



Essay:

An Overview of Research on Music and Learning

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“What we must first seek to answer is whether music is to be placed in education or not, and what power it has...whether as education, play or pastime.”

Aristotle

Introduction: Re-examining the role of music in education through research.

Music’s place in American schools continues to be uncertain as we begin a new millennium of public education. While the business of producing and selling music thrives commercially, while listening to and making music continues to be of major interest to a large population of youth and adults, and while hundreds of community schools across the nation offer music instruction to those who can afford it, the comprehensive, sequential study of music has yet to be accepted as a core ingredient of public education.

Perhaps one reason policy-makers have been reluctant to support music as a core subject in public schools is that educators, administrators, artists, and parents seem to be divided in their advocacy for music’s essential role in public education. On one side, the “essentialists” argue that music should be taught for its own sake. Essentialists maintain that while there exists evidence for several kinds of ancillary benefits from music instruction, music teachers should focus only on the instruction of music’s own set of skills and literature and not be responsible for drawing out “extra-musical benefits” from this instruction. By contrast, those sympathetic to the “instrumentalist” point of view believe that music does not exist in a vacuum, that it is connected intrinsically to other subject areas and art forms, and that learning in music inevitably draws on and engages learning processes and fundamental concepts *shared* across many subject areas—often simultaneously.

As research emerges that establishes stronger relationships between music and learning in other areas of the curriculum, advocates from both camps are caught in a complicated bind. While one side worries about pandering to administrators or to school boards that make decisions based primarily on test scores in the academic subjects, the other side worries that, if we ignore aspects of learning transfer between music and other subject areas, music education will remain outside of the mainstream of public education, and thus will survive only as an educational *elective* for the talented or highly motivated few.

Research papers reviewed in this Compendium support a more interactive model of learning in and through music. Although music study takes place in isolation from math and language learning in schools today, research suggests that music functions as a catalyst for cognitive skills and aspects of social-emotional development across disciplines, especially when conditions for transfer are optimized through teaching to principles and processes that engage and deepen learning across disciplines.

Consequently, studies reviewed in this Compendium suggest how music educators and policy-makers may help resolve what increasingly appears to be a false dichotomy between the essentialist and the instrumentalist positions. The gap between these two points of view is beginning to be bridged through research that will be reported here in terms of four major themes.

Theme 1: Meta-analysis studies based on large bodies of research over the last few decades reveal consistently strong, positive relationships between music and learning in other subject areas.

A review of five recent meta-analyses (1995-2000) is included in this Compendium. The emergence of meta-analysis techniques has been particularly helpful in establishing the background context for understanding the impact of music on various cognitive and social-emotional domains. Meta-analysis is a relatively new area of music research, yet it represents an accepted methodology for synthesizing a vast number of extant bodies of literature for the purpose of describing its characteristics and for providing a basis for informed generalization from these data. The use of new statistical procedures to compute effect sizes across similar variables from diverse studies in turn provides insight as to their combined significance, despite differences in research design and populations.

As the reader will discover, there is now a strong body of evidence based on meta-analyses of a broad range of studies, which establishes positive significant associations between music and:

- spatial-temporal reasoning (Hetland 2000a & b),
- achievement in math (Vaughn 2000),
- achievement in reading (Butzlaff 2000), and
- the reinforcement of social-emotional or behavioral objectives (Standley 1996).

While the authors of these meta-analyses caution against over-reaching claims of causal relationships between music and academic

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achievement in language or math, the extensive presence of strong associations between music and other subject areas overwhelmingly is consistent with evidence for positive extra-musical effects of music instruction. Although several studies suggest that explicit attention to teaching for transfer produces stronger results than older studies conducted without this concern, further practitioner research is needed to specify how these links can be best and most consistently achieved through professional development programs for classroom and music teachers in schools.

Theme 2: Generative neurological and cognitive frameworks for learning transfer have emerged from research on music and learning.

“Music is the effort we make to explain to ourselves how our brains work. We listen to Bach transfixed because this is listening to the human mind.”

Lewis Thomas, U.S. physician, educator, 1979.

