

ASSOCIATIONS BETWEEN INSTRUMENTAL MUSIC AND SCHOOL SUCCESS IN
LOW SES STUDENTS

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The undersigned, appointed by the dean of the Graduate School, have examined the thesis titled

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LOW SES STUDENTS

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Abstract

Building on previous research that shows a positive relationship between instrumental music enrollment and school success, standardized test scores, grade point averages, and attendance information for one cohort of students in two Missouri school districts over five academic years (N1 = 1365, N2 = 606) were analyzed to examine differences in school success for four groups of students categorized by socioeconomic status (SES, high and low) and instrumental enrollment (enrolled or not). Low SES, low ability instrumental and non-instrumental students were also compared. In both districts instrumental students have higher test scores and better attendance in 8th grade than non-instrumental students. Their test scores improve more between 4th and 8th grade than non-instrumental students and self-selection of higher achievers into instrumental music was only clear for one district. The same trends were apparent in low SES, low ability students, but failed to reach statistical significance because of a small sample.

Chapter 1: Introduction

Statement of Problem

The value of non-core subjects and extra-curricular programs for promoting school success is a source of frequent debate, particularly among those teaching non-core subjects and policy makers who allocate funds for these courses. Although the No Child Left Behind Act claims that the arts are a core subject, the use of high stakes testing in the areas of math, language arts, and science has de-emphasized the importance of all other subjects (Ashford, 2004; Beveridge, 2009). Current research on instrumental music, which is reviewed in chapter 2, has shown it is associated with higher levels of school success. Most of these studies have, however, been limited by an inability to separate initial self-selection of high achievers into instrumental music and actual improvement once enrolled, with only a handful of longitudinal studies allowing for baseline measures of school success. Furthermore, students of low socioeconomic status (SES), a group that might benefit greatly from participation in instrumental music, are frequently overlooked in this body of research because of their limited representation in instrumental music programs.

Purpose

To address the shortcomings in the current literature and extend previous longitudinal research, I collected data from multiple districts at the student level and examined the relationship between involvement in instrumental music and school success over time by comparing four groups of students: High SES Instrumental (HI), High SES Non-Instrumental (HN), Low SES Instrumental (LI), and Low SES Non-Instrumental (LN) on multiple

measures of school success (attendance rates, grade point average, communication arts assessments, mathematics assessments, and TerraNova standardized test scores). A retrospective design was used in order to compare measures of success prior to or at the beginning of instrumental enrollment and after several years of instrumental music instruction. Self-selection should be apparent as group differences in the initial baseline measures, while group differences in how students change over time can be argued to reflect the influence of instrumental music instruction.

Significance of Study

There are three major gaps in the literature on the subject of school success and instrumental music enrollment. First, very little research has directly investigated the relationship between instrumental music and school success for low SES students. Most of the research that has focused on music and SES is directed at showing the differences in involvement in music for low and higher SES students, highlighting the lack of involvement from low SES students. Second, many research studies have not controlled for the level of success of students prior to the study of instrumental music. When this variable has been taken into consideration studies have revealed that instrumental music students had higher levels of achievement before enrolling in band or orchestra. Finally, although a great deal of research has examined the relationship between instrumental music and achievement test scores and to a lesser extent teacher assigned grades, it is rare that a study used both elements. Additionally, attendance has been largely overlooked as an outcome of instrumental music study.

To fill these gaps, my study focused on low SES students involved in instrumental music, included multiple measures of school success, and included measurements of these variables prior to or during the first year of enrollment in instrumental music.

Research Questions

1. Are there differences among the four groups of students (HI, HN, LI, LN) prior to enrollment in an instrumental program in five measures of school success: attendance rates, grade point average, communication arts Missouri Assessment Program (CA MAP) scores, mathematics Missouri Assessment Program (MA MAP) scores, and TerraNova percentiles?
2. How do the four groups of students compare over time after instrumental music enrollment on the five measures of school success?
3. How do low SES, low ability instrumental students compare to low SES, low ability non-instrumental students on the five measures of school success?

Chapter 2: Literature Review

Many instrumental music instructors have made the claim that the study of instrumental music improves school performance based on research that has shown a positive correlation between involvement in instrumental music and a variety of measures of school success. Some of these studies use SES as a control variable but only two researchers have actively considered how instrumental music may affect low SES students (Fitzpatrick, 2006; Kinney, 2008, 2009). Most research that involved low SES students and instrumental music was focused on the under-representation of these students in instrumental music programs. If instrumental music is believed to improve school success, then low SES students, who traditionally struggle academically when compared to their high SES peers, should be encouraged to enroll in instrumental programs.

Relationship between Instrumental Music and School Success

The majority of the literature shows a positive correlation between involvement in music and school success as measured by test scores and teacher-assigned grades in communication arts (Babo, 2004; Broh, 2002; Brown, Benedett, & Armistead, 2010; Covay & Carbonaro, 2010; Davenport, 2010; Fitzpatrick, 2006; Gouzouasis, Guhn, & Kishor, 2007; Kinney, 2008, 2009; Southgate & Roscigno, 2009; Wallick, 1998), mathematics (Broh, 2002; Davenport, 2010; Fitzpatrick, 2006; Gouzouasis et al., 2007; Kinney, 2008; Southgate & Roscigno, 2009), science (Fitzpatrick, 2006; Gouzouasis et al., 2007; Kinney, 2008), and citizenship (Fitzpatrick, 2006; Wallick, 1998). Few of these studies have controlled for SES or prior success, and the research is largely correlational. With this kind of research we cannot assign

causation so the positive correlation may be the result of higher income and higher achieving students studying music, rather than studying music causing high achievement.

True experiments are difficult and often unethical in school settings. Costa-Giomi (2004) used a quasi-experimental study to examine how three years of piano lessons would affect academic achievement, school performance, and self esteem. An attempt was made to randomly assign 4th grade students who had no previous formal music training to treatment (n=67) and control (n=50) groups. However 7 of the 15 schools involved in the study only had students in either the treatment or the control group and many students dropped out of the study. This study provided mixed results. Piano lessons did have a significant positive effect on self esteem but did not have a significant effect on achievement test scores or school grades.

Like the Costa-Giomi (2004) study, Kvet (1985) and Wallick (1998) found mixed results. Both researchers used matched pair designs to determine whether there were significant differences between students pulled out of the regular classroom to study instrumental music and those remaining in the classroom. In both studies IQ scores were considered when pairs were matched, but SES was not considered. Wallick (1998) found significant differences for students studying string instruments in reading and citizenship test scores but not for writing or math scores. Kvet (1985) found no significant differences at all. Although these studies did not show a strong positive relationship between the study of music and school success they do show that missing some academic study in order to study music does not put an additional strain on students and that pulling students out of the general education classroom to study instrumental music does not hurt them academically.

