This study is a comparison of the Ohio Proficiency Test (OPT) results of instrumental music students and their noninstrumental classmates according to socioeconomic status (SES) over time. Subjects (N = 15,431) were students in the Columbus Public Schools in Ohio, whose fourth-, sixth-, and ninth-grade OPT results were compared with others of like SES on the subjects of citizenship, math, science, and reading. Results show that instrumental students outperformed noninstrumental students in every subject and at every grade level. Instrumental students at both levels of SES held higher scores than their noninstrumental classmates from the fourth grade, suggesting that instrumental music programs attract higher scorers from the outset of instruction. Results also show a pattern of increased achievement by lower SES instrumental students, who surpassed their higher SES noninstrumental classmates by the ninth grade in all subjects.

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The Effect of Instrumental Music Participation and Socioeconomic Status on Ohio Fourth-, Sixth-, and Ninth-Grade Proficiency Test Performance

In the state of Ohio, as in many states across the union, high-stakes standardized testing has become the moniker of student success. Ushered in by legislation such as the No Child Left Behind Act of 2001 (2002), schools across America are being graded, judged, and monitored primarily on the basis of student standardized test performance. Because the aesthetic, contextual, and subjective aspects of a high-quality music education are not easily quantifiable using typical mea-

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sures of academic performance, music and the other arts have found an uneasy relationship within the standardized testing culture.

This study is an attempt to clarify the relationship between music participation and academic performance through a comparison of the standardized test results of instrumental music students from the Columbus Public School district and those of their noninstrumental music classmates. The Ohio Proficiency Test scores of students receiving free or reduced-price lunches and those of students paying full price were considered differently due to the expected effect of socioeconomic status on academic achievement. This study was designed to shed light on the standardized test performance of Columbus instrumental music students and to lay foundations on which further research can be conducted.

Many previous studies have substantiated a positive relationship between music participation and academic performance (Helwig & Thomas, 1973; Kafer & Kennell, 1998; Schneider & Klotz, 2000). In a large-scale examination of the effect of music and the other arts on student academic achievement, Catterall, Chapleau, and Iwanaga (1999) analyzed the U.S. Department of Education's database of 25,000 students and demonstrated that students with high levels of arts participation academically outperformed those students with little or no arts participation on virtually every measure.

Higher academic performance as measured by standardized test performance also seems to be related to measures of musical ability. Young (1971) observed that students who did better on the Iowa Test of Basic Skills (ITBS) had higher music reading abilities than did lower-performing students, and McCarthy (1980) found that academic reading achievement was related to music reading, music sight-reading, and attrition from the music program in an urban music classroom. Specific to instrumental music, Klinedinst (1990) concluded that reading performance, math performance, and scholastic ability have strong ties to performance achievement among beginning fifth-grade instrumentalists.

The relationship between music participation and higher academic performance is uncertain, however. Kvet (1985), for example, found no significant difference in sixth-grade reading, language, and mathematics achievement between students excused from class for instrumental music and those not excused. In a longitudinal 3-year study, Costa-Giomi (1999) obtained mixed results when comparing pretest and posttest measures of verbal, quantitative, spatial, music, and fine motor ability of students taking private piano instruction and a control group of their peers. After 1 and 2 years of instruction, the students studying piano scored higher on measures of spatial ability. In the third year of study, however, the control group caught up to the music instruction group in measures of spatial ability.

Though many studies have shown higher musician versus nonmusician scores, the nature of this relationship is unclear. Robitaille and O'Neal (1981) attempted to answer the causal/correlational question by matching fifth grade instrumental and noninstrumental stu-

dents by IQ score, and observed that this matching eliminated any differences between the academic performance of the two groups. Similarly, Wallick (1998) obtained mixed results once fourth-grade pullout string students were matched by ability to their string peers. No significant differences were found between these two groups on the math and writing portions of the Ohio Fourth Grade Proficiency Test, whereas the string students had significantly higher scores on the reading and citizenship portions of the exam.

