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THE IMPACT OF MUSIC EDUCATION ON ACADEMIC ACHIEVEMENT

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The central focus of this chapter is an issue that has been of considerable interest to many in the music education community and to the general education community as well. Phrased as a question, this issue is: What is the impact of participation in music education on academic achievement? On the surface there is a fairly straightforward answer: students who participate in music education frequently do better than their peers on many measures of academic achievement such as grade-point averages and standardized tests like the SAT or ACT. For example, using information from the National Center for Educational Statistics, Morrison (1994) reported that on a sample size of 13,327 high school sophomores those who participated in music reported higher grades in English, math, history, and science than those who did not participate in music.

However, closer examination of these and other data adds many caveats and qualifiers to this notion. Consider as just one example the fact that two researchers (Cox, 2001; Holmes, 1997) found that a possible explanation for apparent superior achievement is that music participants had higher academic achievement scores prior to enrolling in music studies. It is the purpose of this chapter to examine the research literature to arrive at a more nuanced understanding of this timely issue.

Unlike many of the topics reviewed in this *SoL Status Report* for which there is a dearth of literature, there is a significant body of research on the impact of music education on academic achievement. These studies are discussed in the following sections that form the organizational structure of this chapter: general academic achievement, reading achievement, mathematics achievement, integrated arts instruction, and background music. Following these sections will be brief discussions of the implications for learning, future research, and policy makers.

GENERAL ACADEMIC ACHIEVEMENT

A modest number of research articles or literature reviews have been concerned with the effects of music education on what has been called general academic achievement, so called because a variety of disciplines were involved. Academic achievement as measured in these studies usually involves reading and/or language arts and mathematics; occasionally science or other disciplines are included as well. In addition to grade point averages and teacher-designed assessments, the following standardized tests have been used in this body of research:

American College Test
Basic Skills Assessment Program
California Test of Basic Skills
Comprehensive Tests of Basic Skills
Cornell Critical Thinking Tests
Florida Comprehensive Achievement Test
Georgia High School Graduation Tests
Iowa Tests of Basic Skills
Kentucky Instructional Results Information System assessment scores
Metropolitan Readiness Tests
(New Jersey) Grade Eight Proficiency Assessment
Scholastic Assessment Tests
Stanford Achievement Test
Stanford-Binet Intelligence Scale
Texas Educational Assessment of Minimum Skills
Tests of Achievement Proficiency
Texas Assessment of Academic Skills
Texas Assessment of Knowledge and Skills
Torrance Tests of Creative Thinking
Wechsler Intelligence Scale for Children

Wechsler Preschool and Primary Scale of Intelligence
Wide-Range Achievement Test-III
Woodcock Johnson Tests of Achievement

Standardized music assessments include;

(Colwell) Music Achievement Tests
(Gordon) Primary Measures of Music Audiation
(Gordon) Intermediate Measures of Music Audiation
(Gordon) Music Aptitude Profile
(Seashore) Measures of Musical Talents
Watkins-Farnum Performance Scale

Subjects in these studies ranged from preschool through college students. Sample sizes ranged from fairly small (e.g., $N = 42$; Huang, 2004) to very large ($N = 17{,}099$; Cobb, 1997). A few studies included variables such as gender or race, but most did not. Musical experiences included traditional music education activities such as elementary general music or high school band, as well as special programs such as keyboard instruction. In a few studies, subjects were participants in general arts or extracurricular activities, not music *per se.* A wide variety of research designs and data analysis strategies were employed.

General Findings

A number of studies support the contention that students who participate in formal music education have higher academic achievement scores than students who do not participate in formal music education (Babo, 2001; Cardarelli, 2003; Cobb, 1997; Cox, 2001; Frakes, 1984; Huang, 2004; Linch, 1993; Miranda, 2001; Mitchell, 1994; Parrish, 1984; Schneider & Klotz, 2000; Trent, 1996; Underwood, 2000; Zanutto, 1997). Furthermore, being excused from nonmusic classes to attend instrumental lessons does not adversely affect academic performance (Corral, 1998; Cox, 2001; Dryden, 1992; Engdahl, 1994; Kvet, 1982).