Attendance

School attendance is positively correlated with higher grade point average (GPA) and achievement test scores for elementary and middle school students (Easton & Engelhard, 1982; Gottfried, 2009; Lamdin, 1996). The relationship between attendance and involvement in instrumental music has been largely unmeasured; only one research project could be located that included attendance as a variable. In his dissertation, Davenport (2010) examined music participation, achievement test scores, and attendance rates of middle school and high school students. Attendance rates were higher for high school students who were enrolled in instrumental music.

Socio-Economic Status in Music Research

Some researchers have done a better job controlling for or even focusing on SES and the role it plays in the relationship between instrumental music and school success. Broh (2002) analyzed data from the National Educational Longitudinal Study of 1988 to examine the effects of involvement in extra curricular activities. Use of a large national data base allowed for a large sample size and provides information that allowed Broh to control for a wide variety of variables including SES. The study primarily focused on interscholastic sports but also examined other extra curricular activities. Music was the only activity other than interscholastic sports linked to higher achievement.

Babo (2004) used multiple regression analysis, controlling for gender, SES, and IQ, to examine the relationship between instrumental music and academic achievement. IQ was determined to be the strongest predictor, but SES and instrumental music were also found to contribute to the variance in academic test scores.

Two recent studies have attempted to examine SES and prior levels of success. Both found that instrumental music students have higher scores before entering instrumental programs. Kinney (2008) examined the relationship between music participation (band, choir, or none), SES, home environment (single or two parent homes) and academic achievement of 6th and 8th grade urban students. Achievement test scores from 4th grade were used as a baseline for participants. SES was significant in predicting test scores while home environment did not have a significant effect. In 6th grade, band students scored significantly higher than choir and non-musicians. The 8th grade results were similar, with non-musicians scoring lower; however, the difference between band and choir students was no longer significant. Band students were found to have significantly higher test scores in 4th grade, prior to instrumental music study, suggesting that higher achievers are more interested in band programs.

My research design is largely influenced by Fitzpatrick (2006), who used a retrospective design to examine the test scores of high school students. Students were divided into two groups: instrumental music and non music and were also sorted by SES. Instrumental music students outperformed non music students at all levels, even prior to instrumental music study. As expected, higher SES students outperformed low SES students. At early grades the higher SES students who would be non musicians in high school outperformed the low SES students who would eventually study music, but by 9th grade the low SES instrumental music students were performing better than the higher SES non-musicians as measured by scores on the Ohio State Proficiency Test.

SES and Representation in Music

Low SES students tend to be underrepresented in instrumental music programs. High costs and lack of safe, reliable transportation to or from extra-curricular activities may prevent many low SES students from participating in instrumental music programs (Cornelli Sanderson & Richards, 2010; Kinney, 2009).

Kinney (2009) examined student demographic information and test scores of 6th and 8th grade students at two middle schools deemed “in need of improvement” by the state department of education. Initial enrollment was not predicted by SES, but retention in a program was predicted, with fewer low SES students persisting in the band programs. Also, students of single parent homes were less likely to be enrolled in band.

Southgate and Roscigno (2009) used two national data sources representing longitudinal studies, providing large sample sizes for both early childhood and adolescence. They examined music involvement based on student demographics and also examined music involvement’s relationship to achievement. They found that participation varies by class, race, and gender. Low SES and minority students are less likely to be involved in school music during adolescence.

Covay and Carbonaro (2010) used data from the Early Childhood Longitudinal Study–Kindergarten Class of 1998–99 to examine the relationship between involvement in extra curricular activities and the perceived SES advantage in cognitive and non-cognitive skills. Participation in extra curricular activities was found to increase with SES level.

Chapter 3: Methods

Research Design and Data Collection

Student data were collected for one cohort of students from two participating school districts. Inspired by the work of Fitzpatrick (2006), a retrospective design was used to look back at measures of school success for this group when they were 3rd through 8th grade students. This design provides a baseline for school success prior to involvement in instrumental music and allows for an examination of group by time interactions. The school districts involved provided all data in a spread sheet and provided a research ID for each student in the data set so that student information would remain anonymous. The use of multiple districts was desirable so that district effects could be examined and to help obtain a large sample size.

Prior to data collection I ran four power analyses in R (R Core Team, 2013) to determine appropriate sample sizes for the research. Low power is a concern when results are not significant but a trend is seen in the data. First I ran a pair of power analyses for a four-group analysis of variance (ANOVA) with two different effect sizes. For a small effect size ($k = 4, f = .1, \text{sig.level}=.05, \text{power}=.80$) a minimum of 274 subjects in each group would be needed. For a moderate effect size ($k = 4, f = .25, \text{sig.level}=.05, \text{power}=.80$) a minimum of 45 subjects in each group would be needed. Then I ran a pair of power analyses for a two group t-test with results for a small effect size ($k = 2, f = .1, \text{sig.level}=.05, \text{power}=.80$) and a moderate effect size ($k = 2, f = .25, \text{sig.level}=.05, \text{power}=.80$) revealing a need for 393 or 64

subjects in each group respectively. Effect sizes are frequently low in similar studies so large sample sizes are desirable (Kinney, 2008; Kvet, 1985).

To identify districts suitable for my research I downloaded a spread sheet file with enrollment data by grade for all Missouri school districts for 2012 through the Missouri Department of Elementary and Secondary Education (“Home Page | Missouri Department of Elementary and Secondary Education,” n.d.). The data for 8th grade were sorted in descending order revealing that there were 544 school districts that served 8th grade students in 2012, ranging in size from 1 student to 1828 students at the 8th grade level. The 30 school districts with the largest 8th grade populations, ranging from 448 to 1828 students, were contacted and invited to participate in the research project. As mentioned previously, low SES students are frequently underrepresented in instrumental programs (Kinney, 2008; Southgate & Roscigno, 2009). The use of large school districts should increase the probability of having low SES instrumental students within the cohort which was important in meeting the requirements of a large sample size.

