Associations Between Length of Music Training and Reading Skills in Children

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2 authors:

Kathleen Ann Corrigall
MacEwan University

Laurel Trainor
McMaster University

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Kathleen A. Corrigall and Laurel J. Trainor
McMaster University, Hamilton, Ontario, Canada

Previous research has found that music training in childhood is associated with word decoding, a fundamental reading skill related to the ability to pronounce individual words. These findings have typically been explained by a near transfer mechanism because music lessons train auditory abilities associated with those needed for decoding words. Nevertheless, few studies have examined whether music training is associated with higher-level reading abilities such as reading comprehension, which would suggest far transfer. We tested whether the length of time children took music lessons was associated with word decoding and reading comprehension skills in 6- to 9-year-old normal-achieving readers. Our results revealed that length of music training was not associated with word decoding skills; however, length of music training predicted reading comprehension performance even after controlling for age, socioeconomic status, auditory perception, full-scale IQ, the number of hours that children spent reading per week, and word decoding skills. We suggest that if near transfer occurs, it is likely strongest in beginning readers or those experiencing reading difficulty. The strong association in our data—between length of music training and reading comprehension—is consistent with mechanisms involving far transfer.

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Key words: music training, word decoding, reading comprehension, near transfer, far transfer

Learning to sing or play a musical instrument is a complex task that involves long-term training of a large number of diverse skills. For example, in the auditory domain, children must learn to focus on and discriminate subtle differences in pitch, rhythm, loudness, and timbre, in the context of learning to differentiate between and remember complex auditory patterns. In the motor domain, they must learn how to control their vocal chords, arms, hands, and/or fingers. Furthermore, they must integrate between auditory and motor domains so that they can monitor how different motor responses, such as fingering patterns, produce different auditory outcomes. Reading musical notation involves learning to map visual symbols onto specific motor responses that produce specific sounds, and these transformations need to be accomplished in real time such that the tempo of the music produced remains steady. Children must learn to use meta-cognitive strategies while playing so that they can monitor the sounds that they are producing, recognize when errors have been made, and correct those errors in subsequent practice. Music making also involves learning to play with other musicians, which requires additional attention to the sounds that others are producing, and adjusting one's own playing to fit with the group. Learning to produce music has the added complexity that it involves learning to express emotion through sound and to understand and appreciate compositions from diverse composers, time periods, and styles. Finally, playing a musical instrument requires high levels of concentration for long periods of time, as well as motivation and dedication to practice new skills.

Because music training appears to involve such a wide range of skills, it is not surprising that it has been associated with widespread perceptual, cognitive, and educational benefits (e.g., Corrigall & Trainor, 2009; Drake, Jones, & Baruch, 2000; Fujioka, Ross, Kakigi, Pantev, & Trainor, 2006; Moreno et al., 2009; Schellenberg, 2004, 2006; Shahin, Roberts, & Trainor, 2004; Shahin, Roberts, Chau, Trainor, & Miller, 2008). Researchers have proposed that music training might benefit skills in various domains through either a near transfer or a far transfer mechanism. Near transfer occurs when training in one skill leads to improvements in a highly associated skill, such as when music training affects auditory skills associated with both music and language. For example, music training has been shown to accelerate the development of harmony perception in 4- and 5-year-olds (Corrigall & Trainor, 2009), to cause faster maturation in brain responses to auditory stimuli (Fujioka et al.,

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2006; Shahin et al., 2004; Shahin et al., 2008), and increase sensitivity to linguistic pitch processing (Moreno et al., 2009). Musically trained children and adults are also better than nonmusicians at tapping back a heard rhythm (Drake et al., 2000), which suggests that music training improves rhythmic skills. Because learning to play a musical instrument clearly trains auditory perception, it is not surprising that music training is associated with skills that depend heavily on auditory processing abilities.

In contrast, far transfer occurs when training in one skill leads to improvements in seemingly unrelated skills. The association between music lessons and general intelligence has been considered the best example of far transfer resulting from music training, because the association between music training and general intelligence is stronger than the associations between music training and any of the subcomponents of general intelligence, such as verbal intelligence or spatial-temporal abilities (e.g., Schellenberg, 2006). The mechanisms supporting far transfer are difficult to explain, however, and attempts at identifying how music training affects general intelligence have thus far failed. For example, Schellenberg (2011) has reported that executive functions, among the most promising candidate mechanisms to support transfer between music training and intelligence, cannot explain their association. Although the mechanisms are not entirely understood, the research suggests that the benefits of music training are multifaceted, involving both near and far transfer, and likely reflect the complex array of skills that are learned with extensive training.

