Article

International Society for Music Education
ISME
Established in 1953

International Journal of
Music Education
28(3) 269–289

DOI: 10.1177/0255761410370658
http://ijm.sagepub.com
SAGE

The power of music: Its impact on the intellectual, social and personal development of children and young people

Susan Hallam
Institute of Education, University of London, UK

Abstract

This paper reviews the empirical evidence relating to the effects of active engagement with music on the intellectual, social and personal development of children and young people. It draws on research using the most advanced technologies to study the brain, in addition to quantitative and qualitative psychological and educational studies. It explains how musical skills may transfer to other activities if the processes involved are similar. It explores the evidence relating to the impact of musical skills on language development, literacy, numeracy, measures of intelligence, general attainment, creativity, fine motor co-ordination, concentration, self-confidence, emotional sensitivity, social skills, team work, self-discipline, and relaxation. It suggests that the positive effects of engagement with music on personal and social development only occur if it is an enjoyable and rewarding experience. This has implications for the quality of the teaching.

Keywords

advocacy, education, intelligence, music, personal development, psychology, social skills

Recent advances in the study of the brain have enabled us to get a better understanding of the way that active engagement with music may influence other development. Although our knowledge of the way the brain works is still in its infancy some of the fundamental processes involved in learning have been established. The human brain contains approximately 100 billion neurons, each of which has considerable processing capacity. A considerable proportion of the 100 billion neurons are active simultaneously and information processing is undertaken largely through interactions between them, each having approximately 1000 connections with other neurons. When we learn there are changes in the growth of axons and dendrites and the number of synapses connecting neurons, a process known as synaptogenisis. When an event is important enough or is repeated sufficiently often synapses and neurons fire repeatedly indicating that this event is worth remembering (Fields, 2005). In this way changes in the efficacy of existing connections are made. As

Corresponding author:
Susan Hallam, Institute of Education, University of London, 20 Bedford Way, London, WC1H OAL, UK.
Email: S.Hallam@ioe.ac.uk

learning continues and particular activities are engaged with over time myelinization takes place. This involves an increase in the coating of the axon of each neuron which improves insulation and makes the established connections more efficient. Pruning also occurs, a process which reduces the number of synaptic connections, enabling fine-tuning of functioning. Through combinations of these processes, which occur over different time scales, the cerebral cortex self-organizes in response to external stimuli and our learning activities (Pantev, Engelien, Candia, & Elbert, 2003).

Extensive active engagement with music can induce cortical reorganization. This may produce functional changes in how the brain processes information. If this occurs early in development the alterations in brain development may become hard-wired and produce permanent changes in the way information is processed (e.g., Schlaug, Jancke, Huang, & Steinmetz, 1995a, 1995b). Permanent and substantial reorganization of brain functioning takes considerable time. Research on Western classical musicians has shown that long years of active engagement with particular musical activities are associated with an increase in neuronal representation specific for the processing of the tones of the musical scale, the largest cortical representations found in musicians playing instruments for the longest periods of time (Pantev et al., 2003). Changes are also specific to the particular musical learning undertaken (Munte, Nager, Beiss, Schroeder, & Erne, 2003). Processing of pitch in string players is characterized by longer surveillance and more frontally distributed event-related brain potentials attention. Drummers generate more complex memory traces of the temporal organization of musical sequences and conductors demonstrate greater surveillance of auditory space (Munte et al., 2003). Compared with non-musicians, string players have greater somatosensory representations of finger activity, the amount of increase depending on the age of starting to play (Pantev et al., 2003). Clearly, the brain develops in very specific ways in response to particular learning activities and the extent of change depends on the length of time engaged with learning. The extent of musical engagement and its nature will be a factor in the extent to which transfer can occur to other areas.

The ways in which we learn are also reflected in specific brain activity. When students (aged 13–15) were taught to judge symmetrically structured musical phrases as balanced or unbalanced using traditional instructions about the differences (including verbal explanations, visual aids, notation, verbal rules, playing of musical examples), or participating in musical experiences (singing, playing, improvising or performing examples from the musical literature), activity in different brain areas was observed (Altenmuller et al., 1997). This suggests that the tools and practices utilized to support the development of particular musical skills will have a direct influence on brain development and subsequently preferred approaches to undertaking musical tasks and the extent to which skills can transfer to other areas.

Taken together, the evidence suggests that the brain substrates of processing reflect the 'learning biography' of each individual (Altenmuller, 2003, p. 349). Individual learning biographies in turn reflect the available opportunities and influences within the prevailing culture. As we engage with different musical activities over long periods of time permanent changes occur in the brain. These changes reflect not only what we have learned but also how we have learned. They will also influence the extent to which our developed skills are able to transfer to other activities.

The transfer of learning from one domain to another depends on the similarities between the processes involved. Transfer between tasks is a function of the degree to which the tasks share cognitive processes. Transfer can be near or far and is stronger and more likely to occur if it is near. Salomon and Perkins (1989) refer to low and high road transfer. Low road transfer depends on automated skills and is relatively spontaneous and automatic, for instance, processing of music and language, using the same skills to read different pieces of music or text. High road transfer requires reflection and conscious processing, for instance, adopting similar skills in solving very different kinds of problems. Some musical skills are more likely to transfer than others, for instance, those

concerned with perceptual processing of sound (temporal, pitch, and rule governed grouping information), fine motor skills, emotional sensitivity, conceptions of relationships between written materials and sound (reading music and text), and memorization of extended information (music and text) (Norton et al., 2005; Schellenberg, 2003).

This aim of this paper is to consider what we currently know about the impact of active engagement with music on the intellectual, social and personal development of children and young people. The paper synthesizes research findings drawing tentative conclusions and makes suggestions for the direction of future research.

Perceptual and language skills

Music has long been argued to provide effective experiences for children to develop listening skills in mainstream schools (Hirt-Mannheimer, 1995; Wolf, 1992) and for children with learning difficulties (Humpal & Wolf, 2007). Research is now able to offer explanations of why this might occur together with supporting evidence.

Much learning occurs without our conscious awareness (Blakemore and Frith, 2000). For instance, when we listen to music or speech we process an enormous amount of information rapidly. The ease with which we do this depends on our prior musical and linguistic experiences and the culturally determined tonal scheme or language to which we have become accustomed (Dowling, 1993). This knowledge is implicit, learned through exposure to particular environments, and is applied automatically whenever we listen to music or speech. As we shall see, speech and music have some shared processing systems. Musical experiences which enhance processing can therefore impact on the perception of language which in turn impacts on reading.

There has long been speculation about the relationship between the processing of music and language. Similar mechanisms seem to be involved. Research with brain damaged patients suggests that there is some degree of brain specialism for music which emerges even in the absence of any explicit musical training (Bigand & Poulin-Carronnat, 2006). However, musical abilities and training sharpen the brain's early encoding of linguistic sound leading to superior coding. This may be one possible mechanism underlying the linguistic benefits of musical training (Patel & Iverson, 2007; Tallal & Gaab, 2006). Musical training has an impact on the cortical processing of linguistic pitch patterns (Magne, Schon, & Besson, 2006; Schön, Magne, & Besson, 2004). The influence of musical training on responses emerges quickly in 8-year-old children. With just eight weeks of training those participating in musical training differed from controls in their cortical event related potentials (ERPs) (Moreno & Besson, 2006). Flohr, Miller and deBeus (2000), in an experimental study with children aged 4–6, provided music training for 25 minutes for seven weeks for an experimental group and compared measured brain activity with controls. Those children who had received musical training produced EEG frequencies associated with increased cognitive processing.

Early studies found correlations between performance of first grade children on tests of phonemic and musical pitch awareness. The ability to perceive slight differences in phonemes appeared to depend on the ability to extract information about the frequencies of the speech sounds (Lamb & Gregory, 1993). There is now evidence that musical abilities predict unique variance in the ability to perceive and produce subtle phonetic contrasts in a second language (Slevc & Miyake, 2006) and in the reading abilities of children in their first language (Anvari, Trainor, Woodside, & Levy, 2002). Musical training enhances the ability to interpret affective speech rhythms (Thompson, Schellenberg, & Husain, 2004).

Speech makes extensive use of structural auditory patterns not based on pitch, but timbre-based differences between phonemes. Musical training seems to develop skills which may enhance perception of these patterns. Musacchia, Sams, Skoe, and Kraus (2007) found that playing a musical

instrument triggers changes in the brainstem as well as the cortex. Musicians had earlier brainstem responses to the onset of a syllable than non-musicians. Musicians playing since the age of five had quicker responses and increased activity of neurons in the brain to both music and speech sounds. The longer the musician had been playing the sharper the responses. The musicians had high-functioning peripheral auditory systems. This superior encoding of linguistic sounds may explain the linguistic benefits of musical abilities.

