Music Instruction for Improving Cognitive and Social Emotional Development and Academic Achievement in School-aged Children and Youth: A Systematic Review
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Music Instruction for Improving Cognitive and Social Emotional Development and Academic Achievement in School-aged Children and Youth: A Systematic Review.

BACKGROUND

Music instruction, while available in most public schools, has struggled to remain relevant in today’s test-focused curriculum. While 89-97% of elementary students receive some kind of music instruction in school, the type and quality of instruction varies widely (Parsad & Spiegelman, 2012). In elementary schools where at least 50% of the students are on free or reduced lunch, 84% of music teachers had a district curriculum to follow, 49% of teachers taught at more than one school, and 25% of teachers taught music class outside of regular school hours. In 2013, as many as 159 art and music teachers were laid off in the Chicago Public School system because of budget cuts (Fang, 2013); Philadelphia city schools completely eliminated funding for art and music programs to deal with a $304 million budget shortfall. (Woodall & Chea-Annan, 2013).

In December of 2015, President Obama signed into law the Every Student Succeeds Act (ESSA) which rejects the overuse of standardized tests and empowers each state to develop their own strong systems for school improvement based upon evidence. This new law also ensures that arts education programs (Section 4104, b, II) are eligible to receive federal funds and Sec 4107 states “programs and activities that use music and arts as tools to support student success” will be funded. With the ESSA grants beginning in July 1, 2016 now is the perfect time to explore the impact of music instruction on student achievement and cognitive development.

Research on the benefits of music instruction has blossomed over that past 20 years. Studies on intelligence, academic success, and cognitive skills have documented the value of music in the lives of children. Concerning IQ, Schellenberg (2004) found a significant increase in children receiving 36 weeks of music. On the other hand, Gromko & Poorman (1998) found no significant difference in IQ for pre-schoolers who received weekly piano instruction for 3 years and those who did not. Ho, Cheung & Chan (2003) found that boys in Hong Kong, who had classical music training for 1-5 years, significantly improved on verbal memory tasks compared with boys who had no music training. However they found no significant difference on visual memory tasks. Johnson & Memmott (2006) found a slight advantage in standardized math and English tests for 3rd, 4th, 8th & 9th graders who had participated in high quality music programs. Both Harris (2008) and Helmrich (2008) found that students who engaged in music instruction performed better in elementary mathematics and algebra. For reading outcomes, Baek’s 2009 study of preschoolers showed that children who received music instruction for 8 weeks had significantly higher reading scores than those with no music instruction.
**Theory of change**: Many skills are required when playing a musical instrument: motor, listening, reading, translating the “language” of music, and memorization (the sharps or flats of a key). Studies have shown that exposure to music can change the way the brain operates. Schlaug, Norton, Overy & Winner’s (2005) study used MRI to examine the brain changes in children involved (or not) in music training. For children aged 5-7, there were no structural brain difference at baseline between the instrumental and matched control groups. After one year of instrumental music training, there was a greater increase in gray matter volume (not significant) for the music group compared to the control group. However, in another study with 9-11 years old subjects with an average of four years of music training, the music group had significantly more gray matter volume compared to a matched group of non-instrumentalists. The music group also performed significantly better on the WISC-III Vocabulary test, and outperformed the controls on phonemic awareness, the Raven’s Progressive Matrices and the Key Math test, although differences were not significant.

Gains in academic achievement, cognitive and social-emotional skills are considered to be far-transfer benefits of music instruction (Jaschke, Eggermont, Honing & Scherder, 2013). While far-transfer effects are harder to detect than near-transfer benefits (fine motor skills, perception of pitch and rhythm), significant effects of music instruction were found for reading, writing and math in their meta-analysis. Miendlarzewska & Trost (2014) describe the effects of music training in childhood in their review. Listening skills are routinely improved by music instruction, which in-turn improves language processing and reading. Miendlarzewska & Trost theorize that music lessons act as additional schooling and that focused attention, memorization, and mastery of technical skills translate into higher IQ scores and achievement.