Participants

Two districts provided me with data sets for my analysis. District 1 serves students from sections of 6 different cities in a large metropolitan area. Although the 6 cities vary greatly in size they share characteristics. Five of the six are predominately white which is similar to the rest of the state of Missouri and all but one have a much higher median income than the state of Missouri as a whole. District 2 serves students from one large city which is also predominately white. This community however has a median income of \$38,192 which is lower than the state of Missouri’s median income of \$47,333 (“QuickFacts from the US Census Bureau,” n.d.).

District 1 provided a data set that included free and reduced lunch status for 3-8th grade, TerraNova Percentiles for 3-8th grade, Math MAP scores for 3-8th grade, Communication Arts scores for 3-8 grade, Attendance data for 4-8th grade, instrumental enrollment data for 5-8th grade, and cumulative GPA for 6-8th grade for 1365 individuals who were enrolled for at least part of their 8th grade year. This data set included some missing data points because not all students were enrolled for all grade levels. Within this data set approximately 21% of students received free or reduced lunch at some point, 69% were white (this percentage is much lower than the census data revealed), 16% black, 9% Asian, 4% Hispanic, 3% Other (mixed race, pacific islander, Indian), 48% female, and 52% male. The majority of the analysis used four comparison groups: HI (n=318), HN (n=482), LI (n=50), LN (n=165).

District 2 provided a data set that included free and reduced lunch status for 4-8th grade, Math MAP scores for 4-8th grade, Communication Arts scores for 4-8 grade, Attendance data for 4-8th grade, and instrumental enrollment data for 6-8th grade for 606 individuals who were enrolled for at least part of their 8th grade year. This data set also included some missing data points because not all students were enrolled for all grade levels. Within this data set approximately 60% of students received free or reduced lunch at some point, 81% were white, 5% black, 2% Asian, 5% Hispanic, 6% Other (mixed race, pacific islander, Indian), 50% female, and 50% male. The majority of the analysis used four comparison groups: HI (n=35), HN (n=98), LI (n=63), LN (n=247).

Variables

Control Variables

District, gender, and race were used as control variables in this study. School districts report race in seven categories to the Missouri Department of Elementary and Secondary

Education: Asian, Black, Hispanic, Indian, Mixed, Pacific Islander, and White. The number of students in the Indian and Pacific Islander categories was very low in both data sets so they were combined with Mixed for all analyses.

Independent Variables

SES

SES is related to years of education, type of employment, income, and access to resources (Berk, 2010; Harwell & LeBeau, 2010). Free and reduced lunch (FRL) will be used as a proxy for SES in this research. FRL has been used interchangeably with SES in many education research studies (Babo, 2004; Fitzpatrick, 2006; Kinney, 2008, 2009). Income guidelines for FRL are 185% of federal poverty guidelines for reduced lunch and 130% for free lunch. For a four person family an income of \$42643 would qualify for a reduced price lunch. In Missouri in 2012 the median income for a four person family was \$69,727 (“Federal Register | State Median Income Estimates for a Four-Person Household: Notice of the Federal Fiscal Year (FFY) 2013 State Median Income Estimates for Use Under the Low Income Home Energy Assistance Program (LIHEAP),” n.d.; United States Department of Agriculture Food and Nutrition Service, 2012)

Districts provided me with information from each grade level about the lunch status of individual students (free, reduced, or not). This information was recoded into a binary category: High SES (never received free or reduced price lunch) and Low SES (received free or reduced price lunch at some point).

Instrumental Music Enrollment

Districts provided me with information about instrumental enrollment for each grade level available. During analysis instrumental enrollment reflected only those who were enrolled in instrumental music in 8th grade.

Dependent Variables

Standardized test scores and grade point averages are commonly used as measures of academic achievement. The Missouri Assessment Program (MAP) and TerraNova are administered to 3rd-8th grade students in Missouri each year (“Appendix D Map Score Use, Meaningfulness, and Dependability,” n.d.). Attendance not only positively correlates with higher test scores and GPAs but is also important in determining state funding for schools.

Communication Arts

Participating districts provided MAP scale scores for each student for each grade level available in communication arts (scale score range 455-875)

Mathematics

Participating districts provided MAP scale scores for each student for each grade level available in mathematics (scale score range 450-885).

TerraNova

One participating district provided national percentiles for each student for each grade level available for the TerraNova. These percentiles were used as an additional measure of success and to approximate ability levels. Percentiles were not transformed because the residuals appeared normal when used in regression models (see Figures 1 and 2).

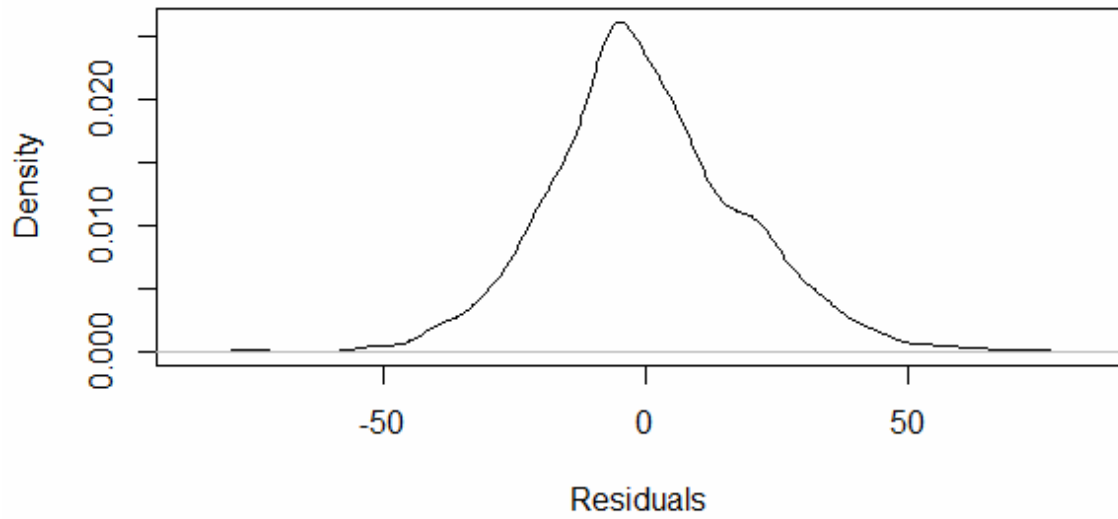


Figure 1. Density of residuals of TerraNova percentiles for District 1.

