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Eugenia Costa-Giomi

Psychology of Music 2004 32: 139

DOI: 10.1177/0305735604041491

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Psychology of Music

Psychology of Music

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Society for Education, Music
and Psychology Research
vol 32(2): 139–152 [0305-7356
(200404) 32:2; 139–152]
10.1170305735604041491
www.sagepublications.com

EUGENIA COSTA-GIOMI

UNIVERSITY OF TEXAS AT AUSTIN

ABSTRACT This study of the effects of three years of piano instruction is based on a sample of 117 fourth-grade children attending public schools in Montreal. The children had never participated in formal music instruction, did not have a piano at home, and their annual family income was below \$40,000 Can. Children in the experimental group ($n = 63$) received individual piano lessons weekly for three years and were given an acoustic piano at no cost to their families. Children in the control group ($n = 54$) did not participate in formal music instruction. Participants were administered tests of self-esteem, academic achievement, cognitive abilities, musical abilities, and motor proficiency at the beginning of the project and throughout the three years of piano instruction. The results indicated that piano instruction had a positive effect on children's self-esteem and school music marks but did not affect their academic achievement in math and language as measured by standardized tests and school report cards.

KEYWORDS: *academic achievement, children, language, math, music education, music instruction*

The Greeks acknowledged the importance of studying music more than 2000 years ago for its beneficial effects on the human soul. Since then, the place of music in the curriculum has receded from being a pillar of the Greek trivium to a much-diminished position in contemporary schools. During the last decade, however, there has been a surge of interest in the contributions of music instruction to the education of children.

Research into the cognitive benefits of active participation in extended music instruction and passive music listening, often known as the Mozart Effect, has produced much controversy in the academic milieu. There is considerable evidence that music instruction improves certain spatial skills in children (see Hetland, 2000 for a meta-analysis of relevant studies), but the

semper :

Mozart Effect has not been supported by recent research (see Schellenberg, 2001 for a review of the literature). One of the educational implications of findings related to active music participation is that learning music develops certain cognitive abilities involved in the performance of math tasks (Graziano et al., 1999; Rauscher et al., 1995, 1997; Vaughn, 2000) and verbal skills (Chan et al., 1998; Thompson et al., 2002). The effects of music participation on academic achievement, including math and language achievement, however, have not been clearly demonstrated.

It has been suggested that exposure to music even in relatively passive situations, such as those involving listening to background music, might improve academic achievement (Schreiber, 1988; Turnipseed, 1978; Wagner and Menzel, 1977). Cutietta (1995, 1996a, 1996b, 1996c) summarized selected studies on the relationship of music instruction and achievement in math and language to show the positive effects of music instruction on academic performance. These and other studies indicate that students who take music courses or participate in music instruction often obtain higher academic scores in math and/or language tests than do nonparticipants (Hurwitz et al., 1975; Linch, 1994; Rauscher et al., 1997; *Teaching Music*, 1995; *Teaching Music*, 2001). Similarly, it was found that children who have a musically enriched environment during their early childhood obtain higher language achievement scores later in elementary school (Harding, 1990). However, some investigations failed to establish a significant relationship between music participation and academic achievement (DeGraffenreid, 1996; Kooyman, 1989; Kvet, 1985; Legette, 1994). This relationship might be dependent upon the type of music instruction children receive and whether instruction is provided by a music specialist (Lamar, 1990; *Teaching Music*, 2000). Furthermore, it could be argued that this relationship might be influenced by a process of selection through which high academic achievers engage themselves and persist in music instruction and lower academic achievers do not pursue or discontinue this type of instruction.

In fact, there is some evidence that this might be the case. Frakes (1985) found that participants in high-school music programs had obtained higher music and academic achievement scores in elementary school than non-participants. Similarly, Stancarone (1992) found that the selection of children that participated in string instruction was best predicted by a set of variables including academic achievement. The prediction of participation and success in music on the basis of academic achievement seems to be valuable even at the college level. Barnett (1987) found that the math Scholastic Aptitude Test (SAT) scores and high-school rank were the best predictors of music grade point average in non-performance courses of freshmen students in music.