**Effects of music instruction on children not at-risk**: Bilhartz et al. (1999) reported on preschoolers who had 30 weeks of parent-involved music instruction. These children showed significant gain in the Stanford-Binet Bead Test compared with controls. In another study, upper-middle-income kindergarten and first grade children were followed for three years after receiving 8 months of keyboard lessons (Rauscher, 2002; Rauscher & Zupan, 2000). Children who received music instruction scored higher on spatial-temporal tasks compared to children in the control condition. However, Rickard, Bambrick & Gill (2012) found no advantage for children engaging in a music education program in reading or math while attending private schools in Australia. A recent study (Hogenes, Oers, Diekstra & Sklad, 2015) of Dutch 5th and 6th graders reports that after 6 months of a music composition intervention, subjects were more engaged in music education and performed better on reading comprehension measures than the control group.

**Music programs, cognitive and social abilities with low-income, high risk children**: Costa-Giomi (2004) studied 63 low-income Montreal fourth graders who were provided with weekly piano lessons for three years; 54 children were not. The children were assessed using the Developing Cognitive Abilities Test (DCAT), language and math subtests from the Canadian Achievement Tests, and other measures. At post-test there was a small effect for
the treatment group on general cognitive abilities and spatial development, but not for verbal and quantitative abilities. There was no difference in academic achievement in math and language as measured by standardized tests and report cards. Rauscher (2005) studied economically disadvantaged elementary school children to see the effects of twice-weekly or three times per month group keyboard lessons or no lessons at all. By the third year, and after improvement of the quality of musical instruction, the keyboard group scored higher on spatial-temporal tasks and arithmetic; however there no difference between groups on verbal measures. A study evaluating the impact of a music program designed to foster cognitive development and social esteem among high-risk 7-9 year old children in Israel (Portowitz, et al., 2009) favored children in the experimental group. The treatment group received private instrumental lessons for two years and the control group did not. Pre and post assessments evaluated the development of cognitive skills with the Raven and the Complex Figure Tests and social esteem (Fitts). Both groups improved their cognition after two years; however, the treatment group's cognitive skills were significantly greater than the control group's skills. In another Portowitz study (2014), elementary-aged children who participated in 32 hours of music training had significantly better memory outcomes than the control group.

In our own pilot study at the W. O. Smith Music School in Nashville, TN, our two-year findings have shown significant differences for children in the music-treatment group. The W. O. Smith Music School is an afterschool program that provides quality music instruction for low-income, at-risk children for a nominal fee. For the spring 2015 follow-up, children who were exposed to music classes and/or private lessons were significantly more accurate on the Cogstate One-Back Working Memory Task than children on the wait-list at a 9-month (Tx = 27, C = 21, p = .018) and 21-month assessment (Tx = 14, C = 10, p = .038).

Additionally, children exposed to music performed more accurately on the Cogstate Social-Emotional Task than children on the wait-list at a 9-month (p = .07) and 21-month follow-up. The treatment group had higher language arts grades after 9-months, while the control group had higher grades in science, math and social studies, but none of these differences were significant. These were parent-reported grades, however, and some subjects' grades were missing (Tx = 26-25, C = 16-18).

Previous Systematic Reviews: While some meta-analyses in this topic area have been completed, they have been quite limited in scope with regard to intervention type, context, and outcomes. This review team proposes to conduct a robust systematic review that will fill the evidence gap in five key areas. First, our outcomes will be comprehensive. We are seeking the effects of music instruction on all areas of academic achievement as well as prosocial behaviour, social emotional skills and cognition. Most of the existing reviews of the effects of music instruction focus on a very narrow set of outcomes often limited to those most commonly associated with the primary author's discipline (see for example, Butzlaff 2000, Hetland 2000b, Pietschnig 2010, Vaughn 2000). This proposal seeks to avoid the silo effect and look at a wide variety of outcome types, essentially covering all the outcome categories examined in the primary literature. This inclusivity among outcomes will allow the review
team to examine variations of effects across outcome domains and with sufficient data, may even allow for the examination of relationships among/between the various outcomes, something that has not been done in systematic review literature in this area before. Second, similar to the outcome situation identified above, most of the completed reviews include only a very narrow definition of music instruction (see for example Hetland 2000a, Pietschnig 2010, Standley 1996) or included both passive listening and active learning but did not differentiate between the two in terms of effects (Jaschke 2013). Third, and to the latter point, the proposed study is designed to examine a wide variety of music instruction formats and will identify which instruction formats and structures are associated with larger effects on the outcome categories. Fourth, in examining the existing systematic reviews in this topic area, issues were discovered with regard to the limited and somewhat flawed use of literature search terms (see for example Jaschke 2013, Standley 1996). The proposed study will be exhaustive when developing search terms to include terms across all academic disciplines. A few of these reviews limited the eligibility criteria to English only studies (Hetland 2000a & 2000b, Standley 1996). To make the proposed study more representative, the review team will utilize Peabody Research Institute’s existing relationships with systematic reviewers outside the U.S. and the U.K. to identify any eligible non-English studies. The fifth and final way the proposed study will fill the gap in literature is by expanding the search years included in the review. The existing reviews examine a limited time frame, most of which end in the late 1990s and our proposed study will perform a literature search on a somewhat unlimited time frame that will cover 1950 through July 2016.