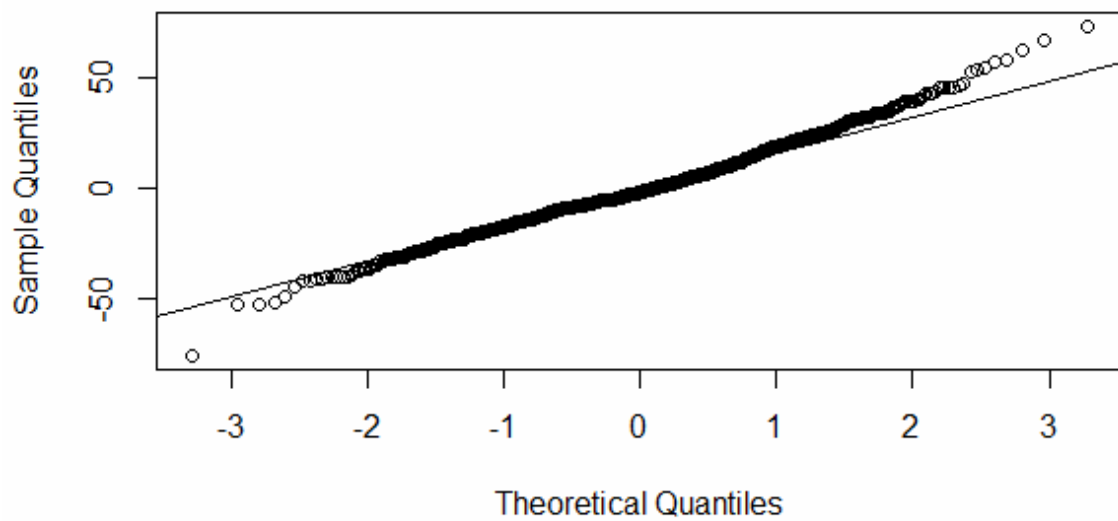


Figure 2. Normal quantile plot of TerraNova percentiles for District 1.

GPA

One participating district provided Cumulative GPAs for each student for 6th-8th grade

Attendance

Attendance percentages were obtained for each grade level available by dividing the number of days in attendance by the number of days enrolled in the school district.

Analysis Procedure

Throughout the analysis for the three research questions, numbers of subjects vary between models because I chose to use all available data. For example, a student may be included in the attendance model because they have all valid data for that model but left out of the MA MAP model due to missing scores. In addition to running all of the analyses with complete data, I also ran the same analyses with a data set that was limited to students who were not missing any data points for 4th-8th grade. The results from the limited data set are only included and discussed when they vary from the original models.

The first research question was, “Are there differences among the four groups of students (HI, HN, LI, LN) prior to enrollment in an instrumental program in five measures of school success: attendance rates, grade point average, communication arts Missouri Assessment Program (CA MAP) scores, mathematics Missouri Assessment Program (MA MAP) scores, and TerraNova percentiles?” To address this research question about initial differences a series of regression models was run for each of the five dependent variables using SES and instrumental music as dummy variables along with SES by instrumental enrollment interaction. This interaction tests for different levels of self-selection into instrumental music from the high and low SES groups. For each regression model the comparison group or

intercept was White, High SES (never received free or reduced lunch), female students who were not enrolled in instrumental music at the 8th grade level.

The second research question was, “How do the four groups of students compare over time after instrumental music enrollment on the five measures of school success?” To address this question three different analyses were used. First, a series of regression models was run using the difference in scores between 4th and 8th grade for TerraNova, CA MAP, MA MAP, and Attendance and the difference between 6th and 8th grade for GPA for District 1 and using the difference in scores between 4th and 8th grade for CA MAP, MA MAP, and Attendance for District 2. The difference in scores shows how much improvement has happened between 4th and 8th grade or 6th and 8th grade for each group (HI, HN, LI, LN). Additionally, linear mixed models using data from all grades were run to further explore the pattern of change found in the regression models. These models are used to look at change over time without using the difference in scores between 4th and 8th grade and allow for repeated measures on an individual.

The third research questions was, “How do low SES, low ability instrumental students compare to low SES, low ability non-instrumental students on five measures of school success?” To address this question an additional analysis was done for low SES, low ability students. For District 1 I used the subset of low SES students (n=198) and split them by their mean TerraNova score in 4th grade (49.35) into high and low ability groups. Fourth grade scores were used because 4th grade is prior to instrumental music enrollment and because TerraNova scores improve slightly each year. The one exception to this is 6th grade when students are moving into middle school. In sixth grade TerraNova scores for low SES

students dropped. Those below the mean were kept (n=107) as low SES, low ability for comparison of instrumental (n=18) and non-instrumental students.

Terra Nova scores were not available for District 2 so an alternative criterion for low ability students was necessary. Based on correlation matrices (Tables 1-5) and their principal components analysis, CA MAP was determined to be the score most highly correlated with TerraNova percentiles. The process above was used to split the low SES students using the mean CA MAP score in 4th grade. In District 1 the students who scored below the CA mean (643.2) were kept (n=92) as low SES, low ability for comparison of instrumental (n=13) and non instrumental students. In District 2 the subset of low SES (n=246) was split by the CA mean (660.3). Those below the mean were kept (n=124) as low SES, low ability for comparison of instrumental (n=41) and non-instrumental students.

Table 1. Correlation matrix for District 1 in 4th grade.

	Terra.4th	CA.4th	MA.4th	AttendPCT4
Terra.4th				
CA.4th	0.917			
MA.4th	0.647	0.724		
AttendPCT4	0.129	0.192	0.223	

Table 2. Correlation matrix for District 1 in 5th grade.

	Terra.5th	CA.5th	MA.5th	AttendPCT5
Terra.5th				
CA.5th	0.897			
MA.5th	0.702	0.765		
AttendPCT5	0.104	0.114	0.124	

Table 3. Correlation matrix for District 1 in 6th grade.

	Terra.6th	CA.6th	MA.6th	AttendPCT6	CumGPA.6 th
Terra.6th					
CA.6th	0.876				
MA.6th	0.719	0.746			
AttendPCT6	0.163	0.193	0.256		
CumGPA.6th	0.617	0.582	0.627	0.352	

Table 4. Correlation matrix for District 1 in 7th grade.

	Terra.7th	CA.7th	MA.7th	AttendPCT7	CumGPA.7 th
Terra.7th					
CA.7th	0.893				
MA.7th	0.732	0.786			
AttendPCT7	0.180	0.200	0.268		
CumGPA.7th	0.606	0.626	0.655	0.352	

Table 5. Correlation matrix for District 1 in 8th grade.