Whether high academic achievement is a cause or a consequence of extended participation or success in music remains unclear. It is interesting to notice that although the real academic benefits of music instruction may

be questionable, no study has found that participation in music programs diminishes students' performance at school or their academic achievement. In fact, Kvet (1985) found that there were no differences in sixth-grade reading, language, and mathematics achievement between students who were excused from regular classroom activities for the study of instrumental music and students not studying instrumental music.

Other non-musical effects of music instruction studied quite extensively are those related to self-esteem. Participation in arts activities seems to have a positive influence on self-esteem (Trusty and Oliva, 1994). This may explain the widespread use of music as an effective therapeutic treatment in clinical settings with groups characterized by low self-esteem (Clendenon-Wallen, 1991; Kivland, 1986). However, research in music education provides unclear findings regarding the contribution of music participation to the education of children with normal levels of self-esteem. While some studies showed the existence of positive correlations between participation in choir, band, or formal music instruction and self-esteem (Amchin et al., 1991; Hietolahti-Ansten and Kalliopuska, 1991; Nolin and Vander Ark, 1977; Wig and Boyle, 1982; Wood, 1973), others failed to do so (Legette, 1994; Linch, 1994).

Research in which music instruction was actually provided as a treatment indicated that, in general, music participation has very limited effects on subjects' self-concept (Lomen, 1970; Wamhoff, 1972) or no effect at all (Legette, 1994; Michel, 1971; Michel and Farrell, 1973). A study comparing the effects of two types of music instruction on first- and third-graders' self-concept did not show any differences between their contribution, or lack of it, to children's self-concept (Legette, 1994). Interestingly, the results of two investigations suggested that participation in instrumental music might affect boys' and girls' self-concept in different ways (Lomen, 1970; Wamhoff, 1972). Although in these studies there were no differences in most aspects of self-concept between participants and non-participants in instrumental instruction regardless of sex, instruction benefited a particular self-concept factor of only the boys (Lomen, 1970). Wamhoff (1972) noticed a decrease in another self-concept factor for girls taking instrumental lessons as compared to non-participants and girls who dropped out of the lessons.

Despite the conflicting empirical data about the real contribution of music instruction to the development of self-esteem, those involved in musical activities often report that learning music makes them feel better about themselves (Duke et al., 1997). In a study that addressed students' beliefs about the benefits of music instruction, Duke, Flowers, and Wolfe (1997) gathered questionnaires from a large number of children studying piano in various regions of the United States, their parents, and their piano teachers. They found that most American piano students were female (70%), white Caucasian (80%), lived in suburban homes and had pianos (96%). They lived with both parents (84%) who were well educated (80% of mothers and fathers held at least one

college degree) and earned medium to high incomes (83% reported incomes above \$40,000 and 4% below \$25,000). The children, their parents, and their piano teachers believed that piano instruction improved the students' lives in many ways, among others, by making them feel more assertive, better about themselves, and happy. A question that remains unanswered is whether the actual cause of these reported benefits was the piano instruction or the many other elements of their privileged environment.

The purpose of the study reported here was to investigate the effects of piano instruction on children's development by observing children from a less privileged environment for three years. The children selected to participate did not own a piano and had never participated in formal music instruction. Approximately half of the children were provided with piano lessons for three years and all children completed a series of tests and questionnaires regularly. The present manuscript will report the results related to academic achievement, school performance, and self-esteem.

Methodology

SAMPLE

A letter describing this project was sent to the parents ($n = 698$) of all fourth-grade children (9 years old) attending the 20 English-language schools of the largest school board in Montreal, Canada. Two hundred and eighty-nine parents stated interest in the project. Of the parents who did not respond to the letter, 43 were contacted by phone and 74 by mail in order to confirm that respondents and non-respondents did not differ in demographic characteristics relevant to the investigation. The 117 children (58 girls and 59 boys) selected to participate in the study had never participated in formal music instruction, did not have a piano at home, and their family income was below \$40,000 Canadian (\$30,000 US at the time of the investigation) per annum. Approximately 25 percent of the children had unemployed parents and 30 percent lived with a single parent. Children were assigned to the experimental group ($n = 67$) or control group ($n = 50$) randomly. Because of ethical and practical problems, three schools did not have a control group and four schools did not have an experimental group. Eight schools had children in both the control and experimental groups.