Peynircioglu, Durgunoglu and Uney-Kusefoglu (2002) working with preschool children found that those children with higher levels of musical aptitude had greater ability to manipulate speech sounds. This has been supported by studies of the way that the brain processes sound (Gaab et al., 2005). Musical training improves how the brain processes the spoken word. It improves the ability to distinguish between rapidly changing sounds. Those with musical training have superior brainstem encoding of linguistic pitch patterns. There is also a positive correlation between the quality of sensory encoding and the amount of musical training suggesting a role for musical experience rather than innate differences (Wong, Skoe, Russo, Dees, & Kraus, 2007). This is critical to developing phonological awareness which in turn contributes to learning to read successfully.

There is increasing evidence that active engagement with music can increase phonological skills. Anvari et al. (2002) working with 100 preschoolers found that musical skills correlated significantly with both phonological awareness and reading development. Schlaug, Norton, Overy and Winner (2005), in a longitudinal study of the effects of music training on brain development and cognition in young children aged 5–7, found that after one year the children learning to play an instrument (mainly the piano) compared to controls had improved auditory discrimination scores. Gromko (2005) studying kindergarten children participating in music instruction also showed that they had improved phonemic awareness. The children received four months of music instruction for 30 minutes once a week. The instruction included active music-making and kinaesthetic movements to emphasize steady beat, rhythm and pitch as well as the association of sounds with symbols. The children who received the music instruction showed significantly greater gains in phonemic awareness when compared to the control group. Learning to discriminate differences between tonal and rhythmic patterns and to associate their perceptions with visual symbols seems to have transferred to improved phonemic awareness.

Humans are able to recognize a pitch pattern transposed in frequency easily. The specialization in human brains for sensitivity to relative pitch may be related to its importance in spoken intonation. A listener needs to be able to hear the similarity of intonation patterns when spoken in different pitch registers, for instance, rising intonation at the end of a sentence in English may mean a question. Speech processing requires similar processing to melodic contour, which in turn is an important component of music perception (e.g., Dowling, Kwak, & Andrews, 1995) and is one of the first aspects of music to be discriminated by infants (Trehub, Bull, & Thorpe, 1984). Melodic contours may be processed by the same brain mechanisms as language (see Patel, 2009). Magne et al. (2006) compared 8-year-old children who had musical training with those who did not and found that the musicians outperformed non-musicians on music and language tests. The study also showed that in the neural basis of development of prosodic and melodic processing, pitch processing seemed to be earlier in music than in language, therefore Magne et al. (2006) concluded that there were positive effects of music lessons for linguistic abilities in children.

Overall, the evidence suggests that engagement with music plays a major role in developing perceptual processing systems which facilitate the encoding and identification of speech sounds and patterns: the earlier the exposure to active music participation and the greater the length of participation, the greater the impact. Transfer of these skills is automatic and contributes not only to language development but also to literacy.

Literacy

The role of music in facilitating language skills contributes to the development of reading skills. An early study where music instruction was specifically designed to develop auditory, visual and motor skills in 7–8-year-old students over a period of six months, found that the mean reading comprehension scores of the intervention group increased while those of the control group did not (Douglas & Willatts, 1994). Similarly, Gardiner, Fox, Knowles and Jeffrey (1996) provided children with seven months of Kodaly training alongside visual arts instruction. Their reading scores were compared with controls and were found to have shown greater improvement.

As we saw earlier, musical skills correlate significantly with phonological awareness. These have been found to be linked to early reading skills in a large sample of 4–5-year-old children (Anvari et al., 2002). Moderate relationships have also been found between tonal memory and reading age (Barwick, Valentine, West, & Wilding, 1989), although finding the main and subsidiary beats in a musical selection was not a significant predictor of reading in 3rd and 4th grade students (Chamberlain, 2003). Lu (1986) compared reading performance of first grade students who received Kodaly-Orff music instruction with others given traditional reading instruction and found no significant differences. Other studies have also found no difference (e.g., Bowles, 2003; Kemmerer, 2003; Montgomery, 1997). However, Butzlaff (2000) in a meta-analysis of 24 studies found a reliable relationship between musical instruction and standardized measures of reading ability. While overall, the research shows a positive impact of musical engagement on reading, differences may be explained by the kind of musical experiences with which the children were engaged and also their prior musical development. If language skills are well developed already, musical activity may need to focus on reading musical notation for transfer benefits to occur in relation to reading.

A recent study (Piro & Ortiz, 2009) focused on the way that learning the piano might impact on the development of vocabulary and verbal sequencing in second grade children. Forty-six children studied piano for three consecutive years as part of an intervention programme, 57 children did not. The music learning group had significantly better vocabulary and verbal sequencing scores. Interestingly, when the study began the music group had already been learning the piano for two years but with no differences in reading between their skills and those of the control group. The authors suggested that this may have been because it takes a long time for effects to be felt, the summer holidays prior to testing may have lowered scores, or perhaps the age of tuition is important. There may also have been changes in the nature of the tuition and the development of fluency in reading music which impacted on transfer.

Some studies have focused on children who are experiencing difficulties with reading. Nicholson (1972) studied students aged between six and eight categorized as slow learners. Those receiving music instruction had significantly higher reading readiness scores than students who received no music instruction. After training the music group exhibited significantly higher reading scores, scoring in the 88th percentile versus the 72nd percentile. After an additional year of musical training the reading scores of the experimental group were still superior to the control group's scores. Movsesian (1967) found similar results with students in grades 1, 2 and 3.

Rhythmic performance certainly seems to be an important factor in reading development. Atterbury (1985) found that reading-disabled children aged 7–9 could discriminate rhythm patterns as well as controls but were poorer in rhythm performance and tonal memory than normal-achieving readers. Long (2007) found that very brief training (10 minutes each week for six weeks) in stamping, clapping and chanting in time to a piece of music while following simple musical notation had a considerable impact on reading comprehension in children experiencing difficulties

in reading. There are also indications from a range of sources that rhythmic training may help children experiencing dyslexia (Thomson, 1993; Overy, 2000, 2003). Overy (2003) found that children with dyslexia have difficulty with rhythmic skills (not pitch) and that tuition focusing on rhythm had a positive effect on both phonological and spelling skills in addition to musical abilities.

One way in which music instruction may help reading in addition to those relating to more general perception, timing and language skills is that it increases verbal memory. Chan, Ho and Cheung (1998) showed that learning to play a musical instrument enhanced the ability to remember words. Adult musicians had enlarged left cranial temporal regions of the brain, the area involved in processing heard information. Those participants in the study with musical training could remember 17 per cent more verbal information that those without musical training. Ho, Cheung and Chan (2003) supported these findings in a study of 90 6–15-year-old-boys. Those with musical training had significantly better verbal learning and retention abilities. Further, the longer the duration of music training the better the verbal memory. A follow-up study concluded that the effect was causal. There were neuro-anatomical changes in the brains of children who were engaged in making music.

Much less attention has been paid to the influence of active engagement with music on writing than reading. An exception was a study where children from economically disadvantaged homes participated in instruction which focused on the concepts of print, singing activities and writing, The children in the experimental group showed enhanced print concepts and pre-writing skills (Standley & Hughes, 1997). Register (2001) replicated this work with a larger sample of 50 children. Results again showed significant gains for the music-enhanced instruction in writing skills and print awareness.

Numeracy

Historically, it has long been assumed that there is a strong connection between music and mathematics (Vaughn, 2000). Musicians playing from notation are constantly required to adopt quasi-mathematical processes to sub-divide beats and turn rhythmic notation into sound. However, this type of activity is related to specific aspects of mathematics, not all. Transfer is only likely to occur when the skills required are ‘near’. This is supported by a recent study which showed that children receiving instruction on rhythm instruments scored higher on part-whole maths problems than those receiving piano and singing instruction (Rauscher, LeMieux, & Hinton, submitted).

Research exploring the relationships between mathematics and active musical engagement has had mixed results. For instance, Geoghegan and Mitchelmore (1996) investigated the impact of a music programme on the mathematics achievement of preschool children. The group of children involved in musical activities scored higher on the mathematics achievement test than the control group, although home musical background may have been a confounding factor. Gardiner et al. (1996) researching the impact of an arts programme also found that participating children performed better in mathematics than those who did not, those participating the longest having the highest scores overall. A study using a national US database also found positive effects for engagement with music. Catterall, Chapleau and Iwanga (1999) using the NELS:88 data compared low socio-economic status students who exhibited high math proficiency in the 12th grade and found that 33 per cent were involved in instrumental music compared with 15 per cent who were not involved. Focusing on children learning to play an instrument, Haley (2001) found that those who had studied an instrument prior to 4th grade had higher scores in mathematics than those in other groups. However, Rafferty (2003) found no effect of the Music Spatial-Temporal Maths Program on the mathematics achievement of second graders. The contradictory outcomes of the research might be explained by the types of musical activities engaged in and the length of time spent on them.