The literature confirms that the confounding variable of socioeconomic status is highly related to both issues of academic performance and musical participation. SES as measured by free and reduced lunch status (FRL) has been found to be the best predictor of the percentage of students scoring at or above the national norm in reading and mathematics on the Iowa Test of Basic Skills (Brooks, 1988), of the failure rate on the Indiana Graduation Exam (Nichols, 2003), and of student performance on all sections of the Ohio Ninth Grade Proficiency Test (Granoff, 1996; Lanese, 1992). SES similarly has been found to be related to arts participation (Catterall, Chapleau, & Iwanaga, 1999), retention in music programs (McCarthy, 1980), music reading, music sight-reading, music achievement (Dunlap, 1975; Taebel & Coker, 1980), tonal memory (Dawkins & Snyder, 1972), and student attitude toward music (Peters, 1973).

Though the literature suggests relationships between music participation and academic achievement, the nature of these relationships is not yet clear, and the effect of socioeconomic status on both of these variables has not yet been examined. This study examines the relationship between standardized test performance and music participation within one large urban district and for the specific population of instrumental music students. It is hoped that further research will continue to investigate these important questions with other populations.

The following research questions were investigated:

1. Do the data confirm the influence of SES on Ohio Proficiency Test (OPT) performance?

2. When the scores of students of like SES are examined, how do instrumental students and noninstrumental students compare across the subjects of the fourth-, sixth-, and ninth-grade proficiency tests?

3. Do eventual high school instrumental music students have higher Ohio Proficiency Test scores than their instrumental music classmates before instrumental music instruction begins, that is, on the fourth-grade tests?

4. How do the mean scores of the four groups compare to each other across time?

METHOD

Data and Subjects

As the majority of schools in America (57%) are in large or midsize cities or their accompanying urban fringe areas, and as these

schools account for more than two-thirds of all public school students (National Center for Education Statistics, 2004), test results from large and midsize urban school districts provide an important insight into the status of America's student academic performance. The Columbus Public School District, which is situated in the most populous city in the state of Ohio (Bureau of the Census, 2003) and serves more than 62,000 students within 142 schools (Columbus Public Schools, 2004), is such a district.

This district has not been exempt from mounting pressure to improve standardized test performance. In the state of Ohio, students from the fourth, sixth, and ninth grades have been expected to take and pass an Ohio Proficiency Test (OPT). In December 1993, the State Board of Education selected learner outcomes for writing, reading, mathematics, and citizenship. Science was added as a requirement in November of 1994 (Ohio Revised Code, 1992). Starting with the class of 2007, a new Ohio Graduation Test will replace the ninth grade exam.

This study is an examination of the OPT results of the entire 2003–2004 Columbus Public Schools high school student population. Access to this large quantity of student data was granted through the district Office of Research, and all data were gathered from the Columbus Public Schools Data Warehouse through the assistance of a district data analyst. Due to strict controls on the type of data granted to researchers, the district was only able to provide summary data of student proficiency test performance, the nature of which limited the type of statistical comparisons that could be made within this study.

Subjects were students in Grades 9 through 12 in the Columbus Public Schools during the 2003–2004 school year (N = 15,431). Students enrolled in an instrumental music course during the 2003-2004 school year were marked for study and placed in a separate database with the aid of a query tool (n = 915). Instrumental music students were defined as those high school students who were enrolled in a band, orchestra, or jazz ensemble during the 2003–2004 school year. Those students who were enrolled in multiple ensembles were only counted once. Noninstrumental music students were defined as those students enrolled in a Columbus Public High School during the 2003–2004 school year whose names did not appear on any instrumental music roster (n = 14,516).

Because SES is such a strong predictor of standardized test performance, it was thought that comparing students of like socioeconomic status would allow a more meaningful comparison to be made between instrumental and noninstrumental music students. In this study, student SES was approximated through the use of free or reduced lunch status (FRL). Eligibility for free or reduced lunch programs is widely employed as a measure to approximate levels of poverty and socioeconomic disadvantage (Brooks, 1998; Granoff, 1996; Mulhall, Flowers, & Mertens, 2002; Nichols, 2003). FRL status is issued on the basis of federal income guidelines. For the year 2003,

the year of this study, a family of four would have needed to make $34,040 or less to receive a reduced-price lunch, or $23,920 to receive a free lunch (National School Lunch Program, 2003). Based on these criteria, students were separated into four groups: instrumental music students receiving free or reduced lunch (FRL-IM) during the year 2003–2004, instrumental music students paying full price (FP-IM), noninstrumental students receiving free or reduced-price lunch (FRL-NI), and instrumental students paying full price (FP-NI).