Three selected studies are briefly reviewed here as illustrations of this type of research. Cardarelli (2003) investigated the effects of instrumental music instruction on standardized test

performance of third-grade students. Students were divided into two groups: those participating in an instrumental music training program and those not participating. The music training activity was designed for inner city students who could not financially afford to take music lessons. She found statistically significant differences between the mean scores of the two groups, with a positive effect of the music program on the students' achievement levels.

Schneider & Klotz (2000) examined the relationship between enrollment in music performance classes and athletic extracurricular activities on academic achievement. Three hundred forty six subjects were divided into three groups: musicians (band or choir), athletes, or non-participants. All three groups were statistically equivalent in fifth and sixth grade. During seventh, eighth, and ninth grades the musicians achieved significantly higher academic achievement scores than the athletes but did not score higher than the non-participants. The authors noted that the musicians showed a tendency to maintain stabilized scores while the athletes and non-participants groups' scores dropped.

Using records from two area high schools, Trent (1996) determined that those high school seniors who had participated in instrumental music programs from sixth through 12th grades scored significantly higher on standardized tests of language arts and math than their counterparts who had participated in non-music extra-curricular activities or who had not participated in extra-curricular activities. Several authors who conducted literature reviews arrived at conclusions supporting these three studies: those who participate in music have higher academic achievement than those who do not (Arnett-Gary, 1998; Shobo, 2001; Yoon, 2000).

Not everyone, however, obtained such clear results. Two researchers found that music participants had higher achievement scores in reading but not math (Dryden, 1992; Neuharth, 2000). Kluball (2000) found that the study of instrumental music was significantly related to

mathematics and science tests but not to language arts, social studies, writing and the SAT verbal and mathematics tests. Other researchers have either found no significant difference in the academic achievement of music participants and other students (Haanstra, 2000; Holmes, 1997; Sprouse, 1971) or identified alternative explanations for their apparent superiority (Cox, 2001; Rossini, 2000; Schneider & Klotz, 2000; Shadd, 2002). In reviewing the literature, McIntyre & Cowell (1984) found that findings were unclear and often contradictory.

Only five experimental studies have been identified that tested the effects of music instruction on academic achievement. Three of the five obtained results indicating that music instruction did have a positive effect on academic achievement. Olson (2003) affirmed parallel reading and math concepts through Kodaly music instruction with first, second, and third grade students. Female students at all three grade levels improved math scores and males at the first and second grades improved reading scores. Barr, Dittmar, Roberts, & Sheraden (2002) provided elementary students with 16 weeks of instruction for the improvement of listening skills in addition to music instruction. Results indicated improved academic performance. Hoffman (1995) compared fifth graders who received keyboard instruction with those who received traditional text-based music instruction. After one year of instruction (at the end of fourth grade) the keyboard students had higher scores on only one measure, a subtest of language mechanics. However, after two years of instruction (at the end of fifth grade), the keyboard students outperformed their counterparts on total language, 3 R's battery, concept of numbers, math computations, math applications, and total math.

In contrast to the positive effects on academic achievement found in the studies mentioned previously, Hines (2000) found that neither reading nor mathematics achievement was affected by the type of instruction students received. She had compared the effects of two types of

instruction—motoric music instruction (utilizing movement) and non-motoric music instruction (excluding movement) on the academic achievement of learning disabled students from kindergarten through ninth grades. Likewise, third, fourth and sixth grade students who received music instruction did not show improved academic performance over peers who did not receive similar music instruction (Legette, 1993).

The Relationship Between Music And Academic Achievement

A number of researchers have been interested in the degree to which music aptitude or music experiences are related to academic achievement. The literature is nearly evenly divided between those studies in which a high degree of relationship was reported and those in which a low or negligent relationship was found.