	Terra.8th	CA.8th	MA.8th	AttendPCT8	CumGPA.8 th
Terra.8th					
CA.8th	0.871				
MA.8th	0.702	0.760			
AttendPCT8	0.202	0.203	0.249		
CumGPA.8th	0.586	0.608	0.643	0.340	

Because these low income, low ability subsets were defined on mean splits the scores were not normally distributed (Figures 3 and 4). For this reason, a series of Kruskal-Wallis rank sum tests were used to describe differences between instrumental and non-instrumental students that parallels the regression models of 4th-8th grade differences in the full dataset described above

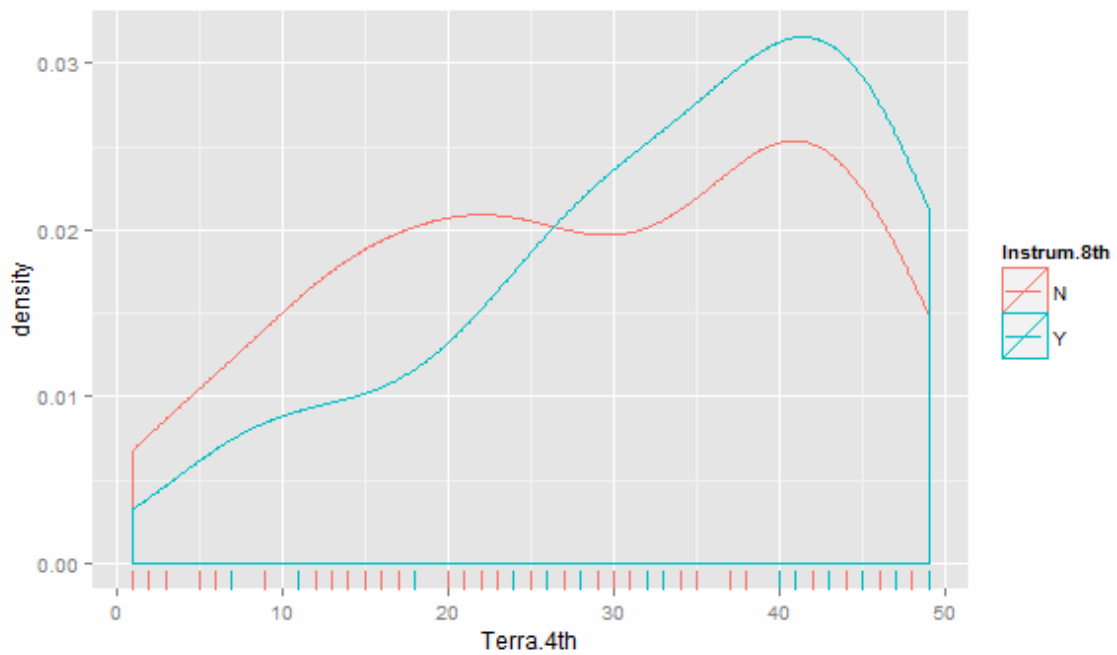


Figure 3. Density of low ability, low income instrumental and non-instrumental students' TerraNova scores for 4th grade.

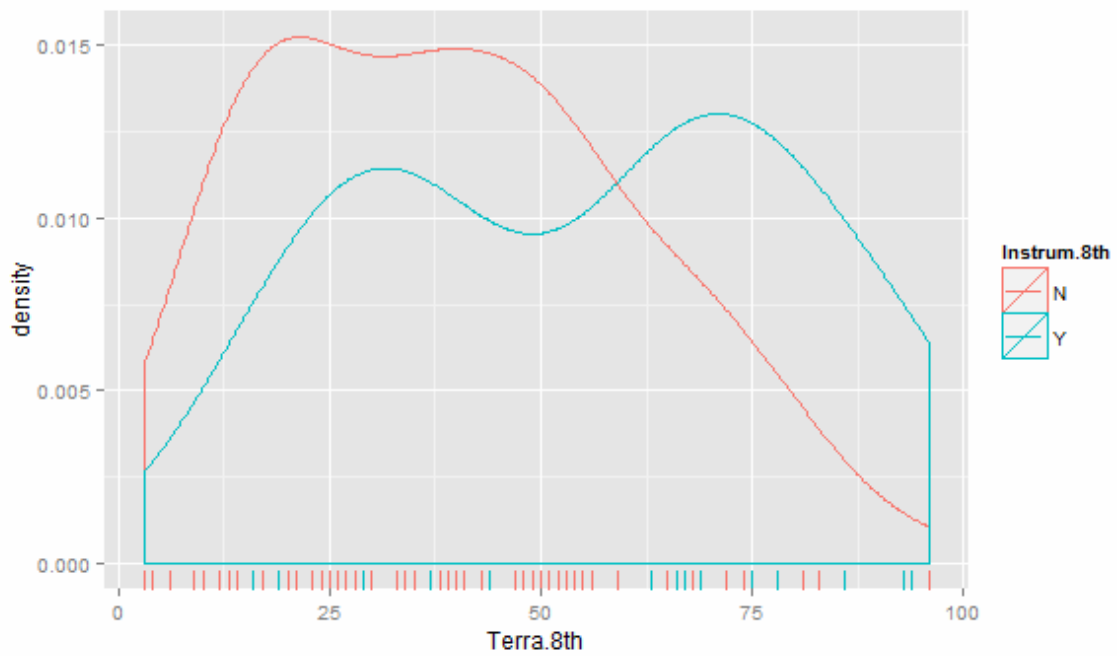


Figure 4. Density of low ability, low income instrumental and non-instrumental students' TerraNova scores for 8th grade.

Chapter 4: Results

Research Question 1

Are there differences among the four groups of students (HI, HN, LI, LN) prior to enrollment in an instrumental program in five measures of school success: attendance rates, grade point average, communication arts Missouri Assessment Program (CA MAP) scores, mathematics Missouri Assessment Program (MA MAP) scores, and TerraNova percentiles?

In District 1 instrumental music enrollment and SES had a strong significant relationship ($p < .001$) with the dependent variables in all five models with instrumental students scoring higher and low SES students scoring lower. Gender was a significant predictor of school success in the TerraNova, CA MAP, and GPA models with male students scoring lower. Race was also significant with Black students scoring lower for TerraNova, CA MAP, MA MAP, and having lower GPAs, Hispanic students scoring lower for TerraNova, CA MAP, and MA MAP, and Asian students scoring higher for MA MAP and having better attendance.