This study was an attempt at examining the proficiency results of one specific group of students across time. Therefore, a retrospective design was used in which students in Grades 9–12 during the year 2003–2004 were marked for study. Once this population was defined, the fourth-, sixth-, and ninth-grade test results of the ninth- through twelfth-grade defined population were retrieved. Because urban districts such as Columbus often have high rates of student mobility, some subjects had moved into the district after fourth or sixth grade, and therefore were without a fourth- or sixth-grade score. Accordingly, the sizes of the fourth- and sixth-grade populations are smaller than the ninth-grade population. Similarly, some students may have been absent for the administration of one test or another, and therefore the population sizes for each of the test subjects may be slightly different. It is important to note, however, that all scores follow the same defined population over time—that is, all scores belong to the group of ninth- through twelfth-grade students during the year 2003–2004. This difference in population size creates limitations that, while not fatal because of the large sample sizes involved, must be considered when interpreting results. Because students might have taken any of the tests multiple times in order to pass, only the first administration of each test was examined in this study.

Interpretation of Data

For each administration of the different grade levels of the Ohio Proficiency Test, a raw score was compiled for each subject taken. These scores were then scaled for difficulty of test items (Ohio Department of Education, 2004) by the state testing authority. Only the scaled scores are presented in this report. The scaled score allows different administrations of the same test to be comparable (i.e., a fourth-grade reading scaled score in 2000 is comparable to a fourth-grade reading scaled score in 2003). The scaling did not make tests comparable with each other (i.e., a fourth-grade reading scaled score is not comparable to a fourth-grade citizenship score), nor did it make tests of different grade levels comparable (i.e., a fourth-grade reading scaled score is not comparable to a ninth-grade reading score). The scaling of these scores did allow, for the purposes of this study, for students of all high school grades to be assembled together into one comparable group.

Although there were five subjects (citizenship, math, reading, science, and writing) on each examination of the Ohio Proficiency Test,

writing was the only subject not graded by computer, was the only subject scored on a different scale, and was the only subject not scaled to be comparable across different years of test administration. For this reason, writing scores were not examined in this study.

After normal distribution of scores was verified, comparisons between instrumental and noninstrumental students of like SES were made. As previously mentioned, the summary data provided by the district limited the researcher's choice of statistical comparisons. Although an analysis of variance would have been the preferred statistic for comparison, necessary between-subject and within-subject data were not available. However, the data provided did afford the use of the two-tailed *t*-test statistic, which allows for meaningful comparisons to be made.

RESULTS

In seven of the twelve tests examined, full-price students outscored free-lunch and reduced-price-lunch students of both instrumental and noninstrumental status (see Tables 1 and 2). For this reason, in further analyses the two SES groups were considered separately.

Students who would eventually become high school instrumental music students outperformed noninstrumental students of like socioeconomic status in every subject and at every grade level. All differences were significant at the $p < .05$ level except for math between FRL-IM and FRL-NI students in sixth grade (see Tables 1 and 2 for data).

Instrumental music students at both levels of SES started out with significantly higher scores than their noninstrumental classmates before instrumental music instruction began (refer again to Tables 1 and 2). This initial difference was found across all subjects of citizenship, math, science, and reading, and all differences were significant at the $p < .05$ level.

Figure 1 illustrates how the performance of each group compares to the others across time. Results show that full price instrumental music students (FP-IM) performed at the highest level of any group for each subject, at every grade level, and across socioeconomic lines, while free or reduced lunch noninstrumental music students (FRL-NI) performed at the lowest level of any group for each subject, at every grade level, and across socioeconomic lines.

With the two other groups, however, the results are not as consistent. On most grade levels examined in this study, the higher SES students outperformed the lower SES students on every subject, regardless of instrumental music participation. However, there is a striking exception in the ninth grade. When future high school instrumental music students receiving free or reduced-price lunch (FRL-IM) took the Fourth Grade Proficiency Test, their mean scores were higher than noninstrumental students receiving lunch assistance (FRL-NI), but lower than both instrumental and noninstrumental students of full-price status (FP-IM and NI) on citizenship, math, and science.