The evidence for an association between music training or musical skills and reading skills is mixed, but such associations are typically explained with near transfer theories. Reading ability has almost always been measured by assessing how well children can sound out or pronounce individual words (word decoding), rather than by assessing how well children understand what they are reading (reading comprehension). Word decoding has been shown to be strongly associated with auditory skills (Ahissar, Protopapas, Reid, & Merzenich, 2000); phonological awareness, or the understanding that words are made up of individual sounds or phonemes, is a very important precursor to early reading (e.g., Bradley & Bryant, 1983). Thus, it makes sense that music ability or music training could influence word decoding. In contrast, reading comprehension requires basic word decoding skills as well as higher-level cognitive processes such as memory and attention (e.g., Cain, Oakhill, & Bryant, 2004; Sesma, Mahone, Levine, Eason, & Cutting, 2009). The question of whether music and reading are related has typically been asked in one of two ways: 1) at a local level, by determining whether very specific musical skills, such as pitch or rhythm discrimination, are related to reading performance, both in normal-achieving and dyslexic readers (Anvari, Trainor, Woodside, & Levy, 2002; Atterbury, 1985; Barwick, Valentine, West, & Wilding, 1989; Douglas & Willatts, 1994; Forgeard, Schlaug, Norton, Rosam, & Iyengar, 2008; Huss, Verney, Fosker, Mead, & Goswami, 2011; Lamb & Gregory, 1993; Overy, 2000, 2003; Overy, Nicolson, Fawcett, & Clarke, 2003); and 2) at a global level, by assessing whether different music training programs improve reading skills or are associated with higher reading skills, typically in dyslexic readers but sometimes in normal-achieving readers as well (Butzlaff, 2000; Douglas & Willatts, 1994; Forgeard et al., 2008; Gromko, 2005; Moreno et al., 2009; Overy, 2003; Schellenberg, 2006; Standley, 2008).

The evidence that auditory perception is associated with reading skill is fairly strong, although which aspects of auditory perception are most important is unclear. In a large study of 50 4-year-olds and 50 5-year-olds, Anvari et al. (2002) found that both rhythm and pitch perception skills predicted early reading performance in 4-year-olds, even after accounting for variance due to phonological awareness. However, only pitch perception skills predicted early reading performance in 5-year-olds after accounting for phonological awareness. Pitch perception has also been found to be associated with reading ability in 5-year-olds after controlling for nonverbal ability (e.g., Lamb & Gregory, 1993), and in 7- to 10-year-old reading disabled children after controlling for general intelligence (Barwick et al., 1989).

By contrast, other studies have suggested that temporal processing is more highly associated with reading skills, and the evidence is especially strong for poor or dyslexic readers. For example, Tallal, Miller, and Fitch (1993) proposed that at the core, dyslexics are impaired at rapid temporal processing. More recently, Goswami and colleagues have shown that dyslexics perform more poorly than normal-achieving readers on tasks involving musical metrical structure (Huss et al., 2011). Similarly, Overy found that dyslexic children and those at high risk for developing dyslexia have impaired rhythmic processing skills—especially for rhythm production—but normal pitch processing skills (Overy, 2000, 2003; Overy et al., 2003).

In a large study with 78 8-year-olds, Douglas and Willatts (1994) found that rhythm processing but not pitch processing correlated with reading and spelling abilities after accounting for vocabulary scores in normal-achieving readers. However, other studies have found that both pitch and rhythm skills are associated with reading ability (e.g., Atterbury, 1985; Forgeard et al., 2008). Thus, although there is a strong link between music perception and reading skills, the precise nature of the association remains unclear. The discrepant findings are likely a result of the different types of pitch and rhythm tasks used, the ages of the children being studied, and whether the participants were dyslexic or normal-achieving readers.

