MUSIC EDUCATION AND INTELLECTUAL DEVELOPMENT IN CHILDREN: HISTORICAL, RESEARCH, AND EDUCATIONAL PERSPECTIVES

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Articles about the benefits of listening to Mozart and providing young children with music instruction became very popular in the early 90s (BANGERTER & HEALTH, 2004). Newspapers, TV shows, and the media in general, disseminated the results of two research studies showing that listening to 10 minutes of Mozart improved college students' performance in a paper and pencil test of spatial abilities (Rauscher et al, 1993) and that providing 3- to 5- year olds with daily music lessons improved their performance in a spatial task (RAUSCHER et al, 1994). Although the studies reported results regarding very specific spatial abilities, the media presented them as if they were reflective of improvements in intelligence and achievement. In fact, the title of an article that appeared on the front page of a national newspaper in the United States referred to the effects of music instruction on children's math and science achievement (ELIAS, 1994) whereas in reality, the actual research had not included any measures of academic performance in those disciplines (RAUSHER et al, 1994). There was much misunderstanding of the actual results of these research studies and the implications of such research for the education of children. The outcome of this extraordinary media attention resulted in the spread of the idea that music makes people smarter (BANGERTER & HEALTH, 2004).

Bizarre applications of the research findings included the distribution of classical music CDs to infants and their mothers and the mandatory performance of classical music at daycare centers (Science Daily, 2010) as well as the development of a booming industry based on the production of classical music recordings targeted specifically to infants and young children (e.g., *Baby Mozart*). Such applications were not based on actual research findings, however, as not a single study had shown that classical music improves young children's cognitive development. Overall, it seems that the research content got lost in the midst of a renewed enthusiasm for the value of music in children's intellectual development. This is unfortunate because there is much that we know about the benefits of music in children's lives (e.g., MACDONALD et al, 2012). Such benefits include many aspects of children's lives besides their intellectual development.

Although almost a hundred years of research on the relationship between music instruction and intelligence has produced a solid body of knowledge, we still have many

questions about this relationship. In this presentation, I will suggest questions for future research studies and provide an overview of the main research findings. My interest is to explore the implications of this research for the education of children, so I will emphasize the educational context of music participation from historical, educational, and research perspectives. I believe that in the United States, the popularity of the idea that music makes people smarter originated at a time in which the place of music in the school curriculum was in jeopardy. By reviewing the educational context of musical participation, we may better understand the contribution and limitations of research on the intellectual benefits of music instruction.

Because of time and space restrictions, I will not be able to elaborate on the research findings of the many studies conducted to date. Readers may find comprehensive and in-depth information about individual studies in recent reviews of literature that have focused on the benefits of music participation in children and young people (HALLAM, 2010), the educational context of music lessons (COSTA-GIOMI, 2012), methodological and interpretative problems of such research (SCHELLENBERG & PERETZ, 2008), and the neurobiological effects of music instruction (e.g., STRAIT & KRAUS, 2011).

Although it seems that research on the intellectual benefits of music instruction only started in the 90s, there's a long history of research on the relationship between music and intelligence. In fact, more than 2000 years ago, the Greeks purported that the teaching of music was invaluable for the development of the soul and identified music as one of the three basic disciplines of the *trivium*, the curriculum of the ideal Greek citizen. There are publications from the early 1900s showing strong correlations between pitch perception and intelligence in children (SMITH, 1911) and weak correlations between musical abilities and intelligence in children and college students (FRACKER & HOWARD, 1928; HOLLINGWORTH, 1926). Research published later, established correlations between music study and intelligence (ANTRIM, 1945; BIENSTOCK, 1942; ROSS, 1936) and showed the superiority in intellectual ability of music students compared to their peers in other disciplines (WHEELER & WHEELER, 1951). Although these findings were often interpreted as indicative of the intellectual benefits of music learning, it is possible that the study of music simply attracts bright students (FARNSWORTH, 1946; ROSS, 1936).

Only in the last 35 years did experimental research attempted to determine whether the relationship between music participation and cognitive skills is of a causal nature. In 1975, HURWITZ, WOLFF, BORTNICK, and KOKAS completed a landmark study that showed the positive effects of music instruction on first graders' sequencing skills, spatial abilities,

and academic achievement. Many other studies followed: BEREL et al., 1971; HASSLER et al, 1985; KARMA, 1979; MASON, 1986; WOLFF, 1978. Then, in 1994, Rauscher, Shaw, Levine, and Ky completed an investigation showing significant improvements in specific spatial skills in 3-5 year olds who received weekly music lessons for eight months. Although a subsequent powerful media campaign reported that music instruction makes children smarter, the results of the study did not show improvements' in children's performance in the intelligence battery. In fact, Rauscher and her colleagues found no differences for any of the subtests of the Weschler Preschool and Primary Scale of Intelligence-Revised between the children receiving and not receiving the lessons except for the Object Assembly subtest. This subtest requires children to put together small puzzles.