By expanding the inclusion criteria to overcome gaps in previous systematic reviews, we will be able to provide empirically supported answers to questions that have not been posed before due to the narrow scope of much of the music instruction literature. In addition to these key questions, the overall objective is to draw on this systematic review of the available research to identify implications for practice and policy and answer questions such as: how can research about children’s exposure to music instruction programs inform educational policy and governmental (local, state, and federal) funding priorities?

**OBJECTIVES**

The proposed review is intended to provide empirically supported answers to the following questions:

1. Do music instruction programs have positive effects on the following outcome categories: children’s academic success, cognitive development, socio-emotional growth?

2. Which music program types (e.g., voice or instrument-based) have the largest effects on each outcome category?
3. Which characteristics of music programs (e.g., instruction duration, instructor background, one-on-one or group instruction) are associated with the largest effects on each outcome category?

4. Which characteristics of music program participants (e.g., at risk youth, age, sex, etc.) are associated with the largest effects on each outcome category?

In addition to these key questions, the overall objective is to draw on the systematic review of the available research to identify implications for practice and policy and answer questions such as: how can research about children’s exposure to music instruction programs inform educational policy and governmental (local, state, and federal) funding priorities?

EXISTING REVIEWS

The following citations include existing systematic reviews on the topic of the cognitive, socio-emotional or academic effects of music instruction:


Our proposal for this systematic review of music effects will fill the evidence gap in the following ways:

1) Our outcomes will be comprehensive. We are seeking the effects of music instruction on all areas of academic achievement as well as prosocial behaviour, social emotional skills and cognition. Each of the reviews listed above focus on a very narrow set of outcomes often limited to those most commonly associated with the primary author’s discipline. This proposal seeks to avoid the silo effect and look at a wide variety of outcome types, essentially covering all the outcome categories examined in the primary literature. This inclusivity among outcomes will allow the proposers to examine the relationships among/between the various outcomes, something that has not been done in systematic review literature in this area before.

2) Similar to the outcome situation identified in #1 above, each of the completed reviews above includes only a very narrow definition of music instruction. The proposed study is designed to examine a wide variety of music instruction formats and will identify which instruction formats and structures are associated with larger effects on the outcome categories.

3) In examining the systematic reviews listed above, issues were discovered with regard to the limited and somewhat flawed use of literature search terms. The proposed study will be exhaustive when developing search terms to include terms across all academic disciplines.

4) Most of these reviews limited the eligibility criteria to English only studies. The proposed study will utilize Peabody Research Institute’s existing relationships with systematic reviewers outside the U.S. and the U.K. to identify any eligible non-English studies.

5) Unlike many of the reviews listed above, the proposed study will perform a literature search on a somewhat unlimited time frame that will cover 1950 through July 2016.

**INTERVENTION**

Based on existing research the underlying hypothesis for this study is that music instruction positively effects other aspects of a child’s life. The logic here is that the acts of doing, making, or learning music positively contributes to a growing and developing youth’s improved cognitive function, socio-emotional capacity, and academic achievement. Following this logic the authors will define music instruction as music programs that involve...
active music participation by the subjects of the intervention and limit the proposed review to this intervention type. Active music instruction is defined as actively learning to read music, playing an instrument in groups or one-on-one with a teacher or singing in a choral ensemble. Any program where learning or performing music is the focus will be included. What will not be included: 1) listening only to music, which might be called music appreciation or general music; 2) Using music to learn other subjects, such as singing the alphabet, memorizing the names of states or a dance class; or 3) listening to music while taking a test.