Using data from first and fourth graders, Lamar (1989) found a significant, positive relationship between music aptitude and reading and one that approached significance for math. Music aptitude was also highly related with academic achievement in eight to 12-year-old students (Johnson, D., 2000). Palos-Tuley (2003) found positive significant effects for academic achievement and the degree of involvement in the fine arts of Hispanic students in grades three, four, and five, involved in either: an intensive fine arts academy, a rotational fine arts program, or a minimal fine arts program. A positive relationship was found for those high schools whose band participated in concert festival and SAT scores (Johnson, P., 2000). For those bands that participated in concert festival, a positive relationship was found between level of difficulty of music and SAT scores, but not for festival ratings and SAT scores. Ciepluch (1988) determined that a significant relationship existed between the sightreading achievement of instrumental music students and reading and math achievement and GPA.

Contradictory results were reported by Drennan (1984), who found that a combination of reading, math, and IQ scores was not a good predictor of musical aptitude, and Barrett (1993) who determined that there was no correlation between music aptitude and academic achievement for disadvantaged six-to-eight-year-olds. Likewise, Hobbs (1985) obtained low positive correlations (r = .33) between music aptitude and scholastic aptitude, indicating that music aptitude and scholastic aptitude tests measure different aspects of cognition. Higher correlations were found between music aptitude and academic achievement (r = .56), although this still indicates only a moderate relationship. Two concerns are that the sample sizes were fairly small (n = 24 in each of first, second, and third grade classes) and levels of significance were not reported for the correlation coefficients.

Duke, Flowers, & Wolfe (1997) found that piano performance ability was unrelated to academic achievement and Laycock (1992) reported a low correlation between musical characteristics of students' original compositions and GPA. Haynes (1982) used a 10% random sample (12,343) of 123,400 high school students who took the ACT Assessment in 1980-81. She found that participation in instrumental music was not among the five independent variables that contributed most to the criterion variable (scores achieved on the ACT). The five contributing variables (high school GPA, years studied or planned to study in mathematics and natural sciences, rank in high school graduating class, and gender) accounted for 48% of the variance, while including all 17 variables for which data were gathered only accounted for approximately 50% of the variance. Finally, there was no difference in critical thinking scores among college music, business and nursing students (Money, 1997). There was a low correlation between critical thinking scores and GPA for music students, but not for business or nursing students.

READING ACHIEVEMENT

Reading is a key to successful academic achievement. Yet, according to the most recent national assessment, only 32% of the nation's fourth grade children are reading at or above grade level (NAEP, 2000). To counteract this situation, the government has allocated nearly $4 billion for Reading First, program that aims to improve reading instruction for K-3 students (http://www.ed.gov/programs/readingfirst/nclb-reading-first.html). An early intervention program to help students acquire better reading skills should enable them to perform better throughout their school years and beyond (Snow, Burns, & Griffin, 1998).

Recently there has been an interest in determining whether music instruction would improve reading skills. As reading and language arts were frequently covered in the previous section on academic achievement, this section reviews the few studies that focused solely on the impact of music experiences on reading.

Preschool Children

Three intact classes of children, aged three to six, with developmental disabilities received two 25-minute music classes per week for six weeks (Stringer, 2004). Although their auditory comprehension and total language scores improved from pretest to posttest, they did not score significantly higher than the control groups.

Elementary School Children

Most of the literature has focused on elementary school children. First grade students who received either one or two years of Kodaly training had higher reading scores than controls (Huriwitz, Wolff, Bortnick, & Kokas, 1975). Nicholson (1972) concluded that students between ages six and eight categorized as slow learners who received music instruction had significantly higher reading readiness scores than students who received

no music instruction. Movsesian (1967) found similar results with students in grades one, two, and three.

This was in contrast to Lu (1986). She compared the reading performance of first-grade students who received Kodaly-Orff music instruction with others who were given traditional reading instruction only and found no significant differences. In fact, a number of other studies failed to show any effect of music instruction on reading achievement.