Cheek and Smith (1999) examined whether the type of music training was related to mathematics achievement in the 8th grade. Those who had two or more years of private lessons had higher scores and those learning keyboard instruments had higher scores than those learning other instruments. Whitehead (2001) found that middle- and high-school students who were placed in high, moderate and no treatment groups for music instruction differed in mathematics gains, the high involvement children showing the greatest gains. Overall, the evidence suggests that active engagement with music can improve mathematical performance, but the nature of this relationship, the kinds of musical training needed to realize the effect, and the length of time required are not currently understood.

Intellectual development

One of the first studies to consider the role of music in children's intellectual development was undertaken by Hurwitz, Wolff, Bortnick and Kokas (1975). First-grade children were assigned to one of two groups. An experimental group received Kodaly music lessons for five days each week for seven months, a control group did not. At the end of the study, the experimental group scored significantly higher than the control group on three out of five sequencing tasks and four out of five spatial tasks. No statistically significant differences were found for verbal measures, although the children in the experimental group had higher reading achievement scores than those in the control group which were maintained after two academic years.

During the 1990s there was a resurgence of interest in these issues which had a particular focus on the impact of active engagement with music on spatial reasoning, an element of intelligence tests. In a typical study, Rauscher et al. (1997) assigned children from three pre-school groups to music, computer or no-instruction groups. The instruction groups received tuition in keyboard and group singing, group singing alone or computer lessons. Singing was for 30 minutes daily. The children in the keyboard group scored significantly higher in the spatial recognition test. Since then, several studies have confirmed that active engagement with music has an impact on visual-spatial intelligence (Bilhartz, Bruhn, & Olson, 2000; Costa-Giomi, 1999; Graziano, Peterson, & Shaw, 1999; Gromko & Poorman, 1998; Orsmond & Miller, 1999; Rauscher, 2002; Rauscher & Zupan, 2000). In a review of 15 studies Hetland (2000) found a 'strong and reliable' relationship and concluded that music instruction lasting two years or less leads to dramatic improvements in performance on spatial-temporal measures. She commented on the consistency of the effects and likened them to differences of one inch in height or about 84 points on the SAT (p. 221). The consistency of these findings suggests a near transfer, automated effect perhaps related to the skills acquired in learning to read music.

Other research has focused on more general manifestations of intelligence. Bilhartz et al. (2000) studied the relationship between participation in a structured music curriculum and cognitive development in 4–6-year-olds. Half of the children participated in a 30-week, 75-minute weekly parent-involved music curriculum. Following this, children were tested with six subtests of the Stanford-Binet intelligence test and the Young Child Music Skills Assessment test. There were significant gains for the music group on the music test and the Stanford-Binet Bead Memory subtest. Adopting a cross sectional approach Schlaug et al. compared 9–11-year-old instrumentalists with an average of four years training and controls. They showed that the instrumental group performed significantly better than the control group on musical audiation, left hand index finger tapping rate, and the vocabulary subtest of the WISC-III. Strong non-significant trends were seen in the phonemic awareness test, Raven's Progressive Matrices, and the Key Math test (Schlaug et al., 2005).

What has become a seminal study was undertaken by Schellenberg (2004) who randomly assigned a large sample of children to four different groups, two of which received music lessons (standard keyboard, Kodaly voice) for a year. The two control groups either received instruction in a non-musical artistic activity (drama) or no lessons. All four groups exhibited increases in IQ as would be expected over the time period but the music groups had reliably larger increases in full scale IQ with an effect size of .35. Children in the control groups had average increases of 4.3 points while the music groups had increases of 7 points. On all but two of the 12 subtests the music groups had larger increases than the control groups. Catterall and Rauscher (2008) argue that the gains seen in more general IQ are likely to be the result of specific gains in visual-spatial intelligence but there may also be effects related to enhanced development of language and literacy skills.

A key issue arising from this research is what kinds of musical activity bring about change in particular kinds of intellectual development and why. The research reported above has been based on the implementation of a variety of musical activities, some offering a broad musical education, others focused more closely on instrumental tuition. To begin to address these questions, Rauscher et al. (2007) explored the impact of different types of musical activity in at-risk preschool children. Five groups received piano, singing, rhythm, computer or no instruction for two years. The three music groups scored higher following instruction than the control groups on mental imagery tasks but the scores of the rhythm group were significantly higher than all other groups on tasks requiring temporal cognition and mathematical ability. The findings from this study suggest that it is rhythmic training which is important for the development of temporal cognition and mathematics (see Rauscher, 2009, for further discussion), while developing enhanced perceptual skills in relation to pitch and melody supports language development, although rhythm emerges as important in relation to literacy.

Overall, taking these findings together it would appear that active engagement with making music can have an impact on intellectual development. What requires further research is the specific types of musical participation which develop skills that transfer automatically to other areas and what are the common features of these skills.

General attainment

Most of the research examining the relationship between general achievement and active engagement with music has been based on correlations. Evidence from the USA has shown that students who participate in music education do better than their peers on many measures of academic achievement. Using data relating to over 13,000 students from the National Centre for Educational Statistics, Morrison (1994) reported that high-school students who participated in music reported higher grades in English, maths, history and science than those who did not participate. Johnson and Memmott (2006) studied 4739 elementary and middle-school students in four regions of the USA and revealed a strong relationship between elementary (3rd and 4th grade) students' academic achievement as measured by test scores and their participation in high-quality music programmes. Similar effects were found by Trent (1996) and Cardarelli (2003), although Schneider and Klotz (2000) comparing enrolment in music performance classes or athletic extracurricular activities and academic achievement found that all groups were equivalent in the 5th and 6th grade but during the 7th, 8th and 9th grades the musicians achieved significantly higher academic achievement scores than the athletes but not the non-participant controls. Several literature reviews support the overall trend of these findings (see Arnett-Gary, 1998; Shobo, 2001; Yoon, 2000) and Hodges and O'Connell (2007) further point out that being excused from non-music classes to attend instrumental lessons does not adversely affect academic performance.

One of the difficulties with this research, however, is that participating in musical activities may be related to other factors which promote academic attainment, for instance, having supportive parents and a home environment conducive to studying. A recent study, adopting more complex and sensitive statistical modelling (Southgate & Roscigno, 2009) using national data sets was able to overcome some of the difficulties experienced by early correlational studies. Three measures of music participation were used: in school, outside school and parental involvement in the form of concert attendance. Two nationally representative data sources ECLS-K (20,000 US kindergarten students) and NELS:88 (25,000 adolescents) were used. Music involvement was found to vary systematically by class and gender status, and such involvement had implications for both maths and reading achievement and for young children and adolescents. However, associations between music and achievement persisted even when prior achievement was taken into account. There was evidence of social class variation in within-school music involvement in adolescents but not in early childhood, while the effects of class on parental music involvement were strong and consistent in both samples. Southgate and Roscigno suggested that this was likely to be related to resource issues. As a mediator of educational outcomes music involvement was significant for both maths and reading achievement. It generally increased achievement levels, although gains were not distributed equally among all students – a white student advantage existed. This may relate to the type of musical activity engaged in and the opportunities afforded the students for performance which may contribute to enhanced self-esteem and increased motivation.

Of the experimental studies that have been carried out on the effects of participation in music on general attainment, two indicated a positive effect (Barr, Dittmar, Roberts, & Sheraden, 2002; Hoffman, 1995), while Hines (2000), studying students with learning difficulties from kindergarten through to 9th grade, found neither reading nor maths achievement was affected by type of music instruction, motoric or non-motoric. Legette (1993) also found no effect of music instruction.

Overall, academic attainment clearly depends on the development of literacy and numeracy skills which have been discussed earlier. However, motivation is a crucial factor in how well children perform at school. Motivation is closely linked to self-perceptions of ability, self-efficacy and aspirations (Hallam, 2005). If active engagement with music increases positive perceptions of self, this may transfer to other areas of study and increase motivation to persist in the light of initial failure. This may account for some of the conflicting evidence relating to general attainment and will be discussed later.

Creativity

Researchers have paid less attention to the impact of music on creativity than other types of learning. Simpson (1969) studying 173 high-school music and 45 non-music students found that the music students scored higher on several elements of Guildford's tests of creativity. Wolff (1979) studied the effects of 30 minutes of daily music instruction for an entire year on first graders. Those participating exhibited significant increases in creativity and in perceptual motor skills compared with controls. Kalmar (1982) studied the effects of singing and musical group play twice weekly for three years on preschool children of 3–4 years of age and found that these children scored higher than controls on creativity, had higher levels of abstraction, and showed greater creativity in improvised puppet play. They also demonstrated better motor development. High-school and university music students scored higher on tests of creativity than non-music majors, this being particularly marked in those with more than 10 years of music education (Hamann, Bourassa, & Aderman 1990). A further study compared music students with those whose experiences included theatrical and visual arts. The music students exhibited greater creativity than controls but no

effects were found for the visual arts. The greater the number of units of music classes the greater the creativity (Hamann, Bourassa, & Aderman, 1991). Other major national reports on the arts have emphasized their importance in developing a range of transferable skills including those related to creativity and critical thinking (NACCCE, 1999).