Because musical skills are associated with reading skills, it is reasonable to ask whether music training improves reading skills. Several explanations for such potential transfer have been proposed, in addition to the aforementioned explanation that music training leads to increased auditory sensitivity. For example, it has been suggested that learning to read musical notation involves many of the same processes as learning to read words, such as understanding that written notation proceeds from left to right, recognizing visual patterns, and understanding that visual symbols map on to particular sounds (e.g., Butzlaff, 2000; Forgeard et al., 2008). Furthermore, singing might be somewhat special in that it involves reading predictable text, segmenting words into syllables so that lyrics can be matched to the music (Forgeard et al., 2008), and recognizing patterns (Butzlaff, 2000). Finally, it has also been suggested that music training teaches children motivational and concentration skills that help them focus for long periods of time, thus potentially helping them to persevere at mastering reading (Butzlaff, 2000).

The evidence for benefits to reading skills following music training is mixed, however. Butzlaff (2000) conducted a meta-analysis of 24 correlational studies and 6 experimental studies testing for an association between music training and reading. The correlational studies showed that music training is strongly associated with better reading scores. The experimental studies, however, showed no causal effects of music training on reading. Because the 6 studies included in the analysis used different types of music training—from instrumental instruction, to singing songs, to music therapy—and because the reading tests varied from measures of prereading ability (e.g., phonological awareness, letter identification), to word decoding, to reading comprehension, it is perhaps not surprising that the results were not significant.

Standley (2008) later conducted a larger meta-analysis on 30 experimental studies that examined the effect of music intervention on prereading and word decoding skill and found a strong overall effect. However, many of the music training programs employed by these studies were specifically designed to train reading skills and thus were not representative of typical instrumental or singing lessons. Some research has found that group training that involves singing and the use of percussive instruments (but no specific musical activities directed at reading skills) improves word decoding skills (e.g., Douglas & Willatts, 1994; Moreno et al., 2009), but other research has shown improvements in phonological awareness following group training but no improvements in word decoding skills (e.g., Gromko, 2005; Overy, 2003). Again, the discrepancy likely arises from the length and type of music training employed, as well as the ages and reading levels of the children being studied. It is possible that music training initially improves phonological awareness skills, especially in very young children who are just beginning to read, whereas the effects of longer training extend to word decoding skills, especially in children who are becoming more fluent at reading.

Although the evidence is somewhat mixed, there appears to be an association between music skill or music training and word decoding skills. However, few studies have examined the association between music training and reading comprehension, especially in children. This is understandable because the focus of research has been on near transfer between auditory perception and word decoding skills, rather than on far transfer between what is likely a complex array of skills acquired through music training and higher level processes such as reading comprehension. However, some evidence exists for far transfer between music training and reading. For example, Schellenberg (2006) found that length of music training predicted academic achievement, measured both by a standardized academic achievement test as well as by average letter grade achieved in school, even after controlling for variance due to general intelligence. In his study, the standardized academic achievement test and school average both included assessments of reading ability, which raises the possibility of far transfer.

We sought to examine the association between length of music training and reading ability in 6- to 9-year-old children enrolled in music lessons. We used a correlational design in which we examined the relation between number of years of music lessons and reading skills. The fact that all children were studying music, but for varying lengths of time, reduced self-selection issues and the need for an appropriate control group for several reasons. First, children who take music lessons are likely to be more similar to each other on a number of important variables than they are to children not taking music lessons. For example, children who come from families of higher socioeconomic status and who are more intelligent are more likely to take music lessons than others (Sergeant & Thatcher, 1974). Furthermore, in musically trained children aged 6 to 9 years, factors such as socioeconomic status and intelligence are not necessarily the most important determinants of length of music training. For example, age at the time of testing is one of the most significant determinants of length of training, with older children having more training than younger children. Pre-existing differences are likely to be much greater between children who take lessons and those who do not, compared to children who have more versus less training. In any case, we were able to statistically test and control for several variables that may influence length of music training, including age, socioeconomic status, age of onset of music training, and the number of instruments that children played. Finally, because music lessons involve practice with such a wide array of skills, it is difficult to determine an appropriate control group (e.g., sports training, art lessons, chess lessons) in a group design. For these reasons, we chose a correlational design. Two subtests from a standardized reading test were administered to children to measure their word decoding skills and reading comprehension. In addition, pitch and rhythm discrimination as well as full-scale IQ were measured to investigate whether auditory processing and general intelligence could explain any potential links between length of music training and reading ability. If near transfer occurred between music lessons and reading, we would expect simple and partial correlations between length of music training and word decoding. If far transfer occurred, we would expect simple and partial correlations between length of music training and reading comprehension.