Kindergarten students who received six weeks of music instruction involving locomotor movement activities while singing action songs did not perform any better than controls on a teacher-made picture-word recognition test in language arts (Montgomery, 1997). Twelve weeks of enhanced music curriculum did not improve reading achievement in 66 elementary students enrolled in an arts school (Bowles, 2003). Kemmerer (2003) compared students from two different school districts, one of which provided 17.5 minutes of general music classes per six-day cycle more than the other. Standardized reading and language test scores for fourth-graders, following four years of this curriculum (K-3), showed that the extra time spent in music did not result in superior performance.

The Relationship of Auditory Perception to Reading

It has seemed reasonable to a number of researchers that music instruction might improve auditory perception skills that, in turn, might impact reading abilities. Indeed, for the most part, research has supported this notion.

Music perception utilized auditory mechanisms related to reading as musical skills correlated significantly with phonological awareness and early reading skills in a group of four and five-year-old children (Anvari, Trainor, Woodside, & Levy, 2002). Also studying four and five-year-

olds, Lamb & Gregory (1993) found that pitch discrimination skills were correlated with reading performance. The important factor in this relationship is detection of pitch changes; timbre discrimination was not significantly related to reading. Using a small sample (N = 16) of nine and ten-year-olds, Barwick, Valentine, West & Wilding (1989) found a significant moderate relationship (r = .53) between tonal memory and reading age. These results were confirmed in a follow-up study with a larger sample (N = 40) and a slightly large age span (six to eleven years).

In a series of three studies, Atterbury (1985) found that reading-disabled children (ages 7-9) could discriminate rhythm patterns as well as controls, but were poorer in rhythm performance and tonal memory than normal-achieving readers. Beat competencies (finding the micro and macrobeats in a musical selection) of third and fourth-grade students were not a significant predictor of reading (Chamberlain, 2003).

Researchers had previously shown that adult musicians who received musical training before the age of 12 had a better memory for spoken words than those without musical training (Chan, Ho, & Cheung, 1998). Subsequently the same group tested this hypothesis in children ages six to 15 (Ho, Cheung, & Chan, 2003). Results confirmed the previous findings as those with musical training improved verbal memory (but not visual memory) more so than those who discontinued or never received such training.

In a meta-analysis of 24 correlational research studies, Butzlaff (2000) calculated a reliable, but low relationship between music instruction and standardized measures of reading ability (r = .17). In the six experimental studies, he calculated an even smaller effect for music instruction on reading. A similar meta-analysis was conducted by Palmarini (2000) for Reviewing Education and the Arts Project. He found little quantitative data to support the notion that the arts improve reading skills.

MATHEMATICS ACHIEVEMENT

According to the U.S. Department of Education, schools in the United States "are not producing the math excellence required for global economic leadership" (http://www.ed.gov/nclb/methods/math/math.html). The average math scores of fourth- and eighth-graders have improved slightly; however, 12th-grade math scores have not improved since 1996 (NAEP, 2000). Beginning in 2005, *No Child Left Behind* requires all states to measure students' progress in mathematics annually in third- through eighth-grade.

The subject of mathematics is generally taught in isolation from other subjects and often lacks any creative or artistic flair. Students often become bored and do not pay attention in class, resulting in lower test scores. However, there is a connection between music and mathematics, both subject areas use numbers, repeating patterns and ratios (Vaughn, 2000). Because of this connection it is possible that participating in music education can improve students' understanding of mathematics, thereby resulting in improved mathematics achievement scores. A large majority of research studies on music and mathematics show that there is some positive effect of music on mathematical achievement, however a few studies have found no effect. As with the section on reading achievement, the studies reviewed here are restricted to studies where the focus was on mathematics specifically and not on general academic achievment.

Preschool Children

Geoghegan and Mitchelmore (1996) investigated the effects of a music program on the mathematics achievement of preschool children. The researchers found that there was a difference in mathematics achievement between the music group and the non-music group. The group of children who were involved in the music program scored higher on the mathematics achievement test than the children who had not been involved in the music program and had a

limited musical background. Further analysis revealed that the difference in mathematics achievement may have been a result of the children's home musical background rather than the music program itself.

