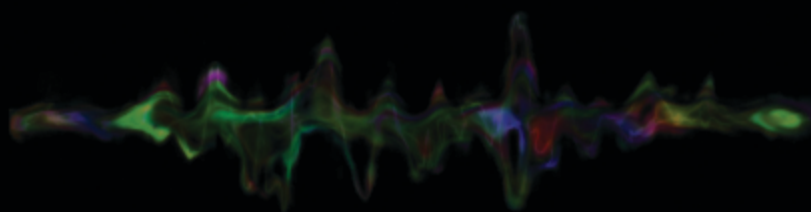


the power of music



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this work was commissioned by the



Executive Summary

The development of electronic media in the latter part of the 20th Century revolutionised access to and use of music in our everyday lives. Music now plays a key role in the lives of most people, particularly adolescents, and is frequently used to manipulate emotions and moods.

Neuroscientific research has demonstrated the way in which the cerebral cortex self-organises in response to external stimuli and the learning activities engaged in by individuals. The brain responds quickly to engagement with musical activities but permanent and substantial reorganisation of brain functioning takes considerable time. The evidence from neuroscience suggests that each individual has a specific 'learning biography' which is reflected in the way the brain processes information. Active engagement with music has a significant impact on brain structure and function. The changes reflect what has been learned and how it has been learned and influence the extent to which developed skills are able to transfer to other activities.

Transfer of learning

The transfer of learning from one domain to another depends on the similarities between the processes involved. Transfer can be near or far and is stronger and more likely to occur if it is near. Low road transfer depends on automated skills and is relatively spontaneous and automatic, while high road transfer requires reflection and conscious processing. Some musical skills (near and low road) are more likely to transfer than others including the perceptual processing of sound, fine motor skills, emotional sensitivity, conceptions of relationships between written materials and sound and memorisation of extended information. Far transfer may occur in relation to the impact of making music on intelligence and attainment, while high road transfer may also occur in relation to self-regulatory and meta-cognitive skills.

Methodological issues

Research exploring the ways in which active engagement with music impacts beyond the development of musical skills has been undertaken

within a number of disciplines and paradigms using a wide range of designs and methods. Much of this research cannot demonstrate the direction of causality. Despite this all of the research has the potential to make a contribution to our developing understanding of the nature of transfer of musical expertise to other domains and skills, albeit in different ways. An inclusive research strategy was adopted in accessing the literature for this paper. Academic data bases relevant to neuroscience, psychology, education and music in addition to web-based searches to locate relevant grey literature were searched. Analysis of located documents frequently led to further relevant material.

Aural perception and language skills

There is considerable and compelling evidence that musical training sharpens the brain's early encoding of sound leading to enhanced performance on a range of listening and aural processing skills. Active engagement with music in childhood produces structural changes in the brain which are related to the processing of sound. These changes can develop over quite short periods of time. The quality of aural encoding is related to the amount of musical training and the nature of the requirements of specific instruments.

The enhanced perceptual skills of musicians play a role in the development of language skills. The auditory expertise gained over years of music training fine-tunes the auditory system. Those who have had musical training demonstrate enhanced speech perception on a wide range of different tasks and have advantages in other language related skills.

Early musical training in infants and pre-school children develops the auditory cortex and leads to enhanced discrimination between sounds. There is causal evidence of the role of music training and less formal musical activities in shaping the development of important neural auditory skills. These benefits have been demonstrated with a range of different groups of children.

The development of phonological skills: Active engagement with music plays a major role in developing aural perceptual processing systems which facilitate the encoding and identification of speech sounds and patterns; the earlier the exposure and the greater the length of participation the greater the impact. Transfer of these skills is automatic and there is now accumulating evidence that this contributes not only to language development but also to literacy.

The development of literacy skills

Reading: Phonological awareness is an important precursor to early reading. Word decoding is strongly associated with auditory skills, while reading comprehension requires basic word decoding skills as well as higher-level cognitive processes such as memory and attention. Correlation studies suggest that there are relationships between musical activities and the various skills related to literacy including verbal and auditory working memory. Where research has attempted to demonstrate causality in relation to reading the findings have been mixed. Musical training may have a differential impact on decoding and comprehension.

Research focusing on children experiencing difficulties with reading has generally had positive outcomes. Musical interventions focusing on developing rhythmic skills seem to have the greatest impact.

Where musical activities involve learning to read notation there may be direct transfer to reading text as many underlying principles are similar for the two activities.

While the precise nature of the relationships between musical training and reading skills are currently unclear there is sufficient accruing evidence to suggest that musical training which supports the development of pitch and rhythmic skills supports the development of fluent reading leading to enhanced comprehension.