Education research based on neurological and cognitive aspects of music enables educators today to look more precisely, and therefore more responsibly, at the contributions music can make toward teaching and learning across various areas of our public school curriculum. Interest in music listening studies that enhance performance in other forms of cognition (commonly known as the “Mozart effect”), for example, reflects an unprecedented willingness of educators, researchers, and the general public to consider new conceptions of, and inter-relationships among, musical skills, the mind, and the brain.

A meta-analysis of the research on the effect of music listening on spatial-temporal reasoning (Hetland 2000a) provides a neurological—rather than a cultural—orientation for determining music’s place in education. The notion that certain forms of music listening appear to prepare the brain for better performance on tasks that require “the ability to transform mental images in the absence of a physical model” is significant, not because it provides another rationale for music appreciation, but because findings from these studies contradict two prevailing views of learning: (1) *brain modularity* (the assumption that cognitive capacities are located in discrete areas of the brain as “separate intelligences”) and, its corollary, (2) that it is difficult or counterproductive to promote *learning transfer* across disciplines (as evidenced by the conventional separation between learning music and spatial reasoning math tasks in schools).

The finding that passive listening to music neurologically “primes” spatial-temporal thinking suggests that cognitive processes normally associated with music share neural networks with other kinds of mental activity. Thus we can conclude that “musical and spatial processing centers in the brain are proximal or overlapping and hence linked, rather than being entirely distinct as was predicted by modular theories of the mind” (Hetland 2000a).

While the “Mozart effect” meta-analyses support a model for learning transfer independent of a music education, results from follow-up studies show that authentic and comprehensive musical training—learning to make music and read music in particular—appears to increase further the association between music and various aspects of mathematical reasoning (Hetland 2000b, Rauscher, et al. 1997, Rauscher & Zupan 2000, Vaughn 2000). Meta-analyses reviewed here suggest not only that the effect of musical training in conjunction with mathematical study may benefit greatly from explicit attention to teaching toward this particular aspect of learning transfer (Vaughn 2000), but also that associations between learning music and understanding math are strongest when authentic music instruction is integrated with mathematical instruction based on spatial-temporal or proportional aspects of learning math (Graziano, et al. 1999, summarized in this volume). Results from this study imply that optimal conditions for enhancing learning transfer may depend on new forms of curriculum in both math and music; that is, the design of curricular units that employ fundamental concepts shared by two disciplines (e.g., proportional or spatial-temporal thinking included in math and music instruction) may be essential for replicating the success of interdisciplinary learning in public school settings.

Likewise, the relationship between music and language follows a similar pattern in this research. Meta-analyses indicate that there is “a strong and reliable association between the study of music and performance on standardized reading and verbal tests” (Butzlaff 2000), and that success in second-language skill development occurred with the use of music-integrated instruction infused with underlying mental processes drawn from linguistics, musical perception, and speech therapy (Lowe 1995). In this research, the use of songs in second-language instruction directly enhances pronunciation, grammatical structure, vocabulary, and idiomatic expressions as well as encouraging wide variety in speed of delivery, significant phrasing, and linking of ideas.

Less robust effects resulted from studies that employed music lessons or listening sessions not linked with language instruction. This research revealed that relatively superficial aspects of integration, such as the association of lyrics with academic topics or the presence of specific vocabulary in songs, are more likely to affect attitudes about

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reading or writing tasks than to produce positive indications of reading achievement (Andrews 1997, Hallam 1999).

Research on learning transfer between music and other areas of cognition is relevant to educators interested in the contribution of interdisciplinary learning. New levels of meaning become possible in the music-integrated curriculum when competing representations of fundamental concepts, as Dewey might have said, “are grasped in their relations to one another—a result that is attained only when acquisition is accompanied by constant reflection upon the meaning of what is studied.”

Theme 3: There is an underlying tension between the “one-way cause and effect” and “two-way interaction” models of research on music and learning.

Vincenzo [Galileo’s father] taught Galileo to sing, and to play the organ and other instruments. . . . In the course of this instruction he introduced the boy to the Pythagorean rule of musical ratios, which required strict obedience in tuning and composition to numerical properties of notes in a scale . . . when Vincenzo filled a room with weighted strings of varying lengths, diameters, and tensions to test certain harmonic ideas, Galileo joined him as his assistant. It seems safe to say that Galileo, who gets credit for being the father of experimental physics, may have learned the rudiments and the value of experimentation from his own father’s efforts.