The development of creative skills is likely to be particularly dependent on the type of musical engagement. This is supported by recent work by Koutsoupidou and Hargreaves (2009). They studied 6-year-olds, comparing those who had opportunities for musical improvisation with those where music lessons were didactic. Performance on Webster's measures of Creative Thinking in Music assessed change in extensiveness, flexibility, originality and syntax. The improvisation activities significantly supported the development of creative thinking as opposed to the didactic teaching. To enhance general creativity music lessons themselves need to be based on creative activities.

Social and personal development

The research on the impact of participation in music on social and personal development has tended to be based on self-report, either questionnaires or interviews. It has received less attention than the impact on intellectual development and attainment, despite the fact that the effects on achievement may in part be mediated by an increase in social and cultural capital. For instance, Broh (2002) showed that students who participated in musical activities talked more with parents and teachers, and that their parents were more likely to talk with friends' parents. She concluded that these social benefits were likely to lead to higher self-esteem in the children in turn leading to increased motivation and self-efficacy. A study by the Norwegian Research Council for Science and Humanities supported this formulation finding a connection between having musical competence and high motivation which led to a greater likelihood of success in school (Lillemyr, 1983). There were high correlations between positive self-perception, a high cognitive competence score, self-esteem, and interest and involvement in school music. Whitwell (1977) drew similar conclusions and argued that creative participation in music improves self-image and self-awareness, and creates positive self-attitudes. Similar findings have been found with urban black middle-school students (Marshall, 1978) and children of low economic status (Costa-Giomi, 1999). It would appear that success in music can enhance overall feelings of confidence and self-esteem, increasing motivation for study more generally.

Research in Switzerland showed that increasing the amount of classroom music within the curriculum did not have a detrimental effect on language and reading skills despite a reduction in time in these lessons (Spychiger, Patry, Lauper, Zimmerman, & Weber, 1993; Zulauf, 1993) and there was an increase in social cohesion within class, greater self-reliance, better social adjustment and more positive attitudes in the children. These effects were particularly marked in low ability, disaffected pupils (Spychiger et al., 1993). Harland et al. (2000) showed that the most frequent overall influences on pupils derived from engagement with the arts in school were related to personal and social development. In music there were perceived effects relating to awareness of others, social skills, well-being and transfer effects. Variations in response between schools related to the degree of musical knowledge and experience that the pupils brought to the school curriculum. Some students perceived the benefits of music classes as listening to music and the development of musical skills while others referred to the sheer fun and therapeutic nature of music, how it gave them confidence to perform in front of others, how it facilitated group work and how it enabled them to learn to express themselves. Those who played instruments mentioned an increase in self-esteem and sense of identity. Tolfree and Hallam (in preparation) also reported a sense of achievement,

increased confidence and the provision of an alternative means of communicating feelings for children aged 9–17 in relation to playing an instrument. They also spoke of enjoying playing with friends and the frustrations that they felt when practising and they were unable to get things right.

Two studies researched the perceived benefits of school band participation in the USA, showing that the majority of those surveyed recognized the benefits including accomplishment, appreciation, discipline, fun, active participation and maturing relationships (Brown, 1980). Ninety-five per cent of parents of non-band participants believed that band provided educational benefits not found in other classrooms and 78 per cent agreed that band was more educational than extra-curricular activities. Band directors talked in general terms about the benefits of discipline, teamwork, co-ordination, development of skills, pride, lifetime skills, accomplishment, cooperation, self-confidence, sense of belonging, responsibility, self-expression, creativity, performance, companionship, building character and personality, improving self-esteem, social development and enjoyment. In a follow-up study (Brown, 1985), 91 per cent of non-band parents, 79 per cent of non-band students, 90 per cent of drop-out band parents and 82 per cent of drop-out band students agreed that participating in a band builds self-esteem, self-confidence and a sense of accomplishment. Similarly, in the UK, peripatetic instrumental teachers working in schools reported considerable benefits of learning to play an instrument, including the development of social skills; gaining a love and enjoyment of music; developing team-work; developing a sense of achievement, confidence and self-discipline; and developing physical co-ordination (Hallam & Prince, 2000).

Being involved in the extra-curricular rehearsal and performance of a school show has been shown to facilitate the development of friendships with like-minded individuals and make a contribution to social life through a widespread awareness of the show by non-participants (Pitts, 2007). Such participation can increase pupils' confidence, social networks and sense of belonging, despite the time commitment which inevitably impinges on other activities. Research in the USA has also shown that involvement in group music activities in the high school helps individuals learn to support each other, maintain commitment and bond together for group goals (Sward, 1989). Reflecting on previous and current group music making activities, university students reported benefits in terms of pride in being an active contributor to a group outcome, developing a strong sense of belonging, gaining popularity and making friends with 'like-minded' people, enhancement of social skills, and the development of a strong sense of self-esteem and satisfaction. Students also reported enhanced personal skills facilitating the students' personal identity and encouraging the development of self-achievement, self-confidence and intrinsic motivation. A further study with non-music students who had previously participated in musical groups established similar benefits but there was a greater preoccupation with the impact of group music making on the self and personal development. Students reported that active involvement in music helped them develop life skills such as discipline and concentration and provided a relaxation outlet during demanding study periods (Kokotsaki & Hallam, 2007, in press). In a study of 84 members of a college choral society, 87 per cent indicated that they had benefitted socially, 75 per cent emotionally, and 49 per cent spiritually. Meeting new people, feeling more positive, and being uplifted spiritually were all referred to (Clift & Hancox, 2001).

Within small musical groups the social relationships and the development of trust and respect have been found to be crucial for their functioning (Davidson & Good, 2002; Young & Colman, 1979). For long-term success rehearsals have to be underpinned by strong social frameworks, as interactions are typically characterized by conflict and compromise related mainly to musical content and its co-ordination, although some interactions are of a more personal nature (e.g., approval) (Murningham & Conlon, 1991; Young & Colman, 1979): the smaller the group the more important personal friendship seems to be.

In adolescence, music makes a major contribution to the development of self-identity. Teenagers listen to a great deal of music (Hodges & Haack, 1996) – in the UK, typically almost three hours a day (North, Hargreaves, & O'Neill, 2000). They do this to pass time, alleviate boredom, relieve tension, and distract themselves from worries (Zillman and Gan, 1997; North et al., 2000; Tolfree and Hallam, in preparation). Music is seen as a source of support when young people are feeling troubled or lonely, acting as a mood regulator, helping to maintain a sense of belonging and community (Zillman & Gan, 1997). Its effect on moods at this time can be profound (Goldstein, 1980). It is also used in relation to impression management needs. By engaging in social comparisons adolescents are able to portray their own peer groups more positively than other groups in their network and are thus able to sustain positive self-evaluations. Music facilitates this process (Tarrant, North, & Hargreaves, 2000).

In addition to developing personal and social skills, music may also have the capacity to increase emotional sensitivity. Resnicow, Salovey and Repp (2004) found that there was a relationship between the ability to recognize emotions in performances of classical piano music and measures of emotional intelligence which required individuals to identify, understand, reason with and manage emotions using hypothetical scenarios conveyed pictorially or in writing. The two were significantly correlated, which suggests that identification of emotion in music performance draws on some of the same sensibilities that make up everyday emotional intelligence.

While it is clear from the research outlined above that music can have very positive effects on personal and social development, it must be remembered that the research has largely focused on those currently participating in active music making, not taking account of those who have not found it an enjoyable and rewarding experience. The quality of the teaching, the extent to which individuals experience success, whether engaging with a particular type of music can be integrated with existing self-perceptions, and whether overall it is a positive experience will all contribute to whether personal change is beneficial or not and subsequently whether it has an impact on motivation.

Physical development, health and well-being

Recent concerns about health and well-being in populations have led to an increase in research exploring the role of the arts and music. Some work has focused on physical development in children, some on more general issues concerned with well-being.

Using rhythmic accompaniment to support physical education programmes improves performance. Anshel and Marisi (1978) observed positive results in performance accuracy and endurance when music was rhythmically synchronized with motor performance. Painter (1966) found similar results. Beisman (1967) found that throwing, catching, jumping and leaping improved when children participated in a programme involving rhythm, while Brown, Sherrill and Gench (1981) also found that an integrated music and PE programme improved preschoolers' motor performance more than movement exploration. Derri, Tsapakidou, Zachopoulou and Kioumourtzoglou (2001) investigated the effect of a 10-week music and movement programme on the quality of locomotor performance in children of 4–6 years and found that the experimental group improved on galloping, leaping, horizontal jump and skipping. In a further study (Deli, Bakle, & Zachopoulou, 2006) a music and movement programme was compared with free play activities. The latter were unable to guarantee the development of locomotor skills in preschool children. There is also evidence that learning to play an instrument improves fine motor skills (Schlaug et al., 2005).