Spelling: There has been little focus on the impact of active engagement with music on spelling in comparison with reading. Such evidence as there is suggests that musical training can support the development of spelling skills but there is too little research to draw any firm conclusions.

Writing: There have been few studies focusing on the relationships between active engagement with music and writing and the evidence from them is mixed.

Aural and visual memory

Musical training has been found to have long-term positive effects on auditory memory. Children with musical training have significantly better verbal learning and retention abilities. The evidence related to visual memory is mixed. This may be because of the different methods used

and the nature of the musical training particularly the extent to which it involves learning to read musical notation.

Spatial reasoning and mathematical performance

Spatial Abilities: The evidence for the impact of active engagement with music on spatial reasoning is compelling. One review of 15 studies found a 'strong and reliable' relationship with differences comparable to one inch in height. The effects seem to be stronger when musical training is early and there is a focus on rhythm.

Mathematical performance: The evidence for the impact of musical activity on mathematics performance is mixed, although there is positive evidence from intervention studies with children particularly where musical concepts are used to support the understanding of fractions. Musical training may support some elements of learning mathematics more than others. Playing an instrument seems to have a greater impact than other activities and the length of engagement and level of commitment are also important.

Intellectual development

Research which has adopted a retrospective approach to studying the relationship between active engagement with music and intelligence has found enhanced performance from musicians on a range of intellectual skills. However, these studies do not address the issue of causality. Those who take up playing musical instruments may have higher IQ scores in the first place, although the evidence regarding this is mixed.

Intervention studies with children have shown that active engagement with music impacts on IQ scores, particularly on elements related to spatial reasoning. If the quality of music tuition is poor and unstructured there is no impact. The evidence suggests that the longer the training the greater the impact and that the relationships between musical training and intelligence remain when a range of confounding variables related to family background are taken into account.

Executive functioning and self-regulation

Executive functioning and self-regulation may act as mediators of the impact of musical engagement on intelligence. Playing a musical instrument, particularly in an ensemble requires many sub-skills associated

with executive functioning including sustained attention, goal-directed behaviour and cognitive flexibility. Formal music practice involves cognitive challenge, controlled attention for long periods of time, keeping musical passages in working memory or encoding them into long-term memory and decoding musical scores and translating them into motor programmes.

Evidence from neuroscience research has shown that there are differences in the frontal cortex of musicians and non-musicians, the area of the brain which is implicated in the regulation of attention.

Intervention studies have shown greater improvements in children in music groups in some executive functions as compared with controls.

Participation in formal early music education classes is linked with better self-regulation skills in infants and pre-school children. Intervention studies with older adults support this.

Overall, the jury is still out on the possible impact of music training on executive functions and their relationship with measured intelligence, although it is clear that some elements of executive functioning are enhanced by musical training.

Creativity

Musicians score higher on tests of creativity than non-musicians. Music intervention studies with young children have found enhanced creativity, the greater the engagement with music the stronger the relationship.

The development of creative skills is likely to be particularly dependent on the type of musical engagement. Where the music making is creative e.g. improvisation the effects are likely to be stronger.

General attainment

The evidence from correlation studies suggests that children who experience musical training have advantages across all school subjects except sport even after general intelligence is controlled for. However, the relationship may not be causal as more able children may be more attracted to musical activities.

Evidence from music intervention studies has tended to show enhanced attainment from participants, although there are exceptions.

High quality musical activities seem to affect aspirations which enhance motivation and subsequently attainment. Research with a range of disadvantaged groups supports this.

Music and personality

Personality factors may act as mediators in the transfer of skills. While there are personality differences between musicians playing different instruments many musicians exhibit high levels of conscientiousness. Musicians are also more open to new experiences than others.

Educational motivation and re-engagement of the disaffected

A small number of studies have demonstrated that engagement with music is related to positive attitudes towards school and better attendance.

There is evidence that musical activities can be effective in re-engaging disaffected students including those in the criminal justice system.

Music offers the potential for enhanced self-efficacy, self-esteem and self-concept, improvements in mood, reduced anger, increased motivation and improved behaviour. The impact is in part mediated by the extent that young people have ownership of the music. This varies across contexts and is influenced by a range of factors, including the skills and approaches of those leading projects.

Research with young people not in education, employment or training (NEETs) has indicated that participants' self-confidence and aspirations are enhanced following active engagement with making music. Outcomes include increased motivation to engage in education, employment, or voluntary activity including gaining qualifications, heightened aspirations, and a more positive attitude towards learning. Participants also develop a range of transferable skills.

The context within which such projects operate is important in their success as are the musical genres focused on and the quality of the musical facilitators.

Social cohesion and inclusion

Music offers opportunities for social bonding and cultural coherence. There is growing evidence that musical synchrony creates social cohesion and increased affiliation in infants and adults. Cohesion in classes in schools can be enhanced through extending music making activities leading to better social adjustment and more positive attitudes. These effects seem to be particularly marked for low ability, disaffected pupils.

