!

1. New ideas and projects sometimes distract me from previous ones.*

- Very much like me
- Mostly like me
- Somewhat like me
- Not much like me
- Not like me at all

2. Setbacks don't discourage me.

- Very much like me
- Mostly like me
- Somewhat like me
- Not much like me
- Not like me at all

3. I have been obsessed with a certain idea or project for a short time but later lost interest.*

- Very much like me
- Mostly like me
- Somewhat like me
- Not much like me
- Not like me at all

4. I am a hard worker.

- Very much like me
- Mostly like me
- Somewhat like me
- Not much like me
- Not like me at all

5. I often set a goal but later choose to pursue a different one.*

- Very much like me
- Mostly like me
- Somewhat like me
- Not much like me
- Not like me at all

6. I have difficulty maintaining my focus on projects that take more than a few months to complete.*

- Very much like me
- Mostly like me
- Somewhat like me
- Not much like me
- Not like me at all

7. I finish whatever I begin.

- Very much like me
- Mostly like me
- Somewhat like me
- Not much like me
- Not like me at all

8. I am diligent.

- Very much like me
- Mostly like me
- Somewhat like me
- Not much like me
- Not like me at all

Scoring:

1. For questions 2, 4, 7 and 8 assign the following points:

- 5 = Very much like me
- 4 = Mostly like me
- 3 = Somewhat like me
- 2 = Not much like me
- 1 = Not like me at all

2. For questions 1, 3, 5 and 6 assign the following points:

- 1 = Very much like me
- 2 = Mostly like me
- 3 = Somewhat like me
- 4 = Not much like me
- 5 = Not like me at all

Add up all the points and divide by 8. The maximum score on this scale is 5 (extremely gritty), and the lowest score on this scale is 1 (not at all gritty).

APPENDIX B: DEMOGRAPHIC QUESTIONNAIRE

Demographic Questionnaire

1. Your Study ID Number (write in)
2. Your Age (write in)
3. With what gender category do you most identify?
 - a. Male
 - b. Female
 - c. I identify my gender as: _____ (please specify)
4. Race/Ethnicity:
 - a. American Indian or Native Alaskan
 - b. Asian
 - c. Black or African American
 - d. Hispanic or Latinx
 - e. Native Hawaiian or Other Pacific Islander
 - f. White
 - g. Other (please specify)
5. Middle and High School Students: Do you qualify for free or reduced lunch?
 - a. Yes
 - b. No
 - c. N/A: I am a university student
6. University Students: Do you qualify for a PELL grant?
 - a. Yes
 - b. No
 - c. N/A: I am a middle or high school student
7. What instrument do you play?
 - a. Violin
 - b. Viola
 - c. Cello
 - d. Bass
8. Years of Experience on Your Instrument (write in)
9. Middle and High School Students: Are you in orchestra at your school?
 - a. Yes
 - b. No
 - c. N/A: I am a university student
10. Do you take private lessons on your instrument?
 - a. Yes
 - b. No
11. If you answered “Yes” to Question 10, please share the number of years you have taken lessons. If you answered “No” to Question 10, please write “N/A.” (Write in)
12. Please list the three most recent solo pieces you have played on your instrument. Include the composer’s name if you can. (Write in)

13. Do you do any other musical activities, like play another instrument or sing?
 - a. Yes
 - b. No
14. If you answered “Yes” to Question 13, please describe the musical activity, including the activity or class, how many years you have participated, and how often you meet. If you answered “No” to Question 13, please write “N/A.”
15. Do you participate in any other extracurricular activities like clubs or sports?
 - a. Yes
 - b. No
16. If you answered “Yes” to Question 15, please describe the activities, including the name of the activity, how many years you have participated, and how often you meet. If you answered “No” to Question 15, please write “N/A.”

APPENDIX C: IRB APPROVAL NOTICE



Heather Lofdahl <halofdah@uncg.edu>

IRB-FY22-289 - Modification: Modification

1 message

do-not-reply@cayuse.com <do-not-reply@cayuse.com>
To: halofdah@uncg.edu, rbmacleo@uncg.edu
Cc: ori@uncg.edu

Fri, Jul 29, 2022 at 11:37 AM



UNC GREENSBORO

July 29, 2022

Heather Lofdahl
Graduate Student, School of Music

Re: Modification Approval - IRB-FY22-289 An Investigation of Variables that Predict String Students' Musical Achievement

Dear Heather Lofdahl:

UNCG Institutional Review Board has rendered the decision below for An Investigation of Variables that Predict String Students' Musical Achievement. This modification is now approved.