To be eligible for the meta-analysis proposed in this review, a study must involve a qualifying music instruction program. As noted above, an eligible music intervention will be defined as one that involves active music participation (as opposed to passive listening such as playing Mozart in the classroom while students take a test). To be eligible, interventions must engage subjects in some form of active learning that cognitively and/or physically engages the subjects such as learning to read music and playing an instrument. An eligible intervention can include any type of music instruction on any kind of instrument, including vocal lessons or choral ensembles as long as it involves active learning. Interventions that are excluded from this study include passive listening to music while engaging in another task and general music classes in which students learn about music generally but do not learn to play an instrument.

Interventions that meet eligibility criteria in terms of intervention type (active music instruction) will be included regardless of intensity or duration of the programs (these characteristics will be coded into the meta-analytic database). An eligible study will also include music instruction programs in any setting or instructional format to include but not limited to school music/band class, extracurricular or home school co-operational settings as well as group or one-on-one instruction formats.

The studies to be included in the proposed meta-analysis must also involve a comparison between one or more focal treatments or active music instruction program(s) and one or more control conditions which can be no music instruction, passive listening (e.g., listening to music during which the participant does not engage in active music learning), or educational curriculum as usual (e.g., control group goes to an honors algebra class or current events instead of music instruction). Additionally, a group of children who drop out or refuse to attend music instruction will not be considered a qualifying control condition however wait-list control groups will be acceptable.

**POPULATION**

The proposed study will focus on children and youth who participate in music instruction. Children and youth will be defined as persons under 18 years of age for the purposes of this study. The proposed study will include all children and youth receiving music instruction regardless of sex, race, ethnicity, or socioeconomic status (these subject characteristics will
all be coded). Because this study aims to assess the effects of music instruction on the average child not constrained by significant medical or psychological deficits, the target population for this study will exclude significantly medically, intellectually and/or psychologically compromised youth. Three examples from searches of primary studies in this topic area that illustrate this exclusion include music instruction and/or exposure for youth diagnosed with autism spectrum disorder, as well as youth undergoing chemotherapy where music is used to limit the effects of “chemo brain” and music therapy for youth with clinical psychopathologies.

It should also be noted that the proposed review will include studies conducted in any country. There will be no limitation on the nationality, race or ethnicity of the subjects where the intervention occurs. Additionally, this review will include studies conducted during or after 1950 with a publication date in 1950 or later.

**OUTCOMES**

To be eligible for the proposed meta-analysis, studies must report at least one outcome variable describing the treatment and control samples with regard to their post-intervention cognition, socio-emotional, academic achievement or the like. This outcome must be quantitative with results reported on at least one variable in a form that, at minimum, allows the direction of the effect to be determined (whether the outcome was more favorable for the treatment or control group). If an outcome is measured but the reported results fall short of this standard, the study will still be acceptable if the required results can be obtained from the author or other sources.

Based on a review of the primary studies in this topic area, the outcomes that will be the focus of the proposed meta-analysis and which represent the different categories of intervention effects in studies of music instruction effects will include but not necessarily be limited to:

**Cognitive function**: working memory, IQ, attention, self-regulation, socio-emotional skills, visual and verbal memory, spatial awareness, spatial memory, etc.

**Socio-emotional capacity**: school behavioural measures, self-esteem, empathy, social skills, emotional comprehension, etc.

**Academic gains or attainment**: STEM achievement (science, technology, engineering, math), language arts achievement (vocabulary, reading, language mechanics, phonological awareness, spelling, reading comprehension, etc.), other academic achievement (e.g., social studies, foreign language, history etc.), standardized testing results (WISC, Wechsler, etc.), grade point average, graduation or degree completion.
STUDY DESIGNS

To be a qualifying design for this review, a study must compare subject group(s) receiving active music instruction with at least one qualifying control condition (no music instruction, passive listening or educational curriculum as usual). To be included, the subjects in a study must either be randomly assigned to a qualifying music intervention and control condition; OR matched mechanically or statistically on recognized variables for music proficiency and demographics such as prior participation in music training, age, and socioeconomic status; OR, if not randomized or matched, must provide pre-treatment data that can be compared.

In terms of sample size, to be eligible for this review a study must include at least 10 subjects in the music instruction group and 10 in the control group at the point of assignment or selection to the experimental conditions (i.e., pretest). Note that studies meeting all other eligibility criteria will be included in this review regardless of their reporting format to help ensure that there is no bias toward formal journal publication. For example, technical reports, dissertations and other forms of grey literature are eligible if they meet the inclusion criteria.