Half of the children ($n = 10$) from a school dropped out of the piano lessons during the first two years of the project. This school was not included in the analyses because the preservation of the randomness of its sample was questionable. The data from the children who discontinued piano instruction during the three years of the treatment but completed all required testing were analyzed in two ways: as part of the experimental group and as a separate 'dropout' group. Children who missed one of the multiple administrations of a specific test were not included in the analyses. A total of 81 children (35 control, 46 experimental) completed all language subtests of the

academic achievement test and 80 children (35 control, 45 experimental) completed all math subtests of the academic achievement test and self-esteem measures.

TREATMENT

Each child in the experimental group received, at no cost to the families, three years of piano instruction and an acoustic piano. Nine teachers (six female and three male) provided children with individual piano lessons weekly. Lessons were held at the participating schools during three school years. The lessons were 30 minutes long during the first two years and 45 minutes during the third year. Teachers followed a traditional curriculum based on the development of basic techniques and repertoire from simple popular melodies to classical sonatinas.

TESTING

To control for differences in academic achievement, self-esteem, musical abilities, motor proficiency, and cognitive abilities between the control and experimental groups, all children were administered a series of tests prior to the treatment: the language and mathematics subtests Level 14 of the Canadian Achievement Test 2 (CAT2), the Coopersmith Self-Esteem Inventories (long form), the tonal and rhythmic audiation subtests of the Musical Aptitude Profile, the fine motor subtests of the Bruininks-Oseretsky Test of Motor Proficiency, and the Level E of the Developing Cognitive Abilities Test (DCAT). The results of *t* tests indicated no differences in tests' scores between the experimental and control groups at the beginning of the study. At the end of the second and third year of piano instruction, children took the language and math subtests of the CAT2 (Levels 15 and 16). At the end of the first, second, and third year of instruction, children took the self-esteem test and the appropriate level of the DCAT. Tests were administered to mixed groups of experimental and control subjects in the same order in all schools. The testing sessions were scheduled during the morning and with appropriate breaks within each session.

Children completed four subtests of the CAT2 in order to obtain a total language score and a total mathematics score: Language Mechanics, Language Expression, Mathematics Computation, and Mathematics Concepts and Applications. The Coopersmith Self-Esteem Inventories provides six scores: General, Social, Home, School, Total, and Lie.

The children's parents provided consent to access the students' school report cards from third grade (the year prior to the start of the study) to sixth grade. Report cards provide a subjective measure of school performance because they are based on teachers' perception of the progress of their students. While they do not measure school academic achievement objectively, they are of most importance for parents, teachers, and students. Children's marks in four subjects were studied: music, math, English, and French.

Results

SELF ESTEEM

An ANOVA with repeated measures (i.e. Year: Pretest, after one, two, and three years of instruction) was used to compare the total self-esteem scores of the control and experimental groups. Because the Group \times Year interaction was close to the standard significance level ($F [3,234] = 2.48, p < .08$), this interaction was studied further. The analysis of simple effects showed that the scores of the experimental group increased significantly during the three years of the study ($F [3,234] = 11.16, p < .01$) but those of the control group did not (Figure 1). No differences between the two groups could be established for any of the four years.