Table 1
Student Performance on the Citizenship and Math Portions of the Ohio Proficiency Test Reported by Grade Level, Lunch Status, and Instrumental Music Participation, with t-Tests of Significance

Citizenship				Math			
4th Grade				**4th Grade**			
Full Price		*Free/Reduced Lunch*		*Full Price*		*Free/Reduced Lunch*	
Noninstr.	Instr.	Noninstr.	Instr.	Noninstr.	Instr.	Noninstr.	Instr.
$n = 1177$	$n = 159$	$n = 1546$	$n = 129$	$n = 1177$	$n = 159$	$n = 1547$	$n = 129$
$m = 224.13$	$m = 237.44$	$m = 211.38$	$m = 221.05$	$m = 209.64$	$m = 224.84$	$m = 198.07$	$M = 208.48$
$SD = 26.74$	$SD = 25.18$	$SD = 22.54$	$SD = 25.18$	$SD = 25.69$	$SD = 28.63$	$SD = 23.15$	$SD = 25.33$
$t_{(1334)} = 6.22, p < .001^*$		$t_{(1673)} = 4.48, p < .001^*$		$t_{(1334)} = 6.36, p < .001^*$		$t_{(1674)} = 4.51, p < .001^*$	
6th Grade				**6th Grade**			
Full Price		*Free/Reduced Lunch*		*Full Price*		*Free/ReducedLunch*	
Noninstr.	Instr.	Noninstr.	Instr.	Noninstr.	Instr.	Noninstr.	Instr.
$n = 4019$	$n = 302$	$n = 4235$	$n = 189$	$n = 4020$	$n = 302$	$n = 4243$	$n = 188$
$m = 202.00$	$m = 215.07$	$m = 187.45$	$m = 192.44$	$m = 192.89$	$m = 206.49$	$m = 178.62$	$M = 182.12$
$SD = 27.00$	$SD = 25.43$	$SD = 25.49$	$SD = 29.04$	$SD = 32.84$	$SD = 32.80$	$SD = 29.88$	$SD = 33.89$
$t_{(1029)} = 8.60, p < .001^*$		$t_{(4422)} = 2.32, p < .05^*$		$t_{(4320)} = 6.94, p < .001^*$		$t_{(4429)} = 1.39, p < .10$	
9th Grade				**9th Grade**			
Full Price		*Free/Reduced Lunch*		*Full Price*		*Free/Reduced Lunch*	
Noninstr.	Instr.	Noninstr.	Instr.	Noninstr.	Instr.	Noninstr.	Instr.
$n = 5114$	$n = 180$	$n = 4258$	$n = 77$	$n = 5083$	$n = 180$	$n = 4241$	$n = 77$
$m = 207.57$	$m = 224.10$	$m = 195.52$	$m = 211.73$	$m = 198.88$	$m = 214.96$	$m = 189.88$	$M = 200.29$
$SD = 25.01$	$SD = 25.97$	$SD = 23.49$	$SD = 24.05$	$SD = 22.39$	$SD = 24.42$	$SD = 9.85$	$SD = 20.96$
$t_{(5292)} = 8.39, p < .001^*$		$t_{(4333)} = 5.87, p < .001^*$		$t_{(5261)} = 8.69, p < .001^*$		$t_{(4316)} = 4.32, p < .001^*$	

Note. * Indicates this test is significant, with alpha set at $p < .05$; n = number of subjects; m = mean score, SD = standard deviation.

This achievement gap was to be expected when considering the previously described strong relationship between SES and academic achievement (Brooks, 1988; Griswold & Patterson, 1998; Mulhall & Flowers, 2002; Nichols, 2003). In sixth grade, the lower-SES instrumental students still lagged behind their higher-SES counterparts. However, by the time they took the ninth-grade proficiency test for the first time, the data show that instrumental music students receiving free or reduced-price lunch (FRL-IM) did better on citizenship, math, and science than did noninstrumental full-price-lunch students (FP-NI). In the case of reading, instrumental FRL students

Table 2

Student Performance on the Science and Reading Portions of the Ohio Proficiency Test Reported by Grade Level, Lunch Status, and Instrumental Music Participation, with t-Tests of Significance