Elementary School Children

A two-year study by Gardiner et al. (1996) investigated the effects of a music and visual-arts curriculum on the academic achievement of first-graders. Students who participated in the arts curriculum had test scores below those of the non-arts curriculum students at the beginning of the school year; however, after seven months the arts curriculum students had higher scores on mathematics achievement. At the beginning of the following year, students were retested and the researchers found that the students who participated in the arts curriculum were still ahead of their peers in mathematics achievement. After a second year of treatment, the arts-curriculum students continued to have higher mathematics achievement scores. The researchers also found that the percentage of students at or above grade level in second-grade math was the highest for those students who participated in the arts curriculum for two years, less for those students who participated for only one year, and lowest for those students who did not participate in the arts curriculum.

Haley (2001) investigated the effects of participating in an instrumental music program (band or orchestra) on the academic achievement of fourth-grade children. The children were placed into three groups: Group A consisted of children who had studied an instrument prior to the introduction of band and orchestra in fourth grade; Group B consisted of children just beginning to study an instrument; and Group C consisted of children with no experience in instrumental instruction. Data indicated that students who had studied an instrument prior to fourth grade had higher scores in mathematics achievement than did students in the other groups.

Rafferty (2003) investigated the effect of the Music Spatial-Temporal (MST) Math Program on mathematics achievement of second graders. Students who participated in the MST received piano lessons in addition to their regular classroom activities. No significant effects of the MST on the mathematics achievement of second graders were found.

Middle and High School Children

Whitehead (2001) examined the effect of music instruction (Orff-Schulwerk) on math scores of middle and high school students. Subjects were randomly placed into three groups: full treatment (which received music instruction for 50 minutes five times per week), limited treatment (which received 50 minutes of instruction once a week), and no treatment (which received no music instruction). After twenty weeks, the full treatment group showed a higher level of significant gain in mathematics than the other two groups. The limited treatment group showed limited mathematics improvement and the no treatment group had the lowest gain in mathematics improvement.

Effect of Duration of Music Study

A study by Rauscher and Zupan (2000) investigated the effects of classroom music instruction on spatial-temporal reasoning of kindergarten students. Students were assigned to one of two groups: keyboard instruction or no music. After four months of treatment, the keyboard group scored significantly higher on the spatial-temporal tasks than the no music group. The researchers found that after eight months of treatment, the keyboard group still scored significantly higher than the no music group and the difference between groups was much greater.

Cheek (1999) examined whether the type of music training is related to the mathematic achievement levels of eighth-grade students. In addition to collecting student data on the Iowa

Tests of Basic Skills (ITBS), Cheek surveyed students about their music background including: type of musical instrument, number of years of school music lessons, number of years of private lessons, and demographics. No significant difference was found between the ITBS mathematics scores of students who did and did not receive private music lessons. However, students with two or more years of private lessons had a significantly higher mean mathematics score than students with no private lessons. Furthermore, students who had keyboard lessons had significantly higher ITBS mathematics scores than students who had music lessons on other instruments.

INTEGRATED ARTS INSTRUCTION

Mortimer Adler (1982) is illustrative of many educational philosophers who have felt that the arts should play a central role in education. Educating students through the arts is felt to be critical for the development of a whole person (Smith, 1984). Eisner (2002) has outlined a number of ways this can be done, including (a) the integration of the arts into specific projects (e.g., a history project), (b) integration within the arts, such as comparing rhythm in music and the visual arts, (c) working out a specific theme from artistic or no artistic perspectives, and (d) problem solving through multiple perspectives.

This process begins quite naturally in infancy and early childhood as learning experiences are holistic and integrated, not separated into specific domains. Consider, for example, children's television programming. Shows such as Sesame Street incorporate music along with a wide variety of arts into the informal learning experience. Several curricular models have been developed with an arts integration approach. For example, the A+ Schools program "combines arts integration, continuous, whole school professional development, and the use of statewide

support networks for teachers and administrators to implement a state's mandated curriculum and meet accountability standards" (e.g., http://aplus-schools.uncg.edu/).