Such controversial interpretation of findings ignited much interest in the research community. Since then, the effects of music engagement on a wide variety of cognitive tasks and skills have been studied: spatial abilities (BILHARTZ, BRUHN, & OLSON, 2000; BROCHARD, DUFOUR, & DESPRÉS, 2004; COSTA-GIOMI, 1999; GROMKO & POORMAN, 1998; HETLAND, 2000; HURWITZ et al.,1975; ORSMOND & MILLER, 1999; RAUSCHER et al., 1997; SLUMING et al. 2007; STOESZ et al., 2007; ZAFRANAS, 2004), verbal skills (BOLDUC, 2009; BRANDLER & RAMMSAYER, 2003; CHAN, HO, & CHEUNG, 1998; COSTA-GIOMI, 1999; 2004; COSTA-GIOMI & RYAN, 2006; DOUGLAS & WILLATTS, 1994; et al., 2008; FRANKLIN et al., 2008; GARDINER et al.,1996; HO, CHEUNG, & CHAN, 2003; HURWITZ et al.,1975; JAKOBSOB, CUDDY, & KILGOUR, 2003; JAKOBSON et al., 2008; KILGOUR, JAKOBSON, & CUDDY, 2000; MAGNE, SCHÖN, & BESSON, 2006; MARQUES et al., 2007; MORENO et al., 2009; PIRO & ORTIZ, 2009; SCHÖN, MAGNE, & BESSON, 2004; THOMPSON, SCHELLENBERG, & HUSAIN, 2004), and memory (BUGOS et al., 2007; CHAN & CHEUNG, 1998; COSTA-GIOMI & RYAN, 2006; FRANKLIN et al., 2008; HUNTSINGER & JOSE, 1991; LEE, LU, & KO, 2007; TIERNEY, BERGESON, & PISONI, 2008). The results of most of these studies suggest that music instruction produces improvements in these specific abilities and skills (for detailed reviews see HALLAM, 2010; SCHELLENBERG, 2011; STRAIT & KRAUS, 2011).

These findings started being disseminated at a critical time for arts education in the United States. The No Child Left Behind Act of 2001 passed by congress under President George W. Bush, imposed unprecedented pressure on schools and students to achieve specific goals in science, math, and language tests. The importance of subjects not included in mandatory testing, such as the arts, diminished: Teachers and school administrators needed to

reinforce the teaching of subjects that were tested by the state to ensure that students would pass the exams. This may explain why music educators and the music industry capitalized on the research findings regarding the positive effects of music on children's intellectual abilities.

There are many indicators of the strong relationship that exists between art instruction and academic achievement. As an average, students who choose to participate in art activities in secondary school, score higher in national tests of math and language achievement than those who don't (e.g., CATTERALL, 1998) and the length of time in which secondary students participate in arts courses is positively correlated to their scores in such tests (e.g., http://professionals.collegeboard.com/data-reports-research/sat/cb-seniors-2010). These statistics do not necessarily mean that arts instruction produces achievement gains, as it is known that students who choose to participate in the arts are more academically inclined than students who choose not to do so (FITZPATRICK, 2006; FRAKES, 1985; KINNEY, 2008; 2010; KLINEDINST, 1991; MCCRARY & RUFFIN, 2006; YOUNG, 1971). In other words, although it is clear that there's a strong relationship between music participation and academic achievement, the causal nature of the relationship is questionable. In order to establish causality unequivocally, it is necessary to conduct experimental studies.

Many experimental investigations have been completed on the short-term effects of learning music. Such studies have been based on music interventions lasting less than one year (BILHART et al., 2000; GROMKO & POORMAN, 1998; GRAZIANO, 1999; HETLAND, 2000; HURWITZ,1975; KOKAS, 1969; MORENO et al., 2009; ORSMOND & MILLER, 1999; PERSELLIN, 2000; PIRO & ORTIZ, 2009; RAUSCHER, SHAW, & KY., 2003; RAUSCHER et al., 1997; RAUSCHER & ZUPAN, 2000; SCHELLENBERG, 2004; TAETLE, 1999; THOMPSON et al., 2004; ZAFRANAS, 2004). In general, their results have consistently shown the positive effects of music instruction on general and specific cognitive abilities in children. However, they have provided no information about whether longer music interventions would result in larger cognitive gains or whether the cognitive benefits persist after the discontinuation of lessons.