Science				Reading			
4th Grade				**4th Grade**			
Full Price		*Free/Reduced Lunch*		*Full Price*		*Free/Reduced Lunch*	
Noninstr.	Instr.	Noninstr.	Instr.	Noninstr.	Instr.	Noninstr.	Instr.
$n = 1173$	$n = 159$	$n = 1545$	$n = 129$	$n = 1167$	$n = 158$	$n = 1535$	$n = 129$
$m = 206.82$	$m = 228.58$	$m = 189.82$	$m = 199.32$	$m = 214.39$	$m = 223.65$	$m = 206.22$	$m = 214.43$
$SD = 34.09$	$SD = 36.82$	$SD = 30.63$	$SD = 33.88$	$SD = 18.20$	$SD = 17.00$	$SD = 18.27$	$SD = 20.11$
$t_{(1330)} = 7.04, p < .001$*		$t_{(1672)} = 3.08, p < .01$*		$t_{(1323)} = 6.39, p < .001$*		$t_{(1662)} = 4.49, p < .001$*	
6th Grade				**6th Grade**			
Full Price		*Free/Reduced Lunch*		*Full Price*		*Free/Reduced Lunch*	
Noninstr.	Instr.	Noninstr.	Instr.	Noninstr.	Instr.	Noninstr.	Instr.
$n = 4014$	$n = 302$	$n = 4225$	$n = 186$	$n = 4004$	$n = 302$	$n = 4229$	$n = 186$
$m = 189.05$	$m = 201.96$	$m = 176.49$	$m = 183.22$	$m = 210.34$	$m = 224.00$	$m = 194.24$	$m = 199.17$
$SD = 25.80$	$SD = 24.32$	$SD = 24.28$	$SD = 24.32$	$SD = 31.24$	$SD = 29.64$	$SD = 31.25$	$SD = 32.72$
$t_{(4314)} = 8.84, p < .001$*		$t_{(4409)} = 3.70, p < .001$*		$t_{(4304)} = 7.72, p < .001$*		$t_{(4413)} = 2.01, p < .05$*	
9th Grade				**9th Grade**			
Full Price		*Free/Reduced Lunch*		*Full Price*		*Free/Reduced Lunch*	
Noninstr.	Instr.	Noninstr.	Instr.	Noninstr.	Instr.	Noninstr.	Instr.
$n = 4970$	$n = 177$	$n = 4152$	$n = 75$	$n = 5119$	$n = 180$	$n = 4269$	$n = 78$
$m = 199.35$	$m = 215.14$	$m = 190.16$	$m = 206.97$	$m = 218.11$	$m = 228.26$	$m = 204.39$	$m = 218.18$
$SD = 19.83$	$SD = 23.33$	$SD = 17.16$	$SD = 22.94$	$SD = 28.80$	$SD = 26.71$	$SD = 29.57$	$SD = 24.59$
$t_{(5145)} = 8.87, p < .001$*		$t_{(4225)} = 6.32, p < .001$*		$t_{(5297)} = 5, p < .001$*		$t_{(4345)} = 4.89, p < .001$*	

Note. * Indicates this test is significant, with alpha set at $p < .05$; n = number of subjects, m = mean score, SD = standard deviation.

began with higher scores than their full-price-lunch noninstrumental music classmates, dropped behind them in sixth grade, and then rose above them again in ninth grade (again, see Figure 1).

DISCUSSION

The above results should be interpreted cautiously due to the previously mentioned issues of differences in sample sizes of compared populations. That being said, the data demonstrate that SES is related to the test performance of Columbus public-school students on