Decision: Approved

Modification Information:

1. The title, purpose, research questions, and measurement tools have shifted slightly.
2. New Title: An Investigation of Variables that Predict String Students' Musical Achievement
3. New Purpose: The purpose of this study will be to investigate the variables that best predict string students' musical achievement.
4. New Research Question: Which variable is the strongest predictor of string students' musical achievement: grit, private lessons, socioeconomic status, race, or gender?
5. New Measurement Tool: Duckworth's Grit-S Scale and Demographic Questionnaire updates
6. Revised the recruitment script and consent/assent forms to reflect the modification

If this modification involved changes to the consent form/IRB Information Sheet, please utilize the the consent form/information sheet with the most recent version date when enrolling participants.

Sincerely,

UNCG Institutional Review Board

APPENDIX D: CONSENT FOR A MINOR TO ACT AS A HUMAN PARTICIPANT

UNIVERSITY OF NORTH CAROLINA AT GREENSBORO

CONSENT FOR A MINOR TO ACT AS A HUMAN PARTICIPANT: LONG FORM

Project Title: An Investigation of Variables that Predict String Students' Musical Achievement

Principal Investigator: Heather A. Lofdahl

Faculty Advisor: Dr. Rebecca B. MacLeod

Participant's Name: _____

Parent/Guardian email: _____

What are some general things you should know about research studies?

Your child is being asked to take part in a research study. Your child's participation in the study is voluntary. You may choose for your child not to join, or you may withdraw your consent for them to be in the study, for any reason, without penalty.

Research studies are designed to obtain new knowledge. This new information may help people in the future. There may not be any direct benefit to your child for being in the research study. There also may be risks to being in research studies. If you choose for your child not to be in the study or you choose for your child to leave the study before it is done, it will not affect your relationship or your child's relationship with the researcher or the University of North Carolina at Greensboro.

Details about this study are discussed in this consent form. It is important that you understand this information so that you can make an informed choice about your child being in this research study.

You will be given a copy of this consent form. If you have any questions about this study at any time, you should ask the researchers named in this consent form. Their contact information is below.

What is the study about?

This is a research project. Your child's participation in this project is voluntary. The purpose of this study will be to investigate the variables that best predict string students' musical achievement. Researchers have identified many important traits and skills related to student success, but some of these should be investigated further within the field of music education. This study will add to a growing body of work related to musical achievement among string students.

Why are you asking my child?

Your child is being asked because they play a string instrument (violin, viola, cello, or bass) and are a member of the Greensboro Symphony Youth Orchestra (GSYO) or Peck Alumni Leadership (PAL) program and are at least 12 years old.

Version 7-22-22

What will you ask my child to do if I agree to let him or her be in the study?

If you agree to allow your child to participate in this study, they would be asked to meet with the researcher once for approximately 30 minutes or less. This meeting would take place at UNCG either before or after GSYO or PAL. During this meeting, your child would complete a questionnaire on a computer provided for them. Your child would be a participant in this study for 3 months or less and would only meet with the researcher once during this time frame.

What are the dangers to my child?

The Institutional Review Board at the University of North Carolina at Greensboro has determined that participation in this study poses minimal risk to participants. In rare instances, participants may feel uncomfortable answering questions about their demographic information. Your child's teachers and peers will never see their questionnaire responses.

If you have questions, want more information or have suggestions, please contact Heather Lofdahl, who may be reached at 770.265.5074 or halofdah@uncg.edu. You may also contact Dr. Rebecca MacLeod at 336.543.0891 or rbmacleo@uncg.edu.

If you have any concerns about your rights, how you are being treated, concerns or complaints about this project or benefits or risks associated with being in this study, please contact the Office of Research Integrity at UNCG toll-free at (855)-251-2351.

Are there any benefits to society as a result of my child taking part in this research?

These results may be transferable to teachers, administrators, or parents who are interested in helping children increase musical achievement.

Are there any benefits to *my child* as a result of participation in this research study?

There are no direct benefits to you; however, you and your child's teacher may benefit from the results of the study. This may directly benefit your child's future learning.

Will my child get paid for being in the study? Will it cost me anything for my kid to be in this study?

There are no costs to you or payments to you or your child as a result of participation in this study.

How will my child's information be kept confidential?

Efforts will be made to keep your child's study-related information confidential. Your child will be given a numerical code, and all data will be de-identified. Data will be stored in a secure UNCG Box folder on a password protected computer. Consent forms will be stored in a locked safe in the researcher's home. All data will be stored for 6 years following completion of the study and then destroyed. All information obtained in this study is strictly confidential unless disclosure is required by law.