I completed one of the few experimental studies on the effects of long-term involvement in piano instruction on children's cognitive abilities, self-esteem, and academic achievement (1999, 2004, COSTA-GIOMI & RYAN, 2007). The 117 children who participated in the study were different from the typical piano students: Their family income was much lower, many lived with a single parent, and most had parents with no postsecondary education. The children were randomly assigned to a group that received three years of individual piano lessons or a control group that did not participate in formal music

instruction. Children in the experimental group were loaned a piano for the duration of the project. The results of the study showed that the piano lessons had short-term effects on cognitive abilities, particularly spatial abilities, but had no long-term effects: Although the piano group scored significantly higher than the no piano group after one and two years of lessons, there were no differences in cognitive performance between the two groups by the end of the third year. Furthermore, a few years after the discontinuation of the lessons, the performance of the two groups in tests of memory and intelligence were remarkably similar.

Another two studies that provided children with more than one year of music instruction also found no evidence that the intellectual benefits of studying music are long lasting (SCHLAUG et al., 2005; 2009; ZULUAF, 1993/1994). On the other hand, there are two studies (PORTOWITZ et al., 2009; Rauscher & Hinton, 2011) that suggest that music lessons produce long-term intellectual improvements. Because of methodological problems such as the presence of confounding variables, the lack of randomization of the sample, and design flaws such as lack of control over the quality of music instruction their results are questionable.

In summary, the results of experimental studies show that (1) studying music during childhood produces intellectual benefits and (2) such improvements may be only temporary as they may last no longer than two years. The studies I have reviewed so far have used intelligence tests as the main measure of intellectual benefits. However, there's another body of research using neurological measures to assess the impact of childhood music instruction on cognitive abilities. Such studies have found that music learning and music practice produces changes in children's and adults' processing of sound (e.g., HYDE et al., 2009; JÄNCKE, 2009; SHAHIN et al., 2004; SHAHIN & et al., 2010; STRAIT & KRAUS, 2011; WU & SCHLAUG, 2010). Their results help explain the superiority of musicians in tasks that are based on sound discrimination but provide no information about the effects of music instruction on intelligence tasks. In other words, although it is clear that intensive music practice produces neurological changes associated with the perception of sounds, it is still unclear whether or how music instruction produces changes associated with improved intelligence.

Conducting longitudinal research poses many problems to researchers. It is difficult to choose who should participate in the study, hard to follow a group of people for years, and impossible not to lose some of them along the way. This may explain why there are so few experimental studies lasting more than just a year. In fact, most of the studies suggesting that the effects of music instruction on cognitive abilities are long lasting are based on cross

sectional or correlational data. For example, Schellenberg (2006) established a positive correlation between the length of involvement in music and IQ in a group of children and adults. His interpretation of the results favored the causal nature of the relationship: music instruction produces improvements in IQ. He gathered the adults from university classes and the children from those who had participated in research studies. In other words, the sample was highly selective to start with. Because we know that those who choose to study music are different from those who don't (ALBERT, 2006; BOWMAN & VANDERARK, 1982; BRANDSTROM & WIKLUND, 1996; ELPUS & ABRIL, 2010; FELDMAN & MATJASKO, 2007; KINNEY, 2010; KLINEDINST, 1991; MCCARTHY, 1980; MCNEAL, 1998; NATIONAL ENDOWMENT FOR THE ARTS, 2009; PHILLIPS, 2003; STEWART, 1991; WOLFE, 1969) and those who persist in the study of music are different from those who don't (COREMBLUM & MARSHALL, 1998; COSTA-GIOMI, 2004; COSTA-GIOMI, FLOWERS & SASAKI, 2005; COSTA-GIOMI & RENTFREW, in preparation; CUTIETTA & MCALLISTER, 1997; KLINEDINST, 1991; MCCARTHY, 1980; MOWBEY, 1973; PRUITT, 1966). it is possible that his results are simply a reflection of the process of selectivity that happens over the years. Variables such as family income, parental education, family structure, student achievement, and student personality indeed affect who pursues, perseveres, and ultimately succeeds in learning music (see COSTA-GIOMI, 2012 for review). In other words, the superior intellectual performance of students who choose, persist, and succeed in learning music may be the result of other educational opportunities in which they participate, or the characteristics of their parents and home environment, or certain personality traits that contribute to their intellectual development rather than the effects of music instruction per se. That children who choose, persist, and succeed in studying music are different than those who don't is a source of concern for the music education community. If music education is afforded only by students from quite privileged environments, the extensive efforts in making music accessible to all students in American public schools may seem to have been in vain. Furthermore, if there are intellectual benefits associated with music instruction, then only those who can afford the opportunity to participate and persevere would benefit from them.