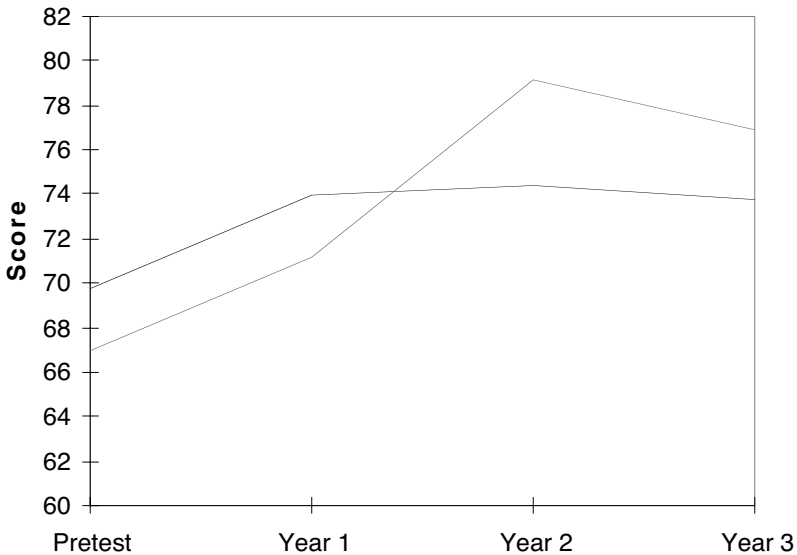


FIGURE 1 Total self-esteem scores of children in the experimental and control groups.
 — Control; - - - - Experimental

To study the effects of piano instruction on children's self-esteem in greater detail, four ANOVAs with repeated measures were conducted on the General, Social, Home, and School subtest scores that the control and experimental groups obtained before instruction started and after one, two, and three years of instruction (i.e. Year, repeated measure). The interaction between Year and Group was significant only for the school self-esteem scores ($F [3,234] = 2.83, p < .05$). Although the school self-esteem scores of the experimental group tended to increase throughout the three years while those of the control group tended to decrease, the analysis of simple effects did not reveal any significant differences between the two groups.

Another set of analyses included additional independent variables: sex,

income (< \$20,000 Can., \$20,000 – \$30,000 Can., or \$30,000 – \$40,000 Can.), family structure (single- or two-parent family), and parental employment. These variables could not be included simultaneously in the model because of certain redundancy in the information. For example, all families with unemployed parents had incomes of less than \$20,000 Can. These analyses yielded similar results to the ones reported earlier and showed no interactions between piano instruction and these variables.

The last set of analyses were based on the data from three groups of children: those who dropped out of the lessons, those who completed the three years of instruction, and the control group. The results of these analyses were also similar to the ones reported earlier. The total self-esteem scores of children who completed the three years of instruction improved significantly ($F [3, 234] = 7.56, p < .01$) while those of the dropout ($F [3, 234] = 2.51, p < .06$) and control groups ($F [3, 234] = 1.14, p < .34$) did not. There were no other significant differences among the groups. Unlike in the ANOVA based on two groups of children, the school self-esteem scores of the three groups of children were not significantly affected by piano instruction.

ACADEMIC ACHIEVEMENT

The academic performance of children in the experimental and control groups was analyzed through ANOVAs with repeated measures (Year: Pretest, Year 1, Year 3) on children's total language scores and total math scores in the CAT2. The results did not show any significant effects.

In order to study children's academic achievement in more detail, their scores in each of the two math subtests and two language subtests were analyzed. The ANOVAs with repeated measures did not reveal any significant differences between the control and experimental groups. The effects of piano instruction on math computation scores (Group x Year: $F [2, 158] = 2.45$, adj. G-G $p = .09$) were close to significance and were studied further through Tukey comparisons. Although the scores of the experimental group tended to be higher than those of the control group, especially after two years of instruction, no differences between the two groups could be established.

The data were re-analyzed taking into consideration gender, income, family structure, and parental employment. Most of these analyses yielded similar results to the ones reported earlier and showed no interactions between piano instruction and these variables. The analysis of math computation scores which included income as an independent variable showed a significant interaction between Year and Group ($F [2, 150] = 3.22$, adj. G-G $p < .05$). This interaction was only close to significance in the previous analysis. Although there was a more pronounced improvement in the experimental group's math computation scores than those of the control group, Tukey comparisons did not indicate significant differences between the math computation scores of the experimental and control groups for any of the years in which the children took the test.

The academic achievements of the children who completed the three years of piano instruction, discontinued the lessons, or never participated in formal music instruction were also compared. Most analyses yielded similar results to the ones already presented with the exception of the ANOVAs on total language scores ($F [4,156] = 3.31$, adj. G-G $p = .01$) and language expression subtest scores ($F [4,156] = 2.53$, adj. G-G $p < .05$). Tukey comparisons indicated that the experimental group obtained higher total language scores than the control group after two years of instruction ($p = .05$) and showed no differences in the language expression subtest scores of the three groups of children.