What if my child wants to leave the study or I want him/her to leave the study?

You have the right to refuse to allow your child to participate or to withdraw him or her at any time, without penalty. If your child does withdraw, it will not affect you or your child in any way. If you or your child chooses to withdraw, you may request that any data which has been collected be destroyed unless it is in a de-identifiable state. The investigators also have the right to stop your child's participation at any time. This could be because your child has had an unexpected reaction, has failed to follow instructions, or because the entire study has been stopped.

What about new information/changes in the study?

If significant new information relating to the study becomes available which may relate to your willingness to allow your child to continue to participate, this information will be provided to you.

Voluntary Consent by Participant:

By signing this consent form, you are agreeing that you have read it or it has been read to you, you fully understand the contents of this document and consent to your child taking part in this study. All of your questions concerning this study have been answered. By signing this form, you are agreeing that you are the legal parent or guardian of the child who wishes to participate in this study described to you by Heather Lofdahl.

_____ Date: _____
Participant's Parent/Legal Guardian's Signature

APPENDIX E: ASSENT TEMPLATE FOR MINORS 12-17

Assent Template for Minors 12-17

Project Title: An Investigation of Variables that Predict String Students' Musical Achievement

Principal Investigator: Heather A. Lofdahl

Faculty Advisor: Dr. Rebecca B. MacLeod

Participant's Name: _____

WHY AM I HERE?

We want to tell you about a research study we are doing. Research studies are done to find better ways of helping and understanding people or to get information about how things work. In this study we want to find out more about traits that impact musical achievement. You are being asked to be in the study because you play a string instrument (violin, viola, cello, or bass), are at least 12 years old, and are a member of the Greensboro Symphony Youth Orchestra (GSYO) or Peck Alumni Leadership (PAL) program. In a research study, only people who want to take part are allowed to do so.

WHAT WILL HAPPEN TO ME IN THIS RESEARCH STUDY?

If it is okay with you and you agree to join this study, you will be asked to meet with me once for about 30 minutes or less. This meeting would take place at UNCG either before or after GSYO or PAL. During this meeting, you would complete a questionnaire on a computer provided for you. You would be a participant in this study for three months or less.

HOW LONG WILL I BE IN THE RESEARCH STUDY?

You will be in this study for three months or less. During that time, we would meet once at UNCG for about 30 minutes to complete the questionnaire.

CAN ANYTHING BAD HAPPEN TO ME?

Sometimes the questions we ask you might seem strange or make you feel uncomfortable. We will ask you questions about your age, gender, race, musical background, passion, perseverance, and whether or not you qualify for free or reduced price lunch. If anything hurts or you are uncomfortable with some of the questions or activities, please let us know and we will stop or do whatever we can to make you feel better.

CAN ANYTHING GOOD HAPPEN TO ME IN THIS RESEARCH STUDY?

We do not know if you will be helped by being in this project. However, we may learn something that will help other children be successful in their musical studies in the future.

DO I HAVE OTHER CHOICES?

You do not have to be in this study.

WHAT IF I DO NOT WANT TO BE IN THIS RESEARCH STUDY?

You do not have to be part of this project. It is up to you. You can even say okay now, but change your mind later. All you have to do is tell us. No one will be mad at you if you change your mind.

WHAT ABOUT MY CONFIDENTIALITY?

We will do everything possible to make sure that your data and or records are kept confidential.

Unless required by law, only the study team can look at your records. They are required to keep your personal information confidential.

WILL I BE PAID FOR BEING IN THIS RESEARCH STUDY?

You will not be paid for taking the time to be in this study.

DO MY PARENTS KNOW ABOUT THIS RESEARCH STUDY?

This study has been explained to your parent/parents/guardian and they have given permission for you to be in it.

WHAT IF I HAVE QUESTIONS?

You can ask Heather Lofdahl, who may be reached at 770.265.5074 or halofdah@uncg.edu, anything about the study. You may also contact Dr. Rebecca MacLeod at 336.543.0891 or rbmacleo@uncg.edu or the Office Research Integrity at 855.251.2351.

ASSENT

This study has been explained to me and I am willing to be in it.

Child's Name (printed) and Signature	Date

Check which applies below

- The child is capable of reading and understanding the assent form and has signed above as documentation of assent to take part in this study.

- The child is not capable of reading the assent form, but the information was verbally explained to him/her. The child signed above as documentation of assent to take part in this study.