Integrated Instruction and Reading

Many music educators have called for music to be integrated into the instruction of the whole child (Adair-Hauser, 1994; Fox, 2000; Lonich, 1994; Trimble, 1994). Unfortunately, there is very little research that identifies the specific effects of music in an integrated approach. Most of the research literature involves integrated instruction involving more arts than just music. Recognizing that in these cases it is impossible to separate out the specific contributions of music, the results are generally favorable for language instruction. Fourth grade students who participated in SAMPLE (Suggested Activities of Music and Poetry for Language Enrichment) outperformed students in a traditional class on language mechanics and total language (Hudspeth, 1986). Matthews (2001) determined that integrated arts (dance, music, drama, and visual arts) instruction improved reading performance for fifth, but not third or fourth grade students.

Three studies that integrated music and not the other arts provided contrary evidence to the foregoing. In one study, first graders received music instruction integrated with whole language instruction (Miller, 1995). No significant differences were found between the music-integrated classes and other control classes. Fourth and sixth grade students received music or no-music language arts instruction (Weisskoff, 1981). The music group studied lyrics and played language games with lyrics from popular/rock music, but there was no significant effect on task performance. In another study, one intact fifth grade class received integrated music and reading and the other had no music integration (Andrews, 1997). Interestingly, all three studies reported an improvement in motivation or attitude in spite of the lack of effect on language arts skills.

Several have investigated the effects of music integrated into instruction of a foreign language. Music instruction was integrated into elementary school Grade 2 French immersion classes in the form of eight weekly units of five 15-minute music lessons (Lowe, 1995). The control group did not have music incorporated into French lessons but did receive weekly 30-minute music lessons. The integrated music class did better in oral grammar and reading comprehension French tests. Using a technique called "suggestopedia" which incorporates music, college students learned German more effectively than a control group (Gassner-Roberts & Brislan, 1984); however, it is not possible to separate the specific effects of music from the overall "suggestopedia" approach. Music was used to teach Spanish to preschool Spanish-speaking children, but no significant differences were found in test scores between experimental and control students (Dominguez, 1991).

Integrated Instruction and Mathematics

The connection between music and mathematics extends as least as far back as the Pythagorean experiments in 6th century BC. In more recent times, many have suggested the use of music in teaching mathematics (Church, 2001; Dudley & Pecka, 1994; Johnson & Edelson, 2003; Rothenberg, 1996; Shilling, 2002; Tips for Beginners, 1991). Some of these suggested programs are quite innovative; for example, Stevens, Sharp, & Nelson (2001) describe a program that has students drumming ratios such as 6:8 in 6/8 meter. Regardless of how creative these suggestions are however, they are just that—suggestions, and there are very few research studies that confirm their enthusiasm.

As with reading, music is sometimes included in an arts integration approach when teaching math such that it is impossible to determine music's unique contributions. Omniewski (1999) compared three groups of second graders: an arts infusion group (music, art, dance, and drama),

a manipulatives group, and a traditional group. There were no significant differences in math achievement among the three groups, though the arts infusion group had the highest gain scores.

Gregory (1988) compared six classes of third graders who were taught math via music to six classes taught math via traditional methods. The music-integrated classes showed significant gains compared to the control groups. Traver (1993) compared the use of music and manipulatives in teaching math to at-risk students. Results were inconclusive because of the high drop-out rate and brief instructional time. Madsen (1981) did not integrate music into math instruction. Rather, he compared the use of televised music lessons as a contingency for correct math responses to the receipt of books and found that both reward systems were effective.

Integrated Music Instruction on Other Subjects

Seventh and eighth grade African-American and Latino students were taught social studies using art, music, poetry, collaborative learning and role playing (Konrad, 1999). Students receiving this experimental treatment achieved higher test scores in social studies. Researchers also examined the effects of integrated music instruction on the study of U. S. history (McTeer & Bailey, 1980). While one group of senior high school students was taught using a traditional lecture-discussion method an experimental group listened to and analyzed popular music that dealt with such topics as aging, assassination, civil rights, crime, drugs, death, ecology, nuclear power, Vietnam, and the women's movement. After five weeks there was no statistically significant difference in either attitudes or knowledge between the two groups, although gain scores were greater for the music group.