There has recently been a surge of interest in the specific benefits of singing to health and well-being. Almost all of this research has been carried out with adults, an exception being the work of

Ashley (2002), who studied choir boys aged 10–14 singing in a major city centre parish church. The boys showed deep appreciation of and engagement with music and exhibited many features of personal well-being, including the social competence to circumscribe the proscriptions of macho culture. In a study of young people who were members of a university choir, Clift and Hancox (2001) found that 58 per cent reported having benefited in some physical way. Eighty-four per cent responded positively in relation to health benefits, mainly referring to lung function, breathing, improved mood, and stress reduction. Further analysis identified six dimensions associated with the benefits of singing – well-being and relaxation, benefits for breathing and posture, social benefits, spiritual benefits, emotional benefits, and benefits for the heart and the immune system (Clift & Hancox, 2001).

There has also been research specifically exploring the benefits of singing on the immune system. In a review of the literature, Clift, Hancox, Staricoff and Whitmore (2008) considered five studies which had used as a measure of the immune system salivary immunoglobulin. Four reported increase in this antibody associated with singing (Beck, Cesario, Yousefi, & Enamoto 2000; Beck, Gottfried, Hall, Cisler, & Bozeman, 2006; Kreutz et al., 2004; Kuhn, 2002). No measurable changes in lung performance, even in professional singers, have been reported when compared with other musicians using their lungs to make music (Clift et al., 2008).

Reviews of the research with adult singers have concluded that there are a range of health and well-being benefits from participating in a choir. There is no reason to suppose that these benefits would not apply to children. The benefits include: physical relaxation and release of physical tension; emotional release and reduction of feelings of stress; a sense of happiness, positive mood, joy, elation, and feeling high; a sense of greater personal, emotional and physical well-being; an increased sense of arousal and energy; stimulation of cognitive capacities – attention, concentration, memory and learning; an increased sense of self-confidence and self-esteem; a sense of therapeutic benefit in relation to long-standing psychological and social problems; a sense of exercising systems of the body through the physical exertion involved, especially the lungs; a sense of disciplining the skeletal-muscular system through the adoption of good posture; and being engaged in a valued, meaningful worthwhile activity that gives a sense of purpose and motivation (Clift et al., 2008; Stacey, Brittain, & Kerr, 2002).

Studies of adults have shown other physical benefits of engaging with music. Playing the piano exercises the heart as much as a brisk walk (Parr, 1985) and there are lower mortality rates in those who attend cultural events, read books or periodicals, make music, or sing in a choir (Bygren, Konlaan, & Johansson, 1996; Hyppa & Maki, 2001; Johansson, Konlaan, & Bygren, 2001; Konlaan, Bygren, & Johansson, 2000). Music making has also been shown to contribute to perceived good health, quality of life and mental well-being (Coffman & Adamek, 1999; Kahn, 1998; Vanderark, Newman, & Bell, 1983; Wise, Hartmann, & Fisher, 1992).

Conclusion

This overview provides a strong case for the benefits of active engagement with music throughout the lifespan. In early childhood there seem to be benefits for the development of perceptual skills which affect language learning and which subsequently impact on literacy. Opportunities to be able to co-ordinate rhythmically also seem important for the acquisition of literacy skills. Fine motor co-ordination is also improved through learning to play an instrument. Music also seems to improve spatial reasoning, one aspect of general intelligence which is related to some of the skills required in mathematics. While general attainment is clearly affected by literacy and numeracy skills, motivation, which depends on self-esteem, self-efficacy and aspirations, is also important in the amount

of effort given to studying. Engagement with music can enhance self-perceptions, but only if it provides positive learning experiences which are rewarding. This means that overall, the individual needs to experience success. This is not to say that there will never be setbacks but they must be balanced by future aspirations which seem achievable and self-belief in attaining them.

References

Altenmuller, E. O. (2003). How many music centres are in the brain? In I. Peretz, & R. Zatorre (Eds.), *The cognitive neuroscience of music* (pp. 346–356). Oxford: Oxford University Press.

Altenmuller, E. O., Gruhn, W., Parlitz, D., et al. (1997). Music learning produces changes in brain activation patterns: A longitudinal DC-EEG-study unit. *International Journal of Arts Medicine*, *5*, 28–34.

Anshel, M., & Marisi, D. (1978). Effect of music and rhythm on physical performance, *Research Quarterly*, *49*, 109–113.

Anvari, S. H., Trainor L. J., Woodside J., & Levy B. Z. (2002). Relations among musical skills, phonological processing, and early reading ability in preschool children. *Journal of Experimental Child Psychology*, *83*, 111–130.

Arnett-Gary, D. (1998). The effects of the arts on academic achievement. *Masters Abstracts International*, *42*(01), 22.

Ashley, M. (2002). Singing, gender and health: Perspectives from boys singing in a church choir. *Health Education*, *102*(4), 180–186.

Atterbury, B. (1985). Musical differences in learning-disabled and normal achieving readers, age eight and nine. *Psychology of Music*, *13*(2), 114–123.

Barr, L., Dittmar, M., Roberts, E., & Sheraden, M. (2002). *Enhancing student achievement through the improvement of listening skills*. ERIC document Reproduction Service No ED465999.

Barwick, J., Valentine, E., West, R., & Wilding, J. (1989). Relations between reading and musical abilities. *The British Journal of Educational Psychology*, *59*, 253–257.

Beck, R., Cesario, T., Yousefi, S., & Enamoto, H. (2000). Choral singing, performance perception and immune system changes in salivary immunoglobulin and cortisol. *Music Perception*, *18*(1), 87–106.

Beck, R. J., Gottfried, T. L., Hall, D. J., Cisler, C. A., & Bozeman, K. W. (2006). Supporting the health of college solo singers: The relationship of positive emotions and stress to changes in the salivary IgA and cortisol during singing. *Journal of Learning through the Arts: A Research Journal on Arts Integration in Schools and Communities*, *2*(1), article 19.

Beisman, G. (1967). Effect of rhythmic accompaniment upon learning of fundamental motor skills. *Research Quarterly*, *38*, 172–176.

Bigand, E., & Poulin-Carronnat, B. (2006). Are we 'experienced listeners'? A review of the musical capacities that do not depend on formal musical training. *Cognition*, *100*, 100–130.

Bilhartz, T. D., Bruhn, R.A., & Olson, J.E. (2000). The effect of early music training on child cognitive development. *Journal of Applied Developmental Psychology*, *20*, 615–636.

Blakemore, S. J., & Frith, U. (2000). *The implications of recent developments in neuroscience for research on teaching and learning*. London: Institute of Cognitive Neuroscience.

Bowles, S. A. (2003). Tune up the mind: The effect of orchestrating music as a reading intervention (Doctoral Dissertation, Indiana University of Pennsylvania). *Dissertation Abstracts International*, *64*(05), 1574A.

Broh, B. A. (2002). Linking extracurricular programming to academic achievement: Who benefits and why? *Sociology of Education*, *75*, 69–95.

Brown, J. D. (1980). *Identifying problems facing the school band movement*. Elkhart: Gemeinhardt Co. Ltd.

Brown, J. D. (1985). *Strategic marketing for music educators*. Elkhart: Gemeinhardt Co. Ltd.

Brown, J., Sherrill, C., & Gench, B. (1981). Effects on an integrated physical education/music programme in changing early childhood perceptual-motor performance. *Perceptual and Motor Skills*, *53*(1), 151–154.

Butzlaff, R. (2000). Can music be used to teach reading? *Journal of Aesthetic Education*, *34*, 167–178.

Bygren, L. O. Konlaan, B. K., & Johansson, S-E. (1996). Attendance at cultural events, reading books or periodicals and making music or singing in a choir as determinants for survival: Swedish interview survey of living conditions. *British Medical Journal*, *313*, 1577–1580.

Cardarelli, D. M. (2003). The effects of music instrumental training on performance on the reading and mathematics portions of the Florida Comprehensive Achievement Test for 3rd grade students (Doctoral dissertation, University of Central Florida). *Dissertation Abstracts International*, *64*(10), 3624A.

Catterall, J., Chapleau, R., & Iwanga, J. (1999). Involvement in the arts and human development: General involvement and intensive involvement in music and theatre arts. In *Champions of Change: The impact of the arts on learning*. Washington DC: Arts Education Partnership.

Catterall, J. S., & Rauscher, F. H. (2008). Unpacking the impact of music on intelligence. In W. Gruhn, & F. H. Rauscher (Eds.), *Neurosciences in music pedagogy* (pp. 171–201). New York: Nova Science Publishers.