Galileo’s Daughter, Dava Sobel, 2001.

One-way causal relationships in learning are difficult to determine. The quotation above suggests Galileo received a significant part of his education in an interdisciplinary learning environment richly supported by concepts and learning processes shared among math, physics, and music. However, in this case, it seems no less true to assert that Galileo’s instrumental lessons enhanced his understanding of math or physics than to assume that Galileo’s interest in his father’s scientific experiments improved his musical skill. As is often the case with interdisciplinary learning, conclusions concerning the determination and direction of cause and effect remain problematic.

In addition to the tension between the “essentialist” and “instrumental” points of view mentioned earlier, there exists another tension among researchers who report the undeniable presence of positive associations between learning in music and other disciplines, yet who disagree on the interpretation of these data. The tension arises principally between (a) those who accept strong associations between musical training and academic achievement as evidence sufficient for advancing the conclusion that music enhances learning in other subject areas and (b) those who insist that conclusions about the effect of music on learning in other subjects be drawn only to experimental studies that adhere strictly to standards of “one-way, cause-and-effect” models of analysis. However, in consideration of the research reviewed here, it may be useful to adopt a middle-ground approach: to analyze data from the point of view of “two-way interaction” models of learning across disciplines.

Given the complexity of public school learning environments, many teachers, administrators, and researchers

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feel it may not be productive to prove that any one form of intervention causes learning in another subject. The “two-way interactionist” position is that improvement in learning in either of two disciplines—taught separately or together—suggests that one discipline catalyzes, reinforces, and deepens learning in the other. Thus, academic performance is just as likely to benefit from strong instruction in music, as music is likely to benefit from strong

instruction in the academics. Hence it is no longer necessary to position the canons of “one-way proof of causality” against the conclusion that significant, positive correlations between high-quality musical training and math/language achievement reported in every meta-analysis included in this Compendium constitute evidence sufficient to support the integration of music into the core curriculum in public education.

Theme 4: The use of music as a tool for social-emotional development and behavior modification in schools.

Studies on the effects of music as reinforcement for education and behavioral objectives investigate the use of music listening and music making in academic classrooms. In addition to isolated studies that simply document the effect of different kinds of background music for students responding to writing assignments (Kariuki & Honeycutt 1998, Hallam 1999), a meta-analysis of a wide range of studies suggests that the use of “contingent music” strategies can provide overwhelming positive reinforcement value for behavior in classrooms, on school buses, and in math and reading achievement tests (Standley 1996). Reports from studies that use contingency-based music programs provide strategies for optimizing classroom management and student motivation while showing no negative effects—and several striking indications of positive effects—on students’ academic perfor-

mance and motivation. Perhaps most important to classroom teachers, research demonstrates that contingency plans for music listening and music making can be adapted creatively to any classroom and that they are applicable across a wide variety of musical, academic, and behavioral objectives.

Studies of emotionally disturbed children provide in-depth views of employing music performance and music listening strategies to improve self-efficacy (concept of self-capacity) in at-risk youth (Kennedy 1998, Kariuki & Honeycutt 1998). Improvements in self-efficacy through music rely on critical thinking and not on optimal therapeutic conditions alone. Descriptive data from this research show how musical performance enables patients to acquire social competencies while coping more effectively with this environment. The performance tasks and supporting cognitive strategies outlined in this research should be studied carefully by music educators—not only because they are sequenced skillfully but also because they show how self-efficacy of any music student would be improved by cognitive strategies that limit negative self-evaluative judgment and provide stimulus for creative work in other disciplines (Kariuki & Honeycutt 1998).

Conclusions and Implications

“If the arts help define our path to the future, they need to become curriculum partners with other subject disciplines in ways that will allow them to contribute their own distinctive richness and complexity to the learning process as a whole.”

Burton, J., Horowitz, R., and Abeles, H.
“Learning In and Through the Arts: Curriculum Implications,”
in *Champions of Change*, 1999.