Method

Participants

Forty-six children (35 girls, 11 boys), ranging in age from 6.1 years to 9.0 years (M = 7.6 years, SD = 0.9 years) participated in the study. An additional seven children were tested but excluded from final analysis for the following reasons: missing socioeconomic data on the parental questionnaire (n = 1), performance that fell below 3 standard deviations of the mean on the auditory perception task (n = 1), and overall reading scores that fell below 2 standard deviations from the mean (n = 5; parental report indicated that 4 out of 5 of these children were learning to read primarily in French). All children participated in music lessons, and some children played more than one instrument. We recorded the number of instruments that children learned and the age at which they first began music lessons. Length of music training for each child was calculated as the number of years of training on their primary instrument, plus the number of years of training on any additional instruments. Using these methods, children's length of music training ranged from 0.1 years to 6.2 years (M = 2.6 years; SD = 1.7 years).

Stimuli

1. *Parental Questionnaire.* Parents filled out a questionnaire on their child's demographics, basic health, formal and informal music experience (through which we obtained information about each child's length of music training, number of instruments, and age of onset of music training), and other extracurricular activities, including an estimation of the number of hours the child spent reading per week. We estimated the child's degree of involvement in formal nonmusical extracurricular activities by adding together years of involvement in arts lessons (art, dance, drama) and sports. Parents also indicated the highest level of education achieved by the mother and father and we numerically coded their responses in the following way: high school or less = 1, some college = 2, bachelor degree = 3, masters or professional degree = 4, Ph.D. = 5. Maternal and paternal education levels were then averaged together to provide an estimate of socioeconomic status.
2. *Standardized Auditory Perception Test.* Children completed both the tonal and the rhythm subtests of the Intermediate Measures of Music Audiation (IMMA; Gordon, 1986). Each subtest had two example trials, two practice trials, and 40 experimental trials. On each trial, children heard two sequences, half of which were the same, and half of which differed in pitch on one or more notes (on the tonal subtest) or in rhythm (on the rhythm subtest). Children circled on a response sheet whether the two sequences sounded the same or different. Each child's percentile score for each subtest was obtained according to his or her grade in school.
3. *Standardized Intelligence Test.* Children completed the Wechsler Intelligence Scale for Children—Fourth Edition (WISC-IV; Wechsler, 2003). All 10 core subtests were administered to calculate full-scale IQ scores, which were standardized according to age using Canadian norms (Wechsler, 2004).
4. *Standardized Reading Test.* Children completed the Word Identification and Passage Comprehension subtests of the Woodcock Reading Mastery Test–Revised (WRMT-R; Woodcock, 1987). On the Word Identification subtest, children read single words aloud to measure word decoding ability. On the Passage Comprehension subtest, children identified a missing word in the context of a sentence or short paragraph to measure their reading comprehension skills. Raw scores on each of these subtests were standardized according to age using updated norms (Woodcock, 1998).

Procedure

The measures described above were part of a larger test battery that children completed over two sessions, each lasting approximately 1.5 hours. During one session, they completed the WISC-IV, and during the other session, they completed the remaining tasks, including several attention tasks that are not described here. The order of the two sessions was counterbalanced across children. The subtests of the WISC-IV were always administered in the same order, according to the manual (Wechsler, 2003). The rest of the tasks were administered in a fixed order: tonal subtest of the IMMA, rhythm subtest of the IMMA, Word Identification subtest of the WRMT-R, and Passage Comprehension subtest of the WRMT-R; however, there were intervening attention tasks between each of these. Children received stickers and a book or toy as appreciation for participating.

Results

Preliminary Analyses

Descriptive statistics for reading scores (word decoding, reading comprehension), auditory perception scores (tonal perception, rhythm perception), full-scale IQ, hours spent reading per week, age of onset of music training, and length of music training are reported in Table 1. Means were significantly higher than published norms for all standardized measures (reading scores, auditory perception scores, full-scale IQ). Two children were missing parental questionnaire data on the number of hours that they spent reading per week; thus, all analyses involving this variable were limited to 44 subjects.