Chamberlain, J. R. (2003). The relationship between beat competency and reading abilities of third and fifth grade students (Doctoral dissertation, The University of North Carolina at Greensboro). *Dissertation Abstracts International*, *64*(06), 2016A.

Chan, A. S., Ho, Y. C., & Cheung, M. C. (1998). Music training improves verbal memory, *Nature*, *396*, 128.

Cheek, J. M., & Smith, L. R. (1999). Music training and mathematics achievement. *Adolescence*, *34*, 759–761.

Clift, S., & Hancox, G. (2001). The perceived benefits of singing: Findings from preliminary surveys of a university college choral society. *The Journal of the Royal Society for the Promotion of Health*, *121*(4), 248–256.

Clift, S., Hancox, G., Staricoff, R., & Whitmore, C. (2008). *Singing and health: A systematic mapping and review of non-clinical research.* Sidney de Haan Research Centre for Arts and Health: Canterbury Christ Church University.

Coffman, D. D., & Adamek, M. (1999). The contribution of wind band participation to quality of life of senior adult band members. *Dialogue in Instrumental Music Education*, *20*(1), 25–34.

Costa-Giomi, E. (1999). The effects of three years of piano instruction on children's cognitive development. *Journal of Research in Music Education*, *47*(5), 198–212.

Davidson, J. W., & Good, J. M. M. (2002). Social and musical co-ordination between members of a string quartet: An exploratory study. *Psychology of Music*, *30*, 186–201.

Deli, E., Bakle, I., & Zachopoulou, E. (2006). Implementing intervention movement programs for kindergarten children. *Journal of Early Childhood Research*, *4*(1), 5–18.

Derri, V., Tsapakidou, A., Zachopoulou, E., & Kioumourtzoglou, E. (2001). Effect of a music and movement programme on development of locomotor skills by children 4 to 6 years of age. *European Journal of Physical Education*, *6*, 16–25.

Douglas, S. and Willatts, P. (1994). The relationship between musical ability and literacy skill. *Journal of Research in Reading*, *17*, 99–107.

Dowling, W. J. (1993). Procedural and declarative knowledge in music cognition and education. In T. J. Tighe, & W.,J. Wilding (Eds.), *Psychology and music: The understanding of melody and rhythm* (pp. 5–18). Hillsdale, NJ: Erlbaum.

Dowling, W. J., Kwak, S., & Andrews, M. W. (1995). The time course of recognition of novel melodies. *Perception and Psychophysics*, *57*, 136–149.

Fields, R. D. (2005). Making memories stick. *Scientific American*, February, 75–81.

Flohr, J. W., Miller, D. C., & deBeus, R. (2000). EEG studies with young children. *Music Educators Journal*, 87(2), 28–32.

Gaab, N., Gaser, C., & Zaehle, T. et al. (2005). Neural correlates of rapid spectrotemporal processing in musicians and nonmusicians. *Annals of the New York Academy of Sciences*, *1069*, 82–88.

Gardiner, M. E., Fox, A., Knowles, F., & Jeffrey, D. (1996). Learning improved by arts training. *Nature*, *381*(6580), 284.

Geoghegan, N., & Mitchelmore, M. (1996). Possible effects of early childhood music on mathematical achievement. *Journal for Australian Research in Early Childhood Education*, *1*, 57–64.

Goldstein, A. (1980). Thrills in response to music and other stimuli. *Physiological Psychology*, *8*(1), 126–129.

Graziano, A. B., Peterson, M., & Shaw, G. L. (1999). Enhanced learning of proportional math through music training and spatial-temporal training. *Neurological Research*, *21*, 139–152.

Gromko, J. (2005). The effect of music instruction on phonemic awareness in beginning readers. *Journal of College Reading and Learning*, *53*(3), 199–209.

Gromko, J., & Poorman, A. (1998). The effect of music training on preschoolers' spatial-temporal task performance. *Journal of Research in Music Education*, *46*, 173–181.

Haley, J. A. (2001). The relationship between instrumental music instruction and academic achievement in fourth grade students (Doctoral Dissertation, Pace University). *Dissertation Abstracts International*, *62*(09), 2969A.

Hallam, S. (2005). *Enhancing learning and motivation through the life span*. Institute of Education, University of London.

Hallam, S., & Prince, V. (2000). *Research into instrumental music services.* London: DfEE.

Hamann, D., Bourassa, R., & Aderman, M. (1990). Creativity and the arts. *Dialogue in Instrumental Music Education*, *14*, 59–68.

Hamann, D., Bourassa, R., & Aderman, M (1991). Arts experiences and creativity scores of high school students. *Contribution to Music Education*, *14*, 35–47.

Harland, J., Kinder, K., Lord, P., Stott, A., Schagen, I., & Haynes, J. (2000). *Arts education in secondary schools: Effects and effectiveness.* London, NFER/The Arts Council of England, RSA.

Hetland, L. (2000). Learning to make music enhances spatial reasoning. *Journal of Aesthetic Education*, *34*(3/4), Special Issue, The arts and academic achievement: What the evidence shows (Autumn – Winter), 179–238.

Hines, S. W. (2000). The effects of motoric and non-motoric music instruction on reading and mathematics achievements of learning disabled students in kindergarten through ninth grade (Doctoral dissertation, The University of North Carolina at Greensboro). *Dissertation Abstracts International*, *61*(05), 1777A.

Hirt-Mannheimer, J. (1995). Music big for little folks. *Teaching Music*, 3(2), 38–39.

Ho, Y. C., Cheung, M. C., & Chan, A. S. (2003). Music training improves verbal but not visual memory: Cross sectional and longitudinal explorations in children. *Neuropsychology*, *17*, 439–450.

Hodges, D. A., & Haack, P. A. (1996). The influence of music on behaviour. In D. A. Hodges (Ed.), *Handbook of music psychology*. San Antonia: IMR Press.

Hodges, D. A., & O'Connell, D. S. (2007). The impact of music education on academic achievement. Chapter 2 in *Sounds of Learning Report*: NAMM Foundation Sounds of Learning.

Hoffman, D. S. (1995). Relationships between academic achievement and participation in a comprehensive and sequential keyboard-based public school music education programme (Doctoral dissertation, University of South Carolina). *Dissertation Abstracts International*, *56*(06), 2161A.

Humpal, M. E., & Wolf, J. (2007). Music in the inclusive classroom. *Young Children*, *58*(2), 103–107.

Hurwitz, I., Wolff, P. H., Bortnick, B. D., & Kokas, K. (1975). Non-musical effects of the Kodaly music curriculum in primary grade children. *Journal of Learning Disabilities*, *8*, 45–52.

Hyppa, M. T., & Maki, J. (2001). Individual-level relationships between social capital and self-rated health in a bilingual community. *Preventative Medicine*, *32*, 148–155.

Johansson, S. E., Konlaan, B. B., & Bygren, L. O. (2001). Sustaining habits of attending cultural events and maintenance of health: A longitudinal study. *Health Promotion International*, *16*(3), 229–234.

Johnson, C. M., & Memmott, J. E. (2006). Examination of relationships between music programs of differing quality and standardized test results. *Journal of Research in Music Education*, *54*(4), Winter, 293–307.

Kahn, A. P. (1998). Healthy aging: A study of self-perceptions of well-being. *Dissertation Abstracts International*, *58*, 4740B. (UMI No. AAT98–10054).

Kalmar, M. (1982). The effects of music education based on Kodaly's directives in nursery school children. *Psychology of Music*, Special Issue, 63–68.

Kemmerer, K. P. (2003). Relationship between the number of hours spent in general music class and reading skills in kindergarten through grade 3. (Doctoral dissertation, Lehigh University). *Dissertation Abstracts International*, *64*(12), 4400A.

Kokotsaki, D., & Hallam, S. (2007). Higher education music students' perceptions of the benefits of participative music making. *Music Education Research*, *9*(1), March, 93–109.

Kokotsaki, D., & Hallam, S. (in press). The perceived benefits of participative music making.

Konlaan, B. B., Bygren, L. O., & Johansson, S-E. (2000). Visiting the cinema, concerts, museums or art exhibitions as determinant of survival: A Swedish fourteen-year cohort follow-up study. *Scandinavian Journal of Public Health*, *28*(3), 174–178.

Koutsoupidou, T., & Hargreaves, D. (2009). An experimental study of the effects of improvisation on the development of children's creative thinking in music. *Psychology of Music*, *37*(3), 251–278.

Kreutz, G., Bongard, S., Rohrmann, S., Grebe, D., Bastian, H. G., & Hodapp, V. (2004). Effects of choir singing or listening on secretory immunoglobulin A, cortisol and emotional state. *Journal of Behavioural Medicine*, *27*(6), 623–635.

