

## Music and Cognitive Achievement in Children

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Music is widely believed to have many benefits for children beyond those within the realm of music itself. These benefits are thought to contribute importantly to development by improving intellectual, motor, and social abilities and skills. This article reviews part of this topic, specifically the relationship between music education and cognitive achievement.

A scan of the research literature suggests the variable pursuit of this problem over the years, rather than a systematically enlarging body of research. With this in mind, let us consider studies that pertain to the single reason for music education that has exhibited continual and substantial increased emphasis in the modern period i.e., the view that music promotes cognitive development and abstract thought (see Matters of Opinion). Within this realm, we include topics such as reading, the mental rotation of representations of objects, and creative thinking. These tap into three of the many aspects of intelligence.

We begin with an older study on music and reading, published by Hurwitz, Wolff, Bortnick and Kokas in 1975 (1). The authors asked whether music training improved reading performance in first grade children. The experimental group received Kodaly training, which uses folk songs and emphasizes melodic and rhythmic elements. The control group consisted of children who were matched in age, IQ and socioeconomic status at the beginning of the study and who received no special treatment. The music instruction was extensive, five days a week for 40 minutes per day, for seven months. Students were tested on reading ability at the start of the school year and then tested again at the end of the year. After training the music group exhibited significantly higher reading scores than did the control group, scoring in the 88th percentile vs. the 72nd percentile. Incidentally, the benefits for the music group were not due to better teaching of reading because students who had the same teacher before, during and after music training showed greatly improved reading performance. Moreover, continued music training was beneficial; after an additional year of Kodaly training, the experimental group was still superior to the control group. These findings clearly support the view that music education facilitates the ability to read.

Although these results are impressive, both in terms of the use of control subjects and because the findings can be interpreted as a cause-effect relationship between music and reading, two questions immediately come to mind. First, was the enhancement of reading ability caused by music itself or simply by having a more varied school program, which happened to consist of music education. After all, the control group was left alone; had they been given some other special non-musical experiences, would they have improved as much as the music group? Second, how could music training possibly improve reading; the music group did not learn to read music but rather to listen, and recognize musical ideas, etc. We will consider both of these questions; an answer to the second will prove relevant to the first.

To understand how music education might benefit reading, we need a brief review of how children usually learn to read after they can understand a language. According to Frith (2) there are three stages: [1] visually recognizing words, [2] learning the correspondences between visual parts of words ("graphemes") and their spoken sounds ("phonemes"), and then [3] achieving visual recognition of words without going through the earlier stages. It is the critical second or "phonemic" stage that is of interest here. We are all familiar with children "sounding-out" syllables and words while they are learning to read (stage 2) which they discard when they reach stage 3. It seems that music facilitates reading by improving the second, phonemic stage.

The evidence comes from a recent study by Lamb and Gregory (3) who determined the relationship between musical sound discrimination and reading ability in first grade children. In addition to some standard reading tests, children were tested on their ability to "sound out" nonsense syllables that they viewed on cards (phonic reading) and pitch awareness, in which they heard pairs of musical notes or chords in sequence and reported whether they sounded the same or different. Also, the children were tested with notes that had the same or different timbres. Finally, their phonemic awareness was assessed by listening to spoken words and telling whether the words began or ended with the same sound. The experimenters then determined the relationships, between performance scores on the various tests. They found a high degree of correlation between how well children could read both standard and phonic material and how well they could discriminate pitch. Timbre awareness was not related to reading, showing the specificity of the findings.