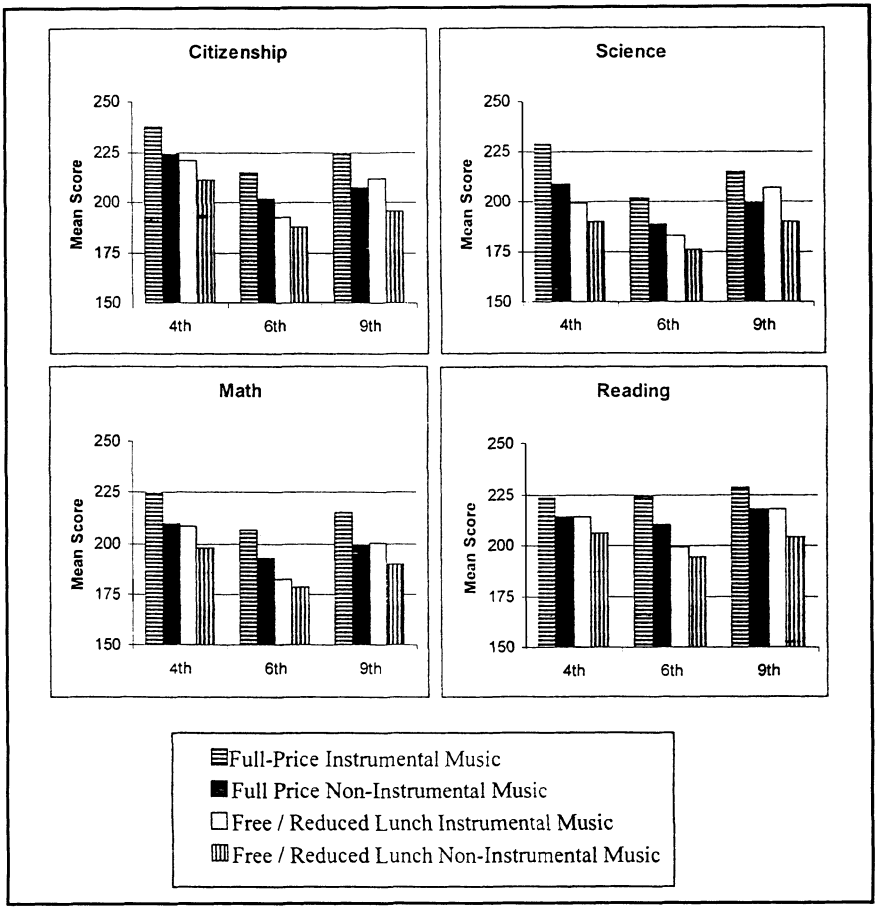

Figure 1. Relationship of Mean Test Scores between Instrumental and Noninstrumental Students of Both Socioeconomic Levels on the Ohio Proficiency Tests.

the Ohio Proficiency Test, as previously found by Granoff (1996) and Lanese (1992). With the far-reaching implications of modern high-stakes testing, more needs to be done to understand the importance of socioeconomic barriers to student performance.

Because all differences between noninstrumental and instrumental music participants of like SES on every subject and at every level except FRL sixth grade were determined significant, this study supports previous research findings that have suggested higher musician versus nonmusician scores across a variety of standardized tests (Kafer & Kennell, 1998; Schneider & Klotz, 2000).

The fourth-grade scores, however, are especially revealing, because the string music program in the Columbus Public Schools begins in

fourth grade, whereas band instrument education does not begin until fifth grade. Because string students would have had a relatively insignificant amount of instrumental music training by the time of the test, and band musicians would not have ever had a class, the fourth-grade test provides a good baseline for looking at the future high school instrumentalists.

The significantly higher fourth-grade scores of those students who would go on to be high school instrumental musicians suggest that Columbus public-school instrumental music classes attracted students with higher test scores from the outset, as also found by Klinedinst (1990) and Robitaille and O'Neal (1981). Young (1971) explains that students of higher academic potential are more attracted to instrumental music programs. The results of this study are clear: Students who eventually became high school instrumental music students had significantly higher test scores across every subject of the OPT before they entered regular instrumental music study.

The change in performance of low-SES instrumental music students versus their higher-income classmates across time is not conclusive, as the aforementioned summary nature of the data prevented the use of further statistical analysis to determine whether these differences in mean were of statistical significance. However, the idea that low-income instrumental music students would even be equal to their higher SES noninstrumental music classmates suggests an interesting pattern that should be examined in further research.

The overreaching question whose answer is sought in this and many other studies is whether instrumental music contributes to the higher standardized test scores of students participating in bands, orchestras, and other instrumental ensembles. This study clearly found that students who participated in high school instrumental music were higher scorers from the beginning of their music study of an instrument, suggesting that the reason for the higher instrumental scores might be a stronger than average concentration of higher-scoring students involved in instrumental music classes.

This initial study suggests many avenues of importance to future research on music participation and standardized test performance. Further research is suggested that will add richness to this line of research through the use of varied statistical applications that are not limited by summary data. Also, because this study focused on only the instrumental music population of one urban Midwestern school district, expansion of further research to other music populations, school contexts, and geographic areas is warranted. In addition to examining SES, more variables, such as race, gender, and parental participation, need to be examined in relation to music participation and standardized test performance. This study also suggests that a comparison between low-income instrumental and higher-income noninstrumental students of matched ability over time would be of value.

Without any effect whatsoever on test performance, instrumental music is a valuable part of education for its own sake. The establish-

ment of relationships between standardized test performance and musical involvement is not necessary to justify the presence of a comprehensive music curriculum for every child. Special attention, however, needs to be paid to all aspects of the understudied and important student population of low-income instrumental music students. Future studies of their academic and musical progress are important in order to serve best those students who, though poor in resources, are rich in dedication and perseverance.

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