The uncertainty of music’s place in education is not due to a lack of research that supports the value of learning in and through music. Research now offers a theoretical basis for, and growing evidence of, the significant effects of learning shared between music and other measures of academic achievement. As a result, music and classroom educators now can embrace learning transfer as a desirable product of interactions between learning in music and academic subjects. From this perspective, fundamental concepts indigenous both to music and math classrooms can become the cornerstone of the music-infused interdisciplinary curriculum. Although music always will exist for its own sake, its unique literature, its particular social and career paths, and as a source of human enjoyment and emotional release—now, bolstered by its value for interdisciplinary learning supported in this research, music can achieve a core status in public education imagined long ago by the ancient Greeks.

Future directions for research in the field of music in education distilled from this Compendium are as follows:

- **Consider levels of musical understanding and skill in cross-disciplinary studies.**

Virtually all research to date concentrates on the effects of music on other areas of learning and uses *exposure* to musical instruction or listening as an agent to effect change. The validity and practical significance of future research will depend on developing ways to include musical ability factors into research methods so that music educators can assess whether the degree of musical skill makes any critical difference in the level of mathematical or language arts achievement.

- **Develop and validate two-way measures of cross-disciplinary learning effects.**

New statistical methods need to be developed and refined to test the statistical significance of two-way interactive models of interdisciplinary learning that do not take place in a one-way causal, linear fashion.

- **Determine and examine optimal conditions for cross-disciplinary effects of learning in and through music.**

Research will benefit from more attention to what constitutes optimal conditions for interdisciplinary instruction, learning, and assessment. Controlling for the quality and comprehensiveness of music teaching and the evaluation of student learning will account for the theoretical as well as practical validity of research in the years to come.

- **Research in music and education should not exist in isolation from studying music’s effect on social-emotional development, behavioral modification, or reinforcement of therapeutic objectives.**

The inclusion of music as a tool for solving social-emotional and behavioral issues that exist at all levels of public education should be addressed by future research. Teachers will not be able fully to understand music’s impact on education without knowing how learning in and through music serves as a window onto the interactions among social-emotional issues, behavior modification, and the ability to learn.

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References

The research reviewed here is organized into four primary points of focus:

I. Music and Language Skills

Butzlaff, R., "Can Music Be Used to Teach Reading?" (*meta-analysis*)

Andrews, L., "Effects of an Integrated Reading and Music Instructional Approach on Fifth-Grade Students' Reading Achievement, Reading Attitude, Music Achievement, and Music Attitude."

Hallam, S., "The Effects of Background Music on Studying."

Lowe, A., "The Effect of the Incorporation of Music Learning into the Second-Language Classroom on the Mutual Reinforcement of Music and Language."

II. Music, Math, and Spatial Reasoning

Graziano, A., Peterson, M., & Shaw, G., "Enhanced Learning of Proportional Math through Music Training and Spatial-Temporal Training."

Hetland, L., "Listening to Music Enhances Spatial-Temporal Reasoning: Evidence for the 'Mozart Effect.'" (*meta-analysis*)

Hetland, L., "Learning to Make Music Enhances Spatial Reasoning." (*meta-analysis*)

Rauscher, F., Shaw G., Levine, L., Wright, Dennis, W., & Newcomb, R., "Music Training Causes Long-term Enhancement of Preschool Children's Spatial-Temporal Reasoning."

Rauscher, F. & Zupan, M., "Classroom Keyboard Instruction Improves Kindergarten Children's Spatial-Temporal Performance: A Field Experiment."

Vaughn, K., "Music and Mathematics: Modest Support for the Oft-Claimed Relationship." (*meta-analysis*)

III. Music and General Cognitive Development

Bilharz, T., Bruhn, R., & Olson, J., "The Effect of Early Music Training on Child Cognitive Development."

Costa-Giomi, E., "The Effects of Three Years of Piano Instruction on Children's Cognitive Development."

IV. Music, Therapeutic, Social/Emotional, and Behavioral Objectives

Kariuki, P. & Honeycutt, C., "An Investigation of the Effects of Music on Two Emotionally Disturbed Students' Writing Motivations and Writing Skills."

Kennedy, J., "The Effects of Musical Performance, Rational Emotive Therapy and Vicarious Experience on the Self-Efficacy and Self-Esteem of Juvenile Delinquents and Disadvantaged Children."

Standley, J., "A Meta-Analysis of the Effects of Music as Reinforcement for Educational/Therapy Objectives." (*meta-analysis*)