Kuhn, D. (2002). The effects of active and passive participation in musical activity on the immune system as measured by salivary immunoglobulin A (SigA). *Journal of Music Therapy*, *39*(1), 30–39.

Lamb, S. J., & Gregory, A. H. (1993). The relationship between music and reading in beginning readers. *Educational Psychology: An International Journal of Experimental Educational Psychology*, *31*(1), 19–27.

Legette, R. M. (1993). The effect of a selected use of music instruction on the self-concept and academic achievement to the musical problem solving abilities of high school students (Doctoral dissertation, Case Western Reserve University). *Dissertation Abstracts International*, *54*(07), 2502A.

Lillemyr, O. F. (1983). Achievement motivation as a factor in self-perception, *Norwegian Research Council for Science and the Humanities*, 245–248.

Long, M. (2007). The effect of a music intervention on the temporal organisation of reading skills (Unpublished PhD, Institute of Education, University of London).

Lu, D. T. (1986). The effects of teaching music skills on the development of reading skills among first graders: An experimental study (Doctoral dissertation, University of Washington). *Dissertation Abstracts International*, *47*(12), 4344A.

Magne, C., Schon, D., & Besson, M. (2006). Musician children detect pitch violations in both music and language better than nonmusician children: behavioural and electrophysiological approaches. *Journal of Cognitive Neuroscience*, *18*, 199–211.

Marshall, A. T. (1978). An analysis of music curricula and its relationship to the self image of urban black middle school age children. *Dissertation Abstracts International*, A 38, 6594A-5A.

Montgomery, A. J. (1997). The influence of movement activities on achievement in melodic pitch discrimination and language arts reading readiness skills of selected kindergarten music classes (Doctoral dissertation, University of Southern Mississippi). *Dissertation Abstracts International*, *58*(09), 3453A.

Moreno, S., & Besson, M. (2006). Musical training and language-related brain electrical activity in children. *Psychophysiology*, *43*, 287–291.

Morrison, S. J. (1994). Music students and academic growth. *Music Educators Journal*, *81*(2), 33–36.

Movsesian, E. (1967). The influence of primary teaching music reading skills on the development of basic reading skills in the primary grades. (Doctoral dissertation, University of Southern California). *Dissertation Abstracts International*, *28*(08), 3078A.

Munte, T. F., Nager, W., Beiss, T., Schroeder, C., & Erne, S.N. (2003). Specialization of the specialized: Electrophysiological investigations in professional musicians. In G. Avanzini, C. Faienza, D. Minciacchi, L. Lopez, & M. Majno (Eds.), *The neurosciences and music.* (pp. 112–117). New York: New York Academy of Sciences.

Murningham, J. K., & Conlon, D. E. (1991). The dynamics of intense work groups: A study of British string quartets. *Administrative Science Quarterly*, *36*, 165–186.

Musacchia, G., Sams, M., Skoe, E., & Kraus, N. (2007). Musicians have enhanced subcortical auditory and audiovisual processing of speech and music. *Proceedings of the National Academy of Sciences of the USA*, *104*(40), 15894–15898.

National Advisory Committee on Creative and Cultural Education (NACCCE). (1999). *All our futures: Creativity culture and education*. London: Department for Culture, Media and Sport/Department for Education and Employment.

Nicholson, D. (1972). Music as an aid to learning (Doctoral dissertation, New York University). *Dissertation Abstracts International*, *33*(01), 0352A.

North, A. C., Hargreaves, D. J., & O'Neill, S. A. (2000). The importance of music to adolescents. *British Journal of Educational Psychology*, *70*, 255–272.

Norton, A., Winner, E., Cronin, K., Overy, K., Lee, D.J., & Schlaug, G. (2005). Are there pre-existing neural, cognitive, or motoric markers for musical ability? *Brain and Cognition*, *59*, 124–134.

Orsmond, G. I., & Miller, L. K. (1999). Cognitive, musical, and environmental correlates of early music instruction. *Psychology of Music*, *27*, 18–37.

Overy, K. (2000). Dyslexia, temporal processing, and music: The potential of music as an early learning aid for dyslexic children. *Psychology of Music*, *28*, 218–229.

Overy, K. (2003). Dyslexia and music: From timing deficits to musical intervention. *Annals of the New York Academy of Science*, *999*, 497–505.

Painter, G. (1966). The effects of a rhythmic and sensory motor activity program on perceptual motor spatial abilities of kindergarten. *Exceptional Children*, *33*, 113–116.

Pantev, C., Engelien, A., Candia, V., & Elbert, T. (2003). 'Representational cortex in musicians'. In I. Peretz, & R. Zatorre (Eds.), *The Cognitive Neuroscience of Music* (pp. 382–395). Oxford: Oxford University Press.

Parr, S. M. (1985). The effects of graduated exercise at the piano on the pianist's cardiac output, forearm blood flow, heart rate, and blood pressure. *Dissertation Abstracts International*, *46*(6), 1436A (UMI No. AAT85–18673).

Patel, A. D., & Iverson, J. R. (2007). The linguistic benefits of musical abilities. *Trends in Cognitive Sciences*, *11*, 369–372.

Patel, I. (2009). *Music and the brain*. In S. Hallam, I. Cross, & M. Thaut (Eds.), *The Oxford handbook of psychology of music* (pp. 208–216). Oxford: Oxford University Press.

Peynircioglu, Z., Durgunoglu, A. Y., & Uney-Kusefoglu, B. (2002). Phonological awareness and musical aptitude. *Journal of Research in Reading*, *25*(1), 68–80.

Piro, J. M., & Ortiz, C. (2009). The effect of piano lessons on the vocabulary and verbal sequencing skills of primary grade students. *Psychology of Music*, *37*(3), 325–347.

Pitts, S. E. (2007). Anything goes: A case study of extra-curricular musical participation in an English secondary school. *Music Education Research*, *9*(1), 145–165.

Rafferty, K. N. (2003). Will a music and spatial-temporal math program enhance test scores? An analysis of second-grade students' mathematics performance on the Stanford-9 Test and the Capistrano Unified School District CORE level test (Doctoral dissertation, University of Southern Carolina). *Dissertation Abstracts International*, *64*(12), 4301A.

Rauscher, F. H. (2002). Mozart and the mind: Factual and fictional effects of musical enrichment. In J. Aronson (Ed.), *Improving academic achievement: Impact of psychological factors on education* (pp. 269–278). New York: Academic Press.

Rauscher, F. H. (2009). The impact of music instruction on other skills. In S. Hallam, I. Cross, & M. Thaut (Eds.), *The Oxford handbook of psychology of music* (pp. 244–252). Oxford: Oxford University Press.

Rauscher, F. H., LeMieux, M., & Hinton, S. C. (submitted). Lasting improvement of at-risk children's cognitive abilities following music instruction.

Rauscher, F. H., Shaw, G. L., Levine, L. J., Wright, E. L., Dennis, W. R., & Newcomb, R. (1997). Music training causes long-term enhancement of preschool children's spatial-temporal reasoning abilities. *Neurological Research*, *19*, 1–8.

Rauscher, F. H., & Zupan, M. (2000). Classroom keyboard instruction improves kindergarten children's spatial-temporal performance: A field experiment. *Early Childhood Research Quarterly*, *15*, 215–228.

Register, D. (2001). The effects of an early intervention music curriculum on prereading/writing. *Journal of Music Therapy*, *38*(3), 239–248.

Resnicow, J. E., Salovey, P., & Repp, B. H. (2004). Is recognition of emotion in music performance an aspect of emotional intelligence. *Music Perception*, *22*(1), 145–158.

Salomon, G., & Perkins, D. N. (1989). Rocky roads to transfer: Rethinking mechanisms of a neglected phenomenon. *Educational Psychologist*, *24*, 113–142.

Schellenberg, E. G. (2003). Does exposure to music have beneficial side effects? In R. Peretz, & R. J. Zatorre (Eds.), *The cognitive neuroscience of music* (pp. 430–448). New York: Nova Science Press.

Schellenberg, E. G. (2004). Music lessons enhance IQ. *Psychological Science*, *15*(8), 511–514.

Schlaug, G., Jancke, L., Huang, Y., & Steinmetz, H. (1995a). In vivo evidence of structural brain asymmetry in musicians, *Science*, *267*, 699–701.

Schlaug, G., Jancke, L., Huang, Y., & Steinmetz, H. (1995b). Increased corpus callosum size in musicians, *Neurophsychologica*, *33*, 1047–1055.

Schlaug, G., Norton, A., Overy, K., & Winner, E. (2005). Effects of music training on the child's brain and cognitive development. *Annals of the New York Academy of Science*, *1060*, 219–230.

Schön, D., Magne, C., & Besson, M. (2004). The music of speech: Electrophysiological study of pitch perception in language and music. *Psychophysiology*, *41*, 341–349.