SCHOOL PERFORMANCE

ANOVAs with repeated measures (third-, fourth-, fifth-, and sixth-grade report cards) were performed on the experimental and control groups' marks in each of four subjects: math, music, English, and French. Piano instruction affected children's music marks (Year \times Group interaction: $F [3,198] = 2.89$, adj. G-G $p = .04$). Analysis of simple effects showed that the marks of the control group varied significantly throughout the three years of the project ($F [3,198] = 2.53$, $p = .05$) while those of the experimental group did not. The declining pattern in music marks of the control group was not found for the experimental group whose marks remained more stable during the three years of piano instruction (Figure 2).

Although the analysis of math marks also showed a significant effect of piano instruction on school math achievement (Year \times Group interaction:

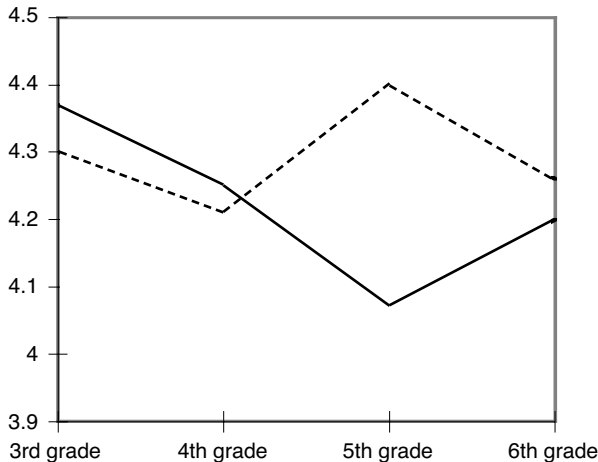


FIGURE 2 Control and experimental groups' school music marks.
 — Control; ---- Experimental

$F [3,210] = 5.73$, adj. G-G $p < .01$), post-hoc analyses did not indicate any differences in school math performance between the control and experimental groups.

Piano instruction did not affect children's school performance in language subjects even when including sex, income, family structure, and parental employment as additional independent variables into the analyses. The consideration of these variables did not modify the results already presented regarding children's math and music marks.

The analysis of the school marks of children who completed, did not complete, or never participated in the three years of piano instruction, yielded similar results to the ones reported earlier. Although the effect of piano instruction on music marks was not significant, Tukey comparisons showed that the experimental group's music grades were significantly higher than those of the control group after two years of instruction ($p = .05$) and that the dropout group's marks did not differ from either the control's or the experimental group's marks.

Discussion

The results of the study indicate that there are specific benefits associated with piano instruction, especially the development of self-esteem. The increase in self-esteem of the children who completed three years of piano instruction was significant while the changes in self-esteem of those who never participated in piano instruction or who dropped out of the lessons were not. Because of the longitudinal nature of the present investigation it is possible to assert that continuous participation in the piano lessons was the cause of the difference among the groups of children. The groups had equivalent levels of self-esteem at the start of the study as well as comparable musical abilities, motor skills, and cognitive abilities. Furthermore, children's motivation and opportunity to learn to play the piano were similar among the groups as the participants were recruited from the public school system, randomly assigned to the experimental and control groups, and provided with all the resources needed for the completion of three years of piano lessons. Although throughout the three years of the study many factors may have influenced the development of self-esteem in these children, the differences in self-esteem improvements among the groups were most likely due to the musical treatment.

The musical treatment used in this investigation was composed of many elements. Children in the experimental group were given an acoustic piano, which was a luxury for most of the families participating in the study. They also received individual attention from experienced teachers, the opportunity to play in recitals in front of their peers and relatives, and the means by which to develop their musical interests and abilities. In addition, the children in the piano group spent time at home practicing, an activity which probably

drew the attention of other family members and likely engaged occasional supervision from an adult. Any single or combination of these multiple factors might have produced the increase in self-esteem of the children taking the lessons. While traditional piano instruction involves all these elements and, as such, has beneficial effects on children's self-esteem, the identification of the exact source of these benefits would allow educators and parents to find other musical or non-musical activities with similar positive effects.