Signature of Person Obtaining Assent

Date

APPENDIX F: CONSENT TO ACT AS A HUMAN PARTICIPANT

UNIVERSITY OF NORTH CAROLINA AT GREENSBORO

CONSENT TO ACT AS A HUMAN PARTICIPANT

Project Title: An Investigation of Variables that Predict String Students' Musical Achievement

Principal Investigator: Heather A. Lofdahl

Faculty Advisor: Dr. Rebecca B. MacLeod

Participant's Name: _____

Participant's email: _____

What are some general things you should know about research studies?

You are being asked to take part in a research study. Your participation in the study is voluntary. You may choose not to join, or you may withdraw your consent to be in the study, for any reason, without penalty.

Research studies are designed to obtain new knowledge. This new information may help people in the future. There may not be any direct benefit to you for being in the research study. There also may be risks to being in research studies. If you choose not to be in the study or leave the study before it is done, it will not affect your relationship with the researcher or the University of North Carolina at Greensboro.

Details about this study are discussed in this consent form. It is important that you understand this information so that you can make an informed choice about being in this research study.

You will be given a copy of this consent form. If you have any questions about this study at any time, you should ask the researchers named in this consent form. Their contact information is below.

What is the study about?

This is a research project. Your participation is voluntary. The purpose of this study will be to investigate the variables that best predict string students' musical achievement. Researchers have identified many important traits and skills related to student success, but some of these should be investigated further within the field of music education. This study will add to a growing body of work related to musical achievement among string students.

Why are you asking me?

You are being asked because you are an undergraduate or high school string player (violin, viola, cello, or bass). Undergraduate participants must be enrolled at UNCG. High school students must be enrolled in the Greensboro Symphony Youth Orchestra (GSYO) or Peck Alumni Leadership (PAL) programs.

What will you ask me to do if I agree to be in the study?

Version 7-22-22

If you agree to participate in this study, you would be asked to meet with the researcher once for approximately 30 minutes or less. During this meeting, you would complete a questionnaire on a computer provided for you. You would be a participant in this study for 3 months or less and would meet with the researcher only once during this time frame.

What are the risks to me?

The Institutional Review Board at the University of North Carolina at Greensboro has determined that participation in this study poses minimal risk to participants. In rare instances, participants may feel uncomfortable answering questions about their demographic information. Your professors, peers, and employers will never see your questionnaire responses.

If you have questions, want more information or have suggestions, please contact Heather Lofdahl, who may be reached at 770.265.5074 or halofdah@uncg.edu. You may also contact Dr. Rebecca MacLeod at 336.543.0891 or rbsmacleo@uncg.edu.

If you have any concerns about your rights, how you are being treated, concerns or complaints about this project or benefits or risks associated with being in this study, please contact the Office of Research Integrity at UNCG toll-free at (855)-251-2351.

Are there any benefits to society as a result of me taking part in this research?

These results may be transferable to teachers, administrators, or parents who are interested in helping children increase musical achievement.

Are there any benefits to me for taking part in this research study?

There are no direct benefits to you; however, the results of this study may help to inform your future musical achievement.

Will I get paid for being in the study? Will it cost me anything?

There are no costs to you or payments made for participating in this study.

How will you keep my information confidential?

Efforts will be made to keep your study-related information confidential. You will be given a numerical code, and all data will be de-identified. Data will be stored in a secure UNCG Box folder on a password protected computer. Consent forms will be stored in a locked safe in the researcher's home. All data will be stored for 6 years following completion of the study and then destroyed. All information obtained in this study is strictly confidential unless disclosure is required by law.

What if I want to leave the study?

You have the right to refuse to participate or to withdraw at any time, without penalty. If you do withdraw, it will not affect you in any way. If you choose to withdraw, you may request that any of your data which has been collected be destroyed unless it is in a de-identifiable state. The investigators also have the right to stop your participation at any time. This could be because you have had an unexpected reaction, or have failed to follow instructions, or because the entire study has been stopped.

Version 7-22-22

What about new information/changes in the study?

If significant new information relating to the study becomes available which may relate to your willingness to continue to participate, this information will be provided to you.

Voluntary Consent by Participant:

By signing this consent form, you are agreeing that you read, or it has been read to you, and you fully understand the contents of this document and are openly willing consent to take part in this study. All of your questions concerning this study have been answered. By signing this form, you are agreeing that you are 18 years of age or older and are agreeing to participate in this study described to you by Heather Lofdahl.

Signature: _____ Date: _____