Schneider, T. W., & Klotz, J. (2000). *The impact of music education and athletic participation on academic achievement.* ERIC Document Reproduction Service No ED448186.

Shobo, Y. (2001). *Arts*, *Recreation and Children in Arkansas*, *2001.* ERIC Document Reproduction Service No. ED463076.

Simpson, D. J. (1969). The effect of selected musical studies on growth in general creative potential (Doctoral Dissertation, University of Southern California). *Dissertation Abstracts*, *30*, 502A–503A.

Slevc, L. R., & Miyake, A. (2006). Individual differences in second language proficiency: Does musical ability matter? *Psychological Science*, *17*, 675–681.

Southgate, D. E., & Roscigno, V.J. (2009). The impact of music on childhood and adolescent achievement. *Social Science Quarterly*, *90*(1), 4–21.

Spychiger, M., Patry, J., Lauper, G., Zimmerman, E., & Weber, E. (1993). Does more music teaching lead to a better social climate. In R. Olechowski, & G. Svik (Eds.), *Experimental research in teaching and learning*. Bern: Peter Lang.

Stacey, R., Brittain, K., & Kerr, S. (2002). Singing for health: An exploration of the issues. *Health Education*, *102*(4), 156–162.

Standley, J. M., & Hughes, J. E. (1997). Evaluation of an early intervention music curriculum for enhancing prereading/writing skills. *Music Therapy Perspectives*, *15*(2), 79–85.

Sward, R. (1989). Band is a family. *Today's Music Educator*, Winter, 26–27.

Tallal, P., & Gaab, N. (2006). Dynamic auditory processing, musical experience and language development. *Trends in Neurosciences*, *29*, 382–370.

Tarrant, M., North, A. C., & Hargreaves, D. J. (2000). English and American adolescents' reasons for listening to music. *Psychology of Music*, *28*, 166–173.

Thompson, W. F., Schellenberg, E. G., & Husain, G. (2004). Perceiving prosody in speech: Do music lessons help? *Emotion*, *4*, 46–64.

Thomson, M. (1993). Teaching the dyslexic child: Some evaluation studies. In G. Hales (Ed.), *Meeting points in dyslexia: Proceedings of the first International Conference of the British Dyslexia Association.* Reading: British Dyslexia Association.

Tolfree, E., & Hallam, S. (in preparation). Young people's uses of and responses to music in their everyday lives.

Trehub, S. E., Bull, D., & Thorpe, L. A. (1984). Infants' perception of melodies: The role of melodic contour. *Child Development*, *55*, 821–830.

Trent, D. E. (1996). The impact of instrumental education on academic achievement (Doctoral dissertation, East Texas State University). *Dissertation Abstracts International*, *57*(07), 2933A.

Vanderark, S. D., Newman, I., & Bell, S. (1983). The effects of music participation on quality of life in the elderly. *Music Therapy*, *3*, 71–81.

Vaughn, K. (2000). Music and mathematics: Modest support for the oft-claimed relationship. *Journal of Aesthetic Education*, *34*(3–4), 149–166.

Whitehead, B. J. (2001). The effect of music-intensive intervention on mathematics scores of middle and high school students (Doctoral dissertation, Capella University). *Dissertation Abstracts International*, *62*(08), 2710A.

Whitwell, D. (1977). *Music learning through performance.* Texas: Texas Music Educators Association.

Wise, G. W., Hartmann, D. J., & Fisher, B .J. (1992). Exploration of the relationship between choral singing and successful aging. *Psychological Reports*, *70*, 1175–1183.

Wolf, J. (1992). Let's sing it again: Creating music with young children. *Young Children*, *47*(2), 56–61.

Wolff, K. (1979). The non-musical outcomes of music education: A review of the literature. *Bulletin of the Council for Research in Music Education*, *55*, 1–27.

Wong, P. C. M., Skoe, E., Russo, N. M., Dees, T., & Kraus, N. (2007). Musical experience shapes human brainstem encoding of linguistic pitch patterns. *Nature Neuroscience*, *10*, 420–422.

Yoon, J. N. (2000). *Music in the classroom: Its influence on children's brain development, academic performance, and practical life skills.* ERIC Document Reproduction Service No. ED442707.

Young, V. M., & Colman, A. M. (1979). Some psychological processes in string quartets. *Psychology of Music*, *7*, 12–16.

Zillman, D., & Gan, S. (1997). Musical taste in adolescence. In D. J. Hargreaves, & A. C. North *The social psychology of music.* Oxford: Oxford University Press.

Zulauf, M. (1993). Three-year experiment in extended music teaching in Switzerland: The different effects observed in a group of French speaking pupils. *Bulletin of the Council for Research in Music Education*, *119*, Winter, 111–121.

Biography

Susan Hallam is Professor of Education at the Institute of Education, University of London and currently Dean of the Faculty of Policy and Society. She is the author of several books including *Instrumental Teaching: A Practical Guide to Better Teaching and Learning* (1998), *The Power of Music* (2001), *Music Psychology in Education* (2005), and co-editor of *The Oxford Handbook of Psychology of Music* (2009). She is past editor of *Psychology of Music*, *Psychology of Education Review* and *Learning Matters*.

Address: Institute of Education, University of London, 20 Bedford Way, London, WC1H OAL, UK. [email: S.Hallam@ioe.ac.uk]

Abstracts

Le pouvoir de la musique: son impact sur les développements intellectuel, social et personnel chez les enfants et les jeunes

Cet article relate l'évidence empirique des effets d'un engagement musical actif axé sur les développements intellectuel, social et personnel procurent aux enfants et aux jeunes**.** Cet article fait état de la technologie la plus avancée utilisée pour étudier le cerveau en complément aux recherches quantitatives et qualitatives menées en psychologie et en éducation. Il s'agit d'expliquer comment les habiletés musicales peuvent être transférées à d'autres activités si le processus impliqué est le même. Il est aussi question d'explorer l'impact évident en lien au développement du langage, la littératie, la numératie, les mesures de l'intelligence, les réalisations globales, la créativité, la motricité fine, la concentration, la confiance en soi, la sensibilité émotionnelle, les habiletés sociales, le travail d'équipe, l'autodiscipline et la relaxation. Les effets positifs d'un engagement dans la musique sur les plans du développement personnel et du développement social sont présents uniquement lorsque l'expérience et agréable et gratifiante. La qualité de l'enseignement est également sujette à ce constat.

Die Macht der Musik: Ihr Einfluss auf die intellektuelle, soziale und persönliche Entwicklung von Kindern und Jugendlichen

Dieser Beitrag überprüft die empirische Bedeutung von Effekten aktiven Umgangs mit Musik auf die intellektuelle, soziale und persönliche Entwicklung von Kindern und Jugendlichen. Er zieht Ergebnisse der Hirnforschung heran, die modernste Technologien einsetzt, ergänzt durch quantitative und qualitative Studien aus dem Bereich der Psychologie und Pädagogik. Es wird klar, wie musikalische Fertigkeiten auf andere Tätigkeiten übertragen werden können, wenn es sich dabei um ähnliche Vorgänge handelt. Darüber hinaus erkundet der Beitrag die Bedeutung der Musik für die Sprachentwicklung, die Lese- und Rechenfähigkeit, für Intelligenz, allgemeine Leistungsfähigkeit, Kreativität, feinmotorische Koordination, Konzentration, Selbstvertrauen, emotionale Sensibilität, Sozialverhalten, Teamfähigkeit, Selbstdisziplin und Entspannung. Es deutet manches darauf hin, dass sich positive Effekte der Beschäftigung mit Musik auf die soziale und persönliche Entwicklung nur dann zeigen, wenn es sich um eine erfreuliche und lohnende Erfahrung handelt. Dies hat dann Auswirkungen auf die Qualität der Lehre.

El poder de la música: su impacto en el desarrollo intelectual, social y personal de niños y jóvenes

Este artículo hace una revisión de las evidencias empíricas de los efectos de la implicación activa de niños y jóvenes con la música sobre su desarrollo personal, social e intelectual. Parte de una investigación en la que se usaron las tecnologías más avanzadas para estudiar el cerebro, además de estudios educativos y psicológicos cuantitativos y cualitativos. Explica cómo las capacidades musicales pueden transferirse a otras actividades si los procesos puestos en juego son similares. Explora las evidencias relacionadas con el impacto del desarrollo del lenguaje, alfabetización, cálculo, medidas de la inteligencia, logros globales, creatividad, coordinación motriz fina, concentración, autoconfianza, sensibilidad emocional, capacidades sociales, trabajo en equipo, autodisciplina, y relajación. Sugiere que los efectos positivos de la implicación con la música sobre el desarrollo personal y social sólo ocurre si es una experiencia agradable y gratificante, con las consiguientes implicaciones para la calidad de la enseñanza.