GPA information was not available prior to 6th grade and instrumental enrollment began in 5th grade so these scores reflect achievement early in instrumental instruction rather than prior to enrollment. A significant but weak interaction ($p < .01$) between SES and instrumental music was found (Figure 5) that may indicate that higher achieving low SES students are self selecting into instrumental music or that higher achievement may be the result of studying instrumental music.

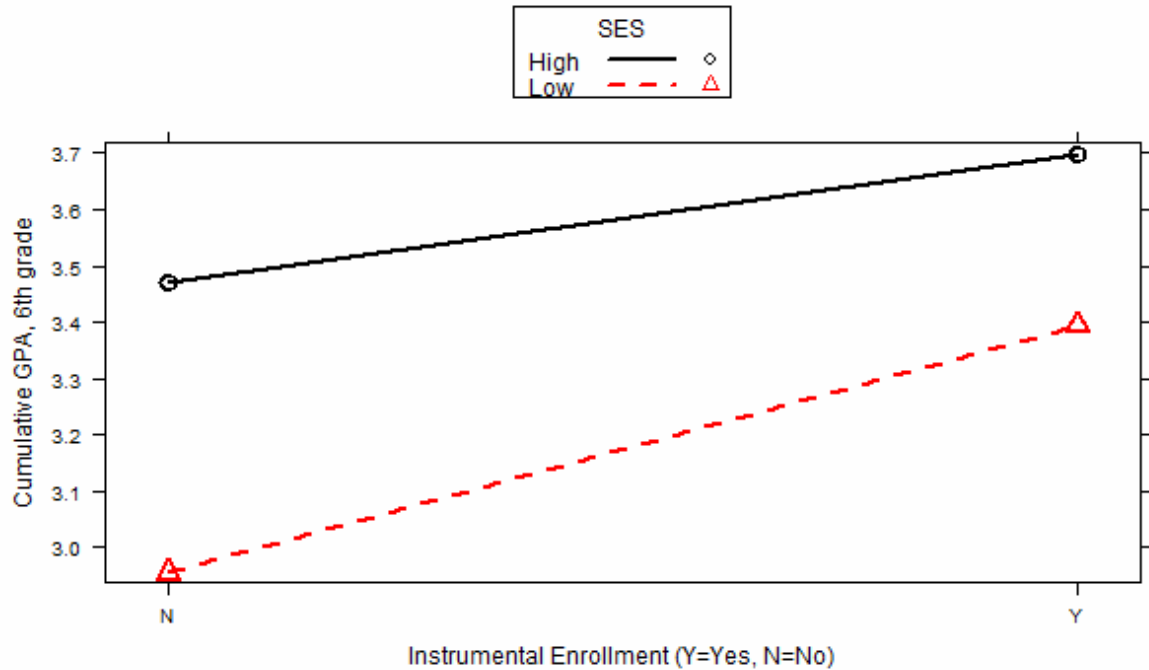


Figure 5. Plot of GPA regression model for 6th grade in District 1.

In District 2 models were run for CA MAP, MA MAP, and Attendance. SES was significant in all three models with low SES students scoring lower in CA MAP and MA MAP ($p < .001$) and having lower attendance ($p < .01$). Gender was strongly significant in CA MAP ($p < .001$) with males scoring lower. The attendance model had unexpected results for instrumental students. Instrumental enrollment was significant ($p < .05$) with students who will be enrolled in instrumental music in 8th grade having lower attendance in 4th grade. There is a significant interaction between SES and instrumental music ($p < .05$). The interaction shows that low SES students who will be enrolled in instrumental music in 8th grade have slightly better attendance in 4th grade than their non-instrumental peers. The interaction is most likely caused by the poor attendance of high SES instrumental students (Figure 6).

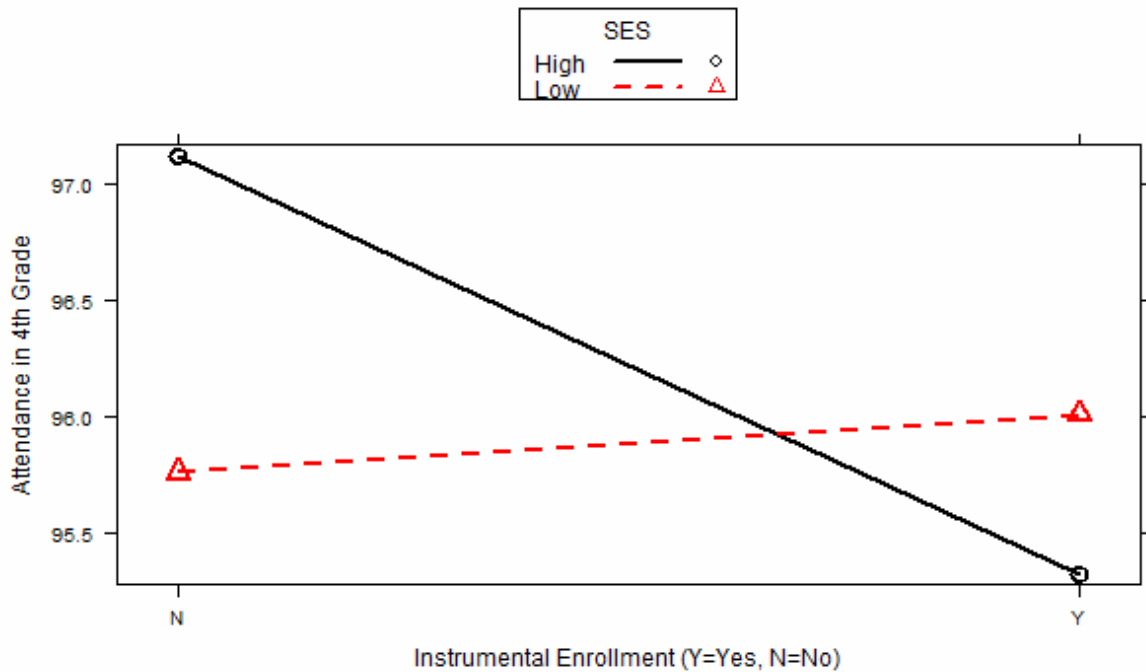


Figure 6. Plot of attendance regression model for 4th grade in District 2.

In summary, the two districts have very different patterns of self-selection into instrumental music. In District 1, there were clear differences among the four groups of students (HI, HN, LI, LN) prior to enrollment in an instrumental program in four measures of school success: attendance rates, CA MAP scores, MA MAP scores, and TerraNova percentiles. In contrast, there was no evidence in District 2 that higher achieving students self-select into instrumental music programs.

Research Question 2

How do the four groups of students compare over time after instrumental music enrollment on the five measures of school success?