Preliminary analyses revealed that amount of involvement in nonmusical extracurricular activities was not significantly correlated with any other variables; thus, it was not included in any subsequent analyses. Table 2 shows simple correlations between all predictor variables used in subsequent regression analyses. As expected, parental education was significantly correlated with both reading scores and with full-scale IQ, and the reading scores correlated with each other as well as with full-scale IQ. Length of music training correlated significantly with age, tonal perception, reading comprehension, and the age of onset of music training, and the correlation between length of music training and full-scale IQ approached significance. Notably, length of training was not associated with word decoding scores. Age of onset of music training also correlated with a number of measures, including the two reading scores, parental education, and full-scale IQ. Because children who played multiple instruments also tended to be the ones with the most training, we examined whether the number of instruments that children played was associated with any other predictor variables. Number of instruments was not significantly associated with any of our variables except for length of music training, $r(44) = .43$, $p < .01$, which confirmed that formal musical experience summed across instruments was more important than the drive to play multiple instruments in our analyses.

TABLE 1. Descriptive Statistics.

Variable	*M*	*SD*
Word decoding	122.0*	8.8
Reading comprehension	115.9*	8.0
Tonal perception	73.5*	26.8
Rhythm perception	62.2*	23.1
Full-scale IQ	115.4*	10.9
Hours spent reading per week	6.0	3.8
Age of onset of music training	4.9	1.2
Length of music training	2.6	1.7

* Significantly higher than published norm ($p < .01$).

Regression Analyses

Because the correlation between length of music training and word decoding performance was not significant, we did not perform any further analyses on that aspect of the data. However, we did perform five regression analyses to investigate the association between length of music training and reading comprehension. In all analyses, we controlled for age and socioeconomic status (as estimated by parental education). Because of the small sample size, we also controlled separately for 1) tonal and rhythm perception, 2) word decoding skills, 3) full-scale IQ, 4) the number of hours children spent reading per week, and 5) the age at which children began music lessons.

Length of music training was robustly associated with reading comprehension. After accounting for age and socioeconomic status, partial correlations between length of music training and reading comprehension were significant after also accounting for tonal and rhythm perception, $pr(40) = .38$, $p < .05$, word decoding skills, $pr(41) = .38$, $p < .05$, full-scale IQ, $pr(41) = .31$, $p < .05$, and the number of hours children spent reading per week, $pr(39) = .36$, $p < .05$. The partial correlation between length of music training and reading comprehension approached significance after controlling for age, socioeconomic status, and the age at which children began music lessons, $pr(41) = .27$, $p < .10$.

TABLE 2. Correlation Data.

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. Word decoding	-	.62**	-.15	.34*	-.01	.20	.56**	.03	-.34*	.13
2. Reading comprehension		-	-.08	.34*	.15	.18	.50**	-.13	-.42**	.34*
3. Age			-	.06	.24	-.05	-.13	.35*	.13	.52**
4. Parental education				-	.09	.19	.39**	.10	-.36*	.22
5. Tonal percentile					-	.36*	.16	-.23	-.28†	.45**
6. Rhythm percentile						-	.33*	-.30*	-.23	.12
7. Full-scale IQ							-	-.16	-.44**	.27†
8. Hours spent reading per week								-	.25	.04
9. Age of onset of music training									-	-.65**
10. Length of music training										-

† $p < .10$ * $p < .05$ ** $p < .01$

Discussion

We examined the association between length of music training and two different aspects of reading ability—word decoding and reading comprehension—in 6- to 9-year-old normal-achieving readers. We found no evidence of an association between length of music training and word decoding skills; even the simple correlation between length of music training and word decoding performance was not significant. However, we found a very robust association between length of music training and reading comprehension. This association was evident even after first accounting for variance due to important factors such as age, socioeconomic status, auditory perception skills, word decoding skills, general intelligence, or the number of hours that children spent reading per week. Furthermore, we made a conservative decision to include only children who were enrolled in music lessons in order to reduce self-selection issues associated with formal music training. This decision likely led to smaller associations than we would have found otherwise. Thus, we found a very strong association between how long children had been taking music lessons, and how well they could understand what they were reading.

One issue that must be considered is whether children who enter music lessons at younger ages, and thus have been in music lessons for longer periods of time, might be more intelligent to begin with and therefore also better readers. This could potentially lead to an association between length of music training and reading comprehension simply because readings skills are highly correlated with full-scale IQ (see Table 2). However, there are several reasons why this explanation cannot fully account for our results. First, length of music training continued to predict reading comprehension scores even after accounting for variance due to age, socioeconomic status, and full-scale IQ, suggesting that the link between music training and reading comprehension skills does not hold only because children with longer training are smarter. Second, the association between length of music training and reading comprehension scores approached significance after first accounting for variance due to age, socioeconomic status, and the age at which children first began music lessons. Because our sample size was small, this association would likely reach significance with a larger sample size. The fact that length of training trended toward mattering over and above the age at which children first began lessons suggests that the effect of experience (length of training) may continue to explain some unique variance in reading comprehension scores. In other words, we found some evidence that brighter children start lessons earlier and also go on to become better readers, but that the amount of formal music experience also contributes to reading ability.