In this study, sex, family income, parental employment, and family structure (i.e. single or two-parent family) did not interact significantly with the musical treatment. In other words, the positive effect of piano instruction on self-esteem was evident regardless of children's sex, parental employment, and family income and structure. This is an important finding in the present investigation because of the characteristics of its sample. Children selected to participate in the study had lower family incomes than the typical piano student and the proportion of single parents and unemployed parents in the sample was much higher than in a nationwide sample of American piano students surveyed by Duke et al. (1997). Apparently, the contribution of piano instruction to the development of self-esteem is not restricted to the privileged children described in Duke et al.'s study but can also reach those who are less privileged if provided with adequate resources. Additionally, in the present study, there was an equal number of boys and girls, a proportion that is unlikely to be found in music schools and studios in which the girls typically outnumber the boys (Duke et al., 1997). The results indicate that piano instruction may benefit boys and girls similarly during the pre-adolescent years.

The results of the study question the existence of a causal relationship between formal music instruction and academic achievement as instruction did not affect children's academic achievement in language and math as measured by standardized tests. No differences were found between the test scores of children taking the piano lessons and those who never participated in formal music instruction. Children receiving the piano lessons tended to obtain higher math computation scores than those not participating in formal music instruction after two years of treatment and those who completed three years of piano instruction tended to obtain higher language scores than those who never took music lessons. However, these trends were not statistically significant. The lack of differences in initial academic achievement between the dropout group and the control or experimental groups suggests that the decision to continue taking piano lessons was not influenced by academic achievement. In other words, there was no indication that those with less academic prowess were the ones who dropped out of the lessons.

The effects of piano instruction on children's academic performance in school, as measured by school report cards, were similar to the ones measured objectively. No academic benefits of piano instruction were evident from

the analyses of school marks in language subjects and math. Although the math marks of the children receiving and not receiving the lessons changed significantly from third-grade to sixth-grade, the results did not indicate any clear overall gain or loss for any of the groups. On the other hand, the analyses of the music marks showed a positive effect of piano instruction on children's school achievement in music. While this might not be surprising, it is of great value for music educators who know that children's attitude towards music class usually declines throughout elementary school (Nolin and Vander Ark, 1977). How to reverse this pattern and motivate students to participate in music classes are questions often addressed by practitioners and researchers. The lack of other effects of piano lessons on school performance is a positive sign that this type of instruction does not necessarily add excessive strain to children's academic responsibilities. Given that children had to spend time and energy attending the lessons and practicing, one might expect that their dedication to school work would be reduced. However, there is no evidence that this occurred during the three years of instruction. The academic school performance of the children participating in the lessons was not jeopardized by the additional work that the lessons imposed on them.

In summary, the study provides evidence that extended participation in piano instruction benefits children's self-esteem and school music marks but does not affect their academic achievement or their school work in math and language. One hopes that the musical and non-musical benefits experienced by the children in this study will be long lasting and will provide them with valuable resources in their future lives.¹

NOTE

1. After the completion of the Piano Project, children were invited to participate in a music program at a public secondary school in Montreal, Canada where they could have continued their piano studies. The McGill Conservatory also offered them scholarships for the continuation of the piano lessons.

ACKNOWLEDGEMENTS

This study was funded by a grant from the National Piano Foundation, Dallas, TX and completed in collaboration with the McGill Conservatory of Music and the English Montreal School Board, Montreal, Canada.

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EUGENIA COSTA-GIOMI is Associate Professor, Music and Human Learning at the University of Texas, Austin. Her research focuses on musical development, music perception and cognition during childhood, and the musical and non-musical effects of music instruction. She has extensive experience in teaching music to children and is a member of the editorial boards of the *Journal of Research in Music Education*, *Musicae Scientiae*, and the *Boletín de Investigación Educativo Musical*.

Address: The University of Texas, School of Music, 1 University Station E3100, Austin, TX 78712-0435, USA. [email: costagiomi@mail.utexas.edu]