In the TerraNova regression model for District 1 instrumental music and SES main effects were not significant, but their interaction was significant ($p < .05$). LI students have the

greatest improvement in TerraNova scores (Figure 7). Instrumental music and SES were both significant ($p < .05$) in the Attendance model with instrumental students having better attendance and low income students having worse attendance than the comparison group. There were no significant differences between the four groups of students for CA MAP, MA MAP or GPA. When the MA MAP model was run using only students who had all valid data for 4-8th grade instrumental music was significant ($p < .001$) with instrumental music students improving their MA MAP scores more than non-instrumental students.

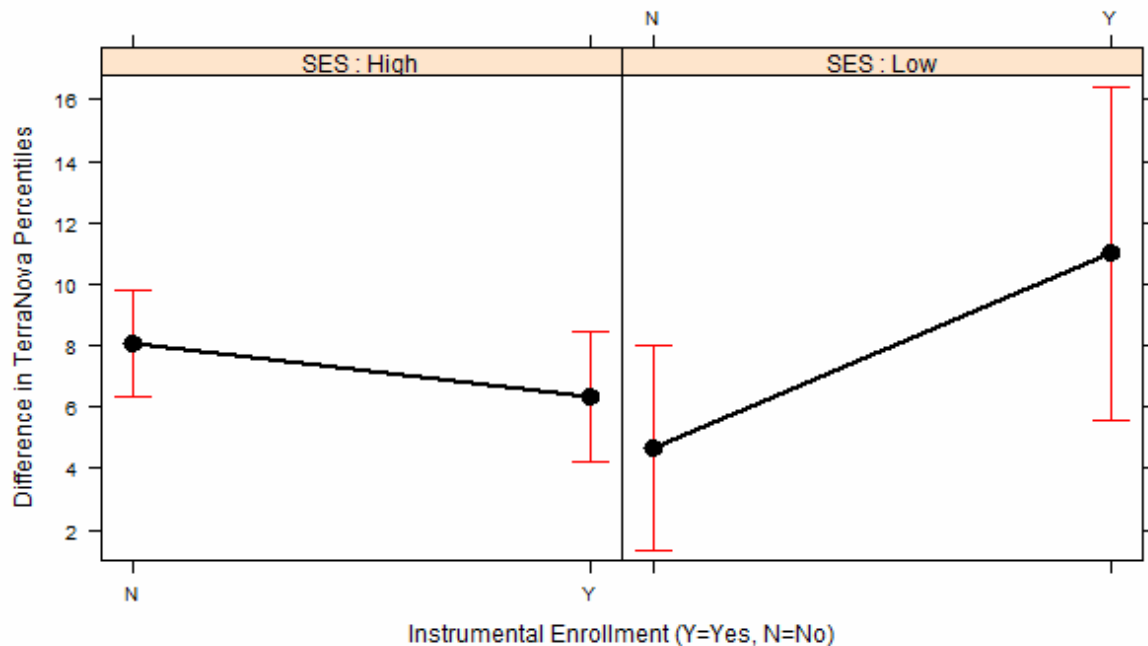


Figure 7. Plot of regression model using the difference in TerraNova percentile scores from 4th to 8th grade for HI, HN, LI, LN in District 1.

A quartic mixed effect model was then run on TerraNova scores using raw percentiles at each grade level rather than the differences between 4th and 8th grade percentiles to better examine the findings from the regression model above (Figure 8). TerraNova percentiles

improve for all four groups but improvement from HI students slows down as the group average approaches the 85th percentile. LI students on the other hand have the greatest growth and nearly catch up with their HN peers.

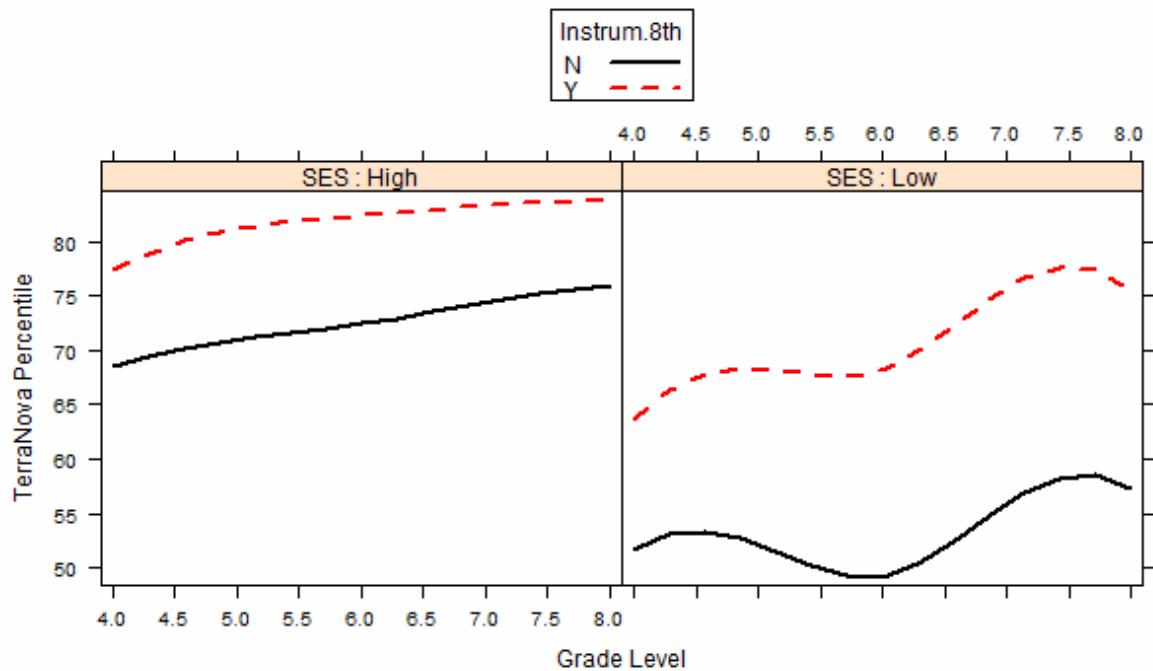


Figure 8. Plot of mixed effect model using TerraNova percentiles at each grade level for HI, HN, LI, and LN in District 1.

In District 2 instrumental enrollment was significant ($p < .05$) in the CA MAP and Attendance models and was approaching significance in the MA MAP Model. Neither SES as a main effect nor the interaction between instrumental enrollment and SES were significant in any model. This implies that in District 2 SES is not having a significant negative impact on any single factor contributing to school success but instrumental enrollment is having a positive impact regardless of SES on each measure of school success.