REFERENCES

(* references we have identified for coding.)


**REVIEW AUTHORS**

**Lead review author:** The lead author is the person who develops and co-ordinates the review team, discusses and assigns roles for individual members of the review team, liaises with the editorial base and takes responsibility for the on-going updates of the review.

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ROLES AND RESPONSIBILITIES

• Content: Gabrielle Chapman and Jan Morrison have been working in the area of music education’s effect on cognition and socio-emotional capacity for several years. They were awarded a grant from Vanderbilt’s Curb Center to pursue a primary pilot study of a local music education program in 2013 and have managed to build collaborations with faculty interested in the effects of music education across several disciplines. Their conference posters in this area have garnered a great deal of interest from the field as their multi-disciplinary approach has provided unique insights into the impacts of music education. While not in music education specifically, Lipsey’s exceptional knowledge of education-based intervention studies and education research adds a great deal of expertise to the review team.

• Systematic review methods: Chapman, a former doctoral student and current colleague of Lipsey, has a great deal of methodological knowledge related to systematic reviews and has worked on numerous meta-analysis projects. Chapman has assisted in the development of a guidance document for evaluation of meta-analytic projects and contributed to the development of a meta-analysis tool for Crimesolutions.gov through Development Service Group, Inc. Additionally, Chapman has published a review and overseen the update of some of the largest meta-analytic databases in the world. Morrison has worked with both Chapman and Lipsey as an exceptional project coordinator on several meta-analysis projects at Peabody Research Institute for over a decade. Lipsey has an extremely high level of expertise in systematic review methods as he has published many completed critically acclaimed reviews, taught graduate level meta-analysis classes, is co-author of a textbook (Practical Meta-Analysis), was Co-Editor-in-Chief of the journal Research Synthesis Methods and currently serves as a Features Editor, and served as a co-Chair of the Campbell Collaboration Steering Group.

• Statistical analysis: Chapman, has a great deal of statistical analysis knowledge and experience relative to meta-analysis having published a completed review and conducted analysis for solo meta-analysis projects and in collaboration with Lipsey. Morrison has competently assisted both Chapman and Lipsey in statistical analysis on numerous meta-analysis projects over more than a decade. Lipsey has an extremely high level of expertise in statistical analysis, especially analysis associated with a meta-analysis project. He has published innumerable reviews, taught graduate level meta-analysis classes, is co-author of a textbook (Practical Meta-Analysis), was Co-Editor-in-Chief of the journal Research Synthesis Methods, currently serves as a Features Editor, and served as a co-Chair of the Campbell Collaboration Steering Group.

• Information retrieval: While we do not have a dedicated information retrieval expert on the review team, the authors and the staff at Peabody Research Institute have developed their own expertise in this area over the past decade (decades in the case of Lipsey) conducting a large number of meta-analysis research projects. Morrison in particular has
successfully overseen complex and extremely large literature searches, managed retrieval, and assisted in the development of coding databases for more than 10 large meta-analysis projects.

Note: CVs for Chapman, Lipsey, and Morrison are attached and provide additional details.

**FUNDING**

None of the members of the review team currently receive any financial support for the proposed music education meta-analysis project. This is the first and only funding proposal this team has submitted for this meta-analysis project either individually or together.

**POTENTIAL CONFLICTS OF INTEREST**

No member of the review team has a financial interest or other conflicts of interest in this project or the results.

**PRELIMINARY TIMEFRAME**

- **Date you plan to submit a draft protocol:**
  
  We will submit the draft protocol within four (4) months of title approval.

- **Date you plan to submit a draft review:**
  
  We will submit a draft review within twelve (12) months of protocol approval.
AUTHOR DECLARATION

Authors’ responsibilities

By completing this form, you accept responsibility for preparing, maintaining, and updating the review in accordance with Campbell Collaboration policy. The Coordinating Group will provide as much support as possible to assist with the preparation of the review.

A draft protocol must be submitted to the Coordinating Group within one year of title acceptance. If drafts are not submitted before the agreed deadlines, or if we are unable to contact you for an extended period, the Coordinating Group has the right to de-register the title or transfer the title to alternative authors. The Coordinating Group also has the right to de-register or transfer the title if it does not meet the standards of the Coordinating Group and/or the Campbell Collaboration.

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Form completed by: Gabrielle Lynn Chapman       Date: 28 March 2016