Based on past research (e.g., Butzlaff, 2000; Douglas & Willatts, 1994; Moreno et al., 2009; Standley, 2008) it is perhaps surprising that we did not find a correlation between length of music training and word decoding skills. However, some other studies have also failed to find a significant association between these measures (e.g., Butzlaff, 2000; Gromko, 2005; Overy, 2003). Although a number of factors might influence whether music training influences word decoding, previous research suggests that one of the most important factors is the age of the participants at the time of training and at the time of reading assessment. In a meta-analysis of 30 studies, Standley (2008) found that children who benefited most from musical interventions were in the prereading stage, and that the effect of music training on word decoding skills diminished at higher grade levels, reaching nonsignificant levels in junior-high school. Thus, the auditory training that children receive in music lessons is most likely to make a difference in their word decoding ability when they are still learning how to sound out words. In other words, after a time, most children become good at word decoding and music training no longer separates better from worse word decoders. Because the children in our sample were all in their elementary school years and none were poor readers, they may have been too advanced at reading to reveal an association between length of music training and word decoding skills. In support of this speculation, children in our sample performed on average 6 points higher on the standardized word decoding subtest than they did on the passage comprehension test, and they performed much higher than the average published norms on both tests, suggesting that they were already very good readers for their age.

Because we found an association between length of music training and reading comprehension, but not between length of music training and word decoding, our results appear to be more consistent with a far transfer than a near transfer hypothesis. It is possible, however, that the association between length of music training and reading comprehension was in part mediated through word decoding. If music training accelerated word decoding in the children at a younger age than we tested, this could have led to earlier and more proficient reading comprehension in children with a lot of music training. By the time we tested them, children with less music training might have caught up to those with more music training on word decoding, but still remained at a disadvantage on reading comprehension.

Alternatively, because length of music training continued to predict reading comprehension after accounting for age, socioeconomic status and, in one analysis auditory perception, and in another word decoding skills, it seems unlikely that a near transfer account can fully explain our results. Rather, it appears that the association between length of music training and reading comprehension skills extends beyond auditory sensitivity and even symbol-to-sound decoding, which implies that higher-level processes might better explain this link. This interpretation is further supported by our results showing that length of music training predicted reading comprehension even after accounting for the number of hours that children spent reading per week. In other words, it is not simply the case that children in our sample who took music lessons for longer durations also spent more time reading.

Our results are broadly in line with those of Schellenberg (2006), who found that in children, length of music training predicted academic achievement as measured both by a standardized academic achievement test as well as by children's average letter grade in school, even after controlling for general intelligence. This suggests that children who participate in music lessons for long periods of time also tend to be very good students, beyond what would be predicted by their IQ scores. Because these results are correlational, the direction of causation cannot be determined. It is of course possible, indeed quite likely, that children who are better readers, who are more intelligent, and who tend to work hard and persist on tasks (such as challenging themselves more on difficult reading passages) are more likely to take music lessons in the first place, to begin lessons at an earlier age, and to stay in music lessons longer compared to their less intelligent and less hardworking peers.

We suggest, however, that an equally plausible explanation for our results, as well as for Schellenberg's (2006) finding of a link between length of training and academic achievement more generally, is that music training teaches children self-discipline and attentional skills that help them concentrate for long periods of time. These accounts are not mutually exclusive: more intelligent and harder working children are probably more likely to take music lessons in the first place, but then those music lessons likely develop concentration and self-discipline skills even further. This bidirectional hypothesis remains a question for future research to address. While Schellenberg (2011) has shown that children in music lessons are no better at executive functions tasks than children not taking music lessons, other attention-related skills, such as the ability to sustain attention for long periods of time, should be examined in relation to music training. Perhaps music lessons help children to become efficient learners who are able to focus better and concentrate for longer periods of time, which ultimately leads to important educational benefits.

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Correspondence concerning this article should be addressed to Laurel J. Trainor, Department of Psychology, Neuroscience, & Behaviour, McMaster University, Hamilton, ON, Canada L8S 4K1. E-mail: LJT@mcmaster.ca

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