Research Question 3

How do low SES, low ability instrumental students compare to low SES, low ability non-instrumental students on the five measures of school success?

Using the groups determined by Terra Nova scores for District 1, low SES, low ability students involved in instrumental music are performing better than non-instrumental peers at the 8th grade level for TerraNova, CA MAP, and MA MAP. Running the same tests at the 4th grade level reveals that the difference already clearly existed for MA MAP.

Using the groups determined by CA scores for District 1 the results indicate that low SES, low ability students involved in instrumental music are experiencing a higher level of success than non-instrumental peers at the 8th grade level in MA MAP. This difference was also evident at the 4th grade level.

In District 2 low ability students involved in instrumental music are experiencing a higher level of success than non-instrumental peers at the 8th grade level for MA MAP. There were no significant differences in 4th grade.

Next a series of Kruskal-Wallis tests were run to determine if the differences in scores between instrumental and non-instrumental students were stronger at the 8th grade level. In District 1 using the groups determined by TerraNova percentiles the difference in how instrumental versus non-instrumental students change from 4th – 8th grade for TerraNova was significant ($p = 0.01588$). When the same tests were run using the CA scores for sorting no significant differences were found but it should be noted that the result was in the predicted direction ($p = .1577$). In district 2 the difference in how instrumental versus non-instrumental students change from 4th – 8th grade was significant ($p = 0.02536$) for MA MAP. Although neither district showed a significant difference between groups for CA MAP scores both

were approaching significance ($p = .1923$) for District 1 and ($p = .1925$) for District 2. The fact that both districts are approaching significance is important to note as Kruskal-Wallis tests are less powerful and are more prone to type two errors than t-tests (Dalgaard, 2008).

Chapter 5: Discussion

Summary

Previous research showed that self-selection of higher achieving students into instrumental music programs was evident and that there is a significant relationship between achievement and the study of instrumental music (Elpus, 2013; Fitzpatrick, 2006; Kinney, 2008). Additionally, to my knowledge, no previous research has compared low SES, low ability instrumental students to low SES, low ability non-instrumental students.

My research replicated previous results linking instrumental enrollment and school success but throughout the analyses the results for the two districts differed. While self-selection was clear in district 1, the study of instrumental music seems to be having a greater impact in district 2. Regression models revealed that instrumental music students in District 1 have significant improvement in TerraNova scores while District 2 has significant improvement in CA scores. Attendance in both districts decreases with age but the drop is smaller for instrumental students in both districts. This is the only shared result between the two districts. Differences between the districts were also seen when low SES, low ability instrumental students were compared to low SES, low ability non-instrumental students but for both districts the instrumental students were scoring higher on standardized tests and having better attendance in 8th grade than non-instrumental students. This implies that both self-selection of higher achievers into instrumental music and changes over time that might reflect the influence of instrumental music instruction are most likely district or program effects.

As mentioned above attendance was the only shared result where instrumental music was significant for both districts. Better school attendance among instrumental music students may reflect a desire to participate in instrumental activities both within the school day and in extra-curricular activities which might be affected by school attendance policies.

These differences could be a result of recruitment techniques or motivation to participate in instrumental music programs, personality of conductors, quality of music programs in elementary and middle school (Johnson & Memmott, 2006), or improvements and changes in academic functioning of the students.

The quality of music programs may be affecting scores prior to and during instrumental instruction. Johnson and Memmott (2006) studied the impact of the differences in the quality of music programs on English and mathematics standardized test scores. In the study schools were selected by university music education professors from each region of the United States. These professors were asked to choose schools that were “as similar as possible in every regard except in the quality of their music programs” (Johnson & Memmott, 2006, p. 296). Students attending elementary schools with high quality music programs had higher scores than those with lower quality music programs. The outcomes for middle schools were similar with students from schools with high quality music programs outperforming those from schools with low quality music programs. Students from schools with music programs, regardless of the quality, outperformed students from school that did not have a music program.

It may be that instrumental music is improving academic functioning. MRI scans showed differences in the amount of gray matter in the brains of adult professional musicians, amateur musicians, and non-musicians. To determine if this and other brain

differences exist prior to instrumental music study Schlaug, Norton, Overy, & Winner (2005) conducted two studies. In the longitudinal study, the researchers scanned the brains of 50 5-7-year-olds. Children were randomly assigned to a control or treatment (music training) group. Baseline tests and MRI scans showed no cognitive, music, motor, or structural brain differences. After fourteen months the experimental group receiving music training showed significant improvement in fine motor and auditory skills which are directly related to music. The researchers also reported seeing “trends in the anticipated direction” (Schlaug et al., 2005, p. 224). Changes were seen in gray matter but the changes were not significant at this point in the study. In the second study, older children with an average of 4 years of instrumental study did have significantly more gray matter than non-musicians.

Limitations of Study

As with many of the previous studies looking at instrumental enrollment and school success, this study is correlational. It is difficult to do a true experiment in a school setting. Although the results cannot be used to determine causation for school success, they can provide us with information about the relationship between variables and reflect the actual outcome of student and educator activities in their everyday school settings..

This research project depended on the willingness of school districts to share data with me and on what data was readily available through those school districts that chose to participate. I was fortunate to have two districts that were willing to share data with me for this project particularly because the districts differed in many ways. Limiting the study to two districts, however limited some of the analysis that would have been useful and makes it

difficult to generalize the results to other school districts. Additionally having only two school districts participate in the study paired with the transient nature of low income students limited the number of subjects involved and sample sizes ended up being smaller than desirable. Moreover, because only two districts participated, I can only speculate on why results were different between the districts.

Need for Further Study

The limitations above paired with the differing results found in the two districts in the study indicate that extending this research to include more school districts in more locations would be useful in improving the analysis. In addressing my third research question, comparing low SES, low ability instrumental students to low SES, low ability non-instrumental students, results were difficult to interpret due to the low numbers of students involved. It appeared that instrumental music was having a positive effect on school success for the low SES, low ability students but due to low numbers I lacked power to detect significant differences. A study that contained a larger sample of LI (low income instrumental) students and more importantly a larger sample of low SES, low ability instrumental music students might improve the quality of the analysis and allow the results to be generalized to other school districts.

Further research that addresses recruitment and motivation to enroll in instrumental music programs would also be useful. Understanding why students choose to join instrumental music programs may help explain some of the differences seen between the two districts involved in my research.

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