Indeed, there are alarming differences in the music programs offered in public schools according to the demographics of their student population. When comparing the characteristics of music programs in Texas public schools of contrasting socio economic status, I found many differences suggesting that some schools are clearly more privileged than others in terms of the availability of resources and support for their programs (COSTA-

GIOMI, 2007; COSTA-GIOMI & CHAPPELL, 2007; COSTA-GIOMI, 2008). Differences found across all schools of contrasting socioeconomic profile and racial make-up included perceived support from parents, colleagues, school administration, and district authorities; inclusion of students with disabilities in the music programs; adequacy of facilities and instructional resources; quantity, quality, and maintenance of instruments; number of guest performers/clinicians; teacher's experience with student teachers; length of class time; and frequency of music instruction. The differences almost invariably favor schools with the lowest proportion of minority or economically disadvantaged students. Overall, high-SES/low-minority schools have more students participating in the music programs, better facilities, better resources, more supportive parents, a higher proportion of students with disabilities, shorter class periods but more frequent music instruction, and teachers who teach at only one school. These findings are relevant to the discussion about the educational context of music instruction because they show that not all students have equal access to comparable music programs. This is true even in the public school system in which students are provided with music instruction free of charge.

Many studies have shown that students who enroll in music programs come from families with higher socio economic status (BRANSTROM & WILKLUND, 1996; CLORENBLUM & MARSHALL, 1998; DUKE, FLOWERS, & WOLFE, 2001; FELDMAN & MATJASKO; KLINEDINST, 1991; MAWBEY, 1973; NABB, 1995; PRUITT, 1966; RICKELS & STAUFFER, 2010; YOUNG, 1971). A longitudinal study in the United States that gathered music enrolment information from over 13,000 high school students in both public and private schools over a period of six years clearly showed that SES is significantly associated with music participation (ELPUS & ABRIL, in press). Additionally, schools serving students with higher SES have a higher enrolment in their music programs than do lower SES schools (COSTA-GIOMI & CHAPELL, 2007; COSTA-GIOMI, 2007; 2008; RICKELS & STAUFFER, 2010).

The selectivity of the children who are engaged in music lessons seems to get magnified over time because of a process of attrition that occurs throughout the years of instruction. For example, in Texas, 75% of the students who start to learn to play an instrument discontinue the lessons within three years (SOUTHWESTERN MUSICIAN, 2004). We know much about who persists and drops-out of lessons. Children who persevere score higher in achievement tests, are more responsible and disciplined, and study more (COSTA-GIOMI, 2005; MCPHERSON & DAVIDSON, 2002; PITTS, S. DAVIDSON & MCPHERSON, 2000). Additionally, we know that SES and academic achievement are

significant predictors of perseverance in music participation in school settings (KINNEY, 2010). It seems likely that the discipline, responsibility, and concentration of students who persevere in learning an instrument may result in superior performance in tests of intellectual ability and academic achievement. These findings reinforce the idea that there's a process of self-selection that occurs over time that may explain why those with many years of music instruction are more intellectually capable than those who with more limited participation in music activities. It is difficult to disentangle the true effects of music instruction from the effects of the many variables that mediate participation, persistence, and success in learning music. And this is why we must be cautious in our assertions about the long-term intellectual benefits of music instruction.

Music educators have welcomed the media and research interest on the benefits of music instruction as it has provided support for the inclusion of music in the school curriculum. After all, providing children with the opportunity to study music is one of the goals of music education. This opportunity is valuable not only because of the possible intellectual benefits it brings to their lives, but also because of the cultural and educational benefits to them and our society. Working towards accessibility to quality music education will continue to be a goal of music educators. Hopefully, future research will also continue to investigate the relationship between music participation and the intellectual performance and interests of children and adults. Music instruction is, undeniably, a powerful source of intellectual stimulation and regardless of its effects on general intelligence, it provides children with the opportunity to develop their musical cognitive abilities.

Note: Many of the points of discussion of this presentation are more fully developed in Costa-Giomi, E. (2012). Music instruction and children's intellectual development: The educational context of music participation. In MacDonald, R., Kreutz, G., & Mitchell, L.. *Music, Health and Wellbeing.* Oxford University Press: London, Chapter 23, pp. 339-355.

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