BACKGROUND MUSIC

Background music is defined as any music played while the listener's attention is focused on a task or activity other than listening to music (Radocy & Boyle, 1988). Over the past few

decades, background music has become more and more prevalent in our society. Background music is commonly used in grocery stores, restaurants, and shopping malls to increase sales, and is often used in doctors' offices to relax or calm patients. Some students claim that they are able to study and learn more effectively with music in the background, while others claim that the music is more of a distraction. There have been quite a few studies that examined the relationship between background music and academic achievement of college students (Hardie, 1990; Haynes, 2003; Husain et al., 2002; Manthei & Kelly, 1999; Oliver, 1996; Rauscher et al., 1995; Steele et al., 1997; Steele et al., 1999; Stough et al., 1994); however, less research exists among elementary, middle, and high school students. Researchers studying the effects of background music on the academic achievement of school age children have obtained mixed results.

Effects on Reading/Language Arts

Carlson et al. (2004) examined the effects of background music and relaxation on the reading performance of third-grade students. Students, who participated in this study, sat in a vibroacoustic music chair, which allowed students to feel the vibrations of the music, while completing the reading-based tasks. The results of the study showed a statistically significant positive impact for both sight-word recognition and reading comprehension. There was no significant increase for oral reading accuracy. Furthermore, the researchers stated that all students who were reading below grade level at the beginning of the study improved their performance to grade level or higher.

Researchers investigated the effects of background music on spelling word retention of elementary school students (Anderson et al., 2000). They found that spelling test scores and

report card grades improved after listening to background music. The researchers concluded that the music enabled the students to relax, concentrate, and visualize the spelling words.

Hallam (2002) examined the effects of background music on story writing of fifth- and sixth-grade students. Students were divided into three groups: calm music, exciting music, or no music. After completion of the story writing, the students were asked whether they were aware of the music, if they liked it, if they thought it helped them, and how it made them feel. The researcher found that writing scores for the calm music and no music groups were similar, while writing scores for the exciting music group were significantly lower than scores in the other two groups. Additionally, children in the exciting music group spent more time off-task and asked more non-work related questions than students in the other two groups. Results of the questionnaire showed that childrens' perceptions of how music affected their work were often incorrect. They perceived the music they liked as helpful, and music they did not like as distracting.

Dawson (2003) examined the effects of four different auditory background conditions on the reading achievement of seventh-grade students. The four auditory conditions included instrumental music of Mozart, instrumental music of Yanni, instrumental music of Pink Floyd, and silence. The researcher found a significant effect for vocabulary, comprehension, and total reading ability when the auditory background condition consisted of listening to the instrumental music of Mozart or the auditory condition of silence.

Effects on Mathematics

Hallman and Price (1998) investigated the effect of background music on behavior and mathematics achievement of children with emotional and behavioral difficulties. All of the children in the study were between nine- and ten-years old and attended a school for children

with emotional and behavioral difficulties. The researchers found that background music of a "calming nature" significantly improved math performance and significantly decreased rule breaking behavior of children with emotional and behavior difficulties. Additionally, the researchers found that the "calming music" had the greatest effect on children who had hyperactive behaviors.

Fioranelli (2001) examined the effect of background classical music on mathematics problem solving skills of third grade students in a computer lab setting. Classical music played in the background during the treatment group's computer lab sessions, while no music played during the control group's sessions. Fioranelli found no significant differences between the mathematics problem solving skills of third grade students who had listened to classical music and those who did not.

Attwell (1988) examined the effects of background music with subliminal auditory stimulation on math achievement and attitude of eighth-grade students. A taped subliminal auditory message "Math can be fun and easy" (Attwell, 1988) was embedded in a music ask at 10db below the music level and repeated every ten seconds. Results from the math diagnostic test and attitude scale revealed no significant effects of background music on math achievement or attitude of eighth-grade students.