What does all of this mean? The findings support the conclusion that good pitch discrimination benefits learning to read by enhancing the second, phonemic stage of learning. Pitch change of verbal word components (formants) is thought to be the most important factor in conveying word information (4). The relationship to music education is straightforward, because such training invariably involves improvement in pitch discrimination. Therefore, the findings of Hurwitz et al that music training facilitates learning to read can be understood as being mediated by enhanced pitch discrimination. That timbre awareness is unrelated to reading suggests that the benefits to reading are not due to the increased richness of the educational experience but rather to some highly specific aspect of music education, i.e., pitch training. One might point out that the Lamb and Gregory study is correlational not causal because no music training was involved, only measures of various abilities. That is quite true. Any causal conclusions have to be based on other previous causal findings, such as the fact that learning to read requires the second phonemic stage. It seems unlikely that high scores on pitch discrimination were caused by good reading abilities, since the latter depend upon more basic processes such as the former. No doubt, further studies are needed. But the findings of both studies dovetail nicely and together provide evidence that music education facilitates reading and a mechanism by which music exerts its beneficial effect.

We next consider the effects of training with music on learning and creativity. Mohanty and Hejmadi (5) investigated the effects of various types of training of four and five year olds on learning the names of their body parts and on creativity as assessed by the Torrence Test of Creative Thinking, involving picture construction and picture

completion. There were four matched groups: non-training control, verbal instruction in the names and uses of body parts, verbal instructions plus acting out movements, and the music/dance group in which instructions were given by song and acting out movements was done in the form of a dance. After twenty days of training, all experimental groups exhibited higher test scores than the control group. The music/dance group showed the greatest improvement in both learning about body parts and tests of creativity. Thus, improvement in cognitive abilities can result from a variety of training experiences but music is the most effective of these treatments. The means by which music, and the other training, produces improvement in the cognitive abilities studied remains to be determined.

Lastly, we turn to recent research on musical training and the abstract cognitive ability to mentally rotate objects, a means of assessing spatial abilities. Rauscher, Shaw, Levine, Ky and Wright (6) studied preschool children who received daily group singing lessons and weekly keyboard instruction. A matched control group received no special experiences. All children were tested using subtests of a standard intelligence test, one of which was a spatial task. After four months, the music group was superior to the control group on the test of spatial abilities but not on other tests of intelligence. Improvement was even greater eight months after the start of music training. The authors believe that this high degree of specificity in the improvement only of spatial abilities indicates that improvement was not due simply to the extra attention and enriched experiences of the experimental group, but rather specifically due to the fact that the experiences were musical in nature.

In summary, we have reviewed several studies that support the conclusion that musical training facilitates cognitive skills, including reading, abstract spatial abilities and creativity. In each case, there is an *extramusical* positive effect. Thus, it appears that music studied for good and sufficient reasons for its own sake (see the first two items in the list at the beginning of this article) has beneficial "side effects" on cognition. An examination of the extent to which music may or may not have such side effects on the other *extramusical* aspects of child development and behavior is a topic that will have to be left for succeeding issues.

#### Footnotes

(1) Hurwitz, I., Wolff, P.H., Bortnick, B.D., & Kokas, K. (1975). Nonmusical effects of the Kodaly music curriculum in primary grade children. *Journal of Learning Disabilities*, 8, 45-51.

(2) Frith, U. (1985) Beneath the surface of developmental dyslexia, In: K.E. Patterson, J.C. Marshall & M. Coltheart (Eds) *Surface Dyslexia* Hove, Lawrence Erlbaum Associate Ltd, pp. 301-330.

(3) Lamb, S.J., & Gregory, A.H. (1993). The relationship between music and reading in beginning readers. *Educational Psychology*, 13, 19-26.

(4) Lieberman, A.M., Cooper, F.S., Shankweiler, D.P., & Studdert-Kennedy, M. (1967). Perception of the speech code. *Psychological Review*, 74, 431-461.

(5) Mohanty, B. & Hejmadi, A. (1992.). Effects of intervention training on some cognitive abilities of preschool children. *Psychological Studies*, 37, 31-37.

(6) Rauscher, F.H., Shaw,G.L. Levine,L.J., Ky, K.N & Wright, E.L. Paper presented at the annual meeting of the *American Psychological Society*, Los Angeles, CA., August 13, 1994.

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<http://www.musica.uci.edu/mrn/V1I2F94.html#cognitive>