Effects on Science

Davidson and Powell (2001) examined the effect of easy-listening background music on on-task performance of a fifth-grade science class. A significant increase in on-task performance was found for the male subjects and for the total class. Although there was not a significant increase in on-task performance for the girls, the researchers believed that this was due to the ceiling effect. The on-task performance of girls in the classroom prior to the treatment was very

high (99%), slightly higher during the treatment (99.4%), and slightly lower after treatment (98.7%).

Smith and Davidson (1991) investigated the effects of background music on academic achievement of seventh-grade students. The students were divided into one of four conditions (rock music, classical music, easy listening music, or no music) while studying the earth-sun relationship. The researchers found no significant differences in the academic achievement of seventh-graders among the four background conditions.

IMPLICATIONS FOR LEARNING

Considering this body of research literature as a whole leads to a mid-position on the effects of music on academic achievement, regardless of whether it is specifically music instruction, music integrated with other disciplines, or background music. That is, at one extreme the data do not support the contention that music will necessarily improve academic performance and at the other extreme there is certainly no basis for saying that music instruction has no effect on academic achievement. Human learning is such a complex phenomenon that any simplistic explanation such as these must be rejected. Therefore, *some* music experiences have a positive impact on academic performance under *certain* circumstances. Although these excessive qualifiers are frustrating to teachers and administrators, the data simply do not support a more definitive statement.

Almost completely neglected in the research literature is the impact of the individual teacher. Simply testing the effects of a given form of music instruction without taking into account the characteristics of the teacher is short sighted. Logically, there is the possibility that excellent teachers who are enthusiastic and who relate well to students may make a greater difference in educational outcomes than the particular methodology used.

IMPLICATIONS FOR FUTURE RESEARCH

Although one may view the nearly ubiquitous statement "more research is needed" appended at the conclusion of almost every study to be a weak ending, there is definitely a sense in which this is true. Take the following as a comparison to the literature reviewed in this chapter: More than 100,000 research studies on reading have been published since 1996, with another 15,000 or so prior to that (National Institute of Child Health and Human Development, 2000). Based on these figures, the number of reports cited in this section seems meager indeed. Even if there are other relevant studies that are not included in this review, it is abundantly clear that we simply do not have anything close to enough research on this topic.

Quantity alone, of course, is not the only issue. Increasingly higher standards in research design and statistical analysis are called for. Larger sample sizes, random assignment of subjects to treatment groups, and longer treatment periods, would be especially helpful. Music education researchers should also be encouraged to collaborate with colleagues in psychology, sociology, and education.

IMPLICATIONS FOR POLICY MAKERS

To reiterate the point made previously, we must move away from simplistic notions regarding the impact of music education. Anecdotally, one of us (Hodges) can report that in a presentation to a statewide meeting of elementary school principals and superintendents, several attendees were quite upset to discover that playing music during test taking would not necessarily improve scores. Likewise, it has also been reported anecdotally that some parents have taken their children out of band because, while doing well in music, their math grades had not improved. Thus, one of the clear implications for policy makers is that music education is not a panacea that will cure all of education's ills.

Conversely, it is also not true that music education has no relevance for the overall academic achievement of students. Earlier reviews of this literature (Cutietta, Hamann, & Walker, 1995; Wolff, 1978) have recognized that even with limitations in this body of research there is support for the role that music can play in academic achievement. In a broader review of the effects of arts instruction on academic achievement, Eisner (1998) stressed the unique contributions arts instruction can make. Perhaps we would do well to return to a position once taken by the Music Educators National Conference when it was noted that the ancillary effects of music instruction "accrue to the student regardless of the motivation that initially led to the inclusion of music in the curriculum" (The Role of Music in the Total Development of the Child, 1977, 59). There is no reason why we cannot teach music for all the wonderful humanizing benefits it provides as well as for the potential for improving academic achievement.

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