Group music making has been shown to contribute to feelings of social inclusion; the more frequent the engagement in social musical activities the more socially included children feel.

Music has been used successfully to support the social inclusion of refugee children.

Group music making offers the opportunity to engage in wider cultural experiences, explore new ideas, places and perspectives and support social cohesion through broadening experience.

Participating in group music making may encourage tolerance and the development of social ethics.

Pro-social behaviour and team work

There is evidence of the impact of group music making on pro-social behaviour in children across the age range and adults. Collective music making supports co-operation, pro-social behaviour, belongingness, relationships, collaborative learning, social advancement, group identity, solidarity, taking turns, teamwork and helping others.

Cross community music education projects have been effective in addressing prejudice amongst young people. The specific contexts of each setting can set limits on what can be achieved.

Positive social relationships and the development of trust and respect are crucial for the functioning of small musical groups.

Empathy and emotional intelligence

Participation in active music making may increase the development of empathy and emotional sensitivity in children.

Musicians tend to have higher trait emotional intelligence (a behavioural trait) than others but not ability emotional intelligence (skill in processing emotional information and using it in everyday life).

Psychological well-being

The benefits of active engagement with music in relation to psychological well-being across the lifespan are well documented. Music is increasingly being recognised for its beneficial effects on physical health and wellbeing.

People from a range of different backgrounds can experience benefits to their emotional and physical well-being from making music with an increased sense of self-worth, enhanced social skills and wider social networks.

Babies born premature or underweight can benefit from the stimulation of music reducing inconsolable crying and leading to improvement in physiological measures including heart rate, respiration rate, oxygen saturation and mean arterial pressure.

Music therapy with hospitalized infants has shown robust results in relation to infants' capacity to self-regulate and engage in social interaction. Parent-infant interactions and communication can benefit from joint musical activities.

Research with disadvantaged and disabled children and their parents has demonstrated benefits in terms of parent and child behaviours, parent-reported irritable parenting, educational activities in the home, parent mental health, child communication and social play skills.

Musical activities can lead to a sense of accomplishment, enhanced determination and persistence and of children being better able to cope with anger and express their emotions more effectively. There are also reported benefits in terms of discipline, time management, relaxation, coping with difficulties, communication, and the ability to work with others.

Research with 'looked after children' has shown that engagement in high quality music-making projects can support the development of resilience when dealing with the challenges that they face. Music-making can contribute to improved negotiation skills, co-operative working and

learning to trust peers. It also provides respite from problems and opportunities for having fun.

Music making can play a role in supporting the healing of those who have been traumatized. Creative musical activities can benefit children who have experienced war promoting the development of self-esteem, trust and identity.

Personal development and self-beliefs

Active engagement with music can support the development of musical and other identities and impact on self-beliefs. Depending on the nature of feedback received from others these may be positive or negative. Most of the evidence supports the positive impact of music on self-esteem and self-confidence. Opportunities to perform and receive positive feedback are important in this process.

Intervention studies have shown that school-based music classes can prevent a decline in global self-esteem measures.

Most evaluations of programmes for disadvantaged children point to the positive impact on self-beliefs. This is attributed to recognition by participants of their own abilities and these being acknowledged by families and friends.

Group music making can act as a vehicle for change for children with behavioural problems leading to reductions in aggression and improvement in self-esteem. There is also evidence of positive benefits for children with autism and a range of special educational needs.

Music and health

There is increasing interest in the role of music in enhancing health. The impact of music on psychological wellbeing and subsequently good health is largely, although not exclusively, through the emotions it evokes which can be wide ranging.

Music has a particular role in the reduction of stress and anxiety and related to this the reduction of pain and the strengthening of the immune system.

Many health benefits are reported from adult participants in music making. It is likely that these benefits also apply to young people and children.

Music in hospitals has been used effectively to promote the well-being of young patients enhancing relaxation, providing distraction and helping them to cope with their hospital experiences. In some cases music making can reduce or remove the need for sedation.

There are benefits of music making to the families of children in hospital. Parents value being able to participate in musical activities with their child as this enables them to share the hospital experience.

Physical development

There is relatively little research exploring the impact of active engagement with making music on physical development despite the fact that children and adults frequently respond to music with movement.

Neuroscientific research has shown that extensive instrumental music training affects the anatomy of the brain with greater gray matter volumes in motor-related areas.

Using rhythmic accompaniment to support physical education programmes can improve performance.

Learning to play an instrument improves fine motor skills particularly when training commences before the age of seven.

Conclusions

There is accruing evidence which indicates that actively making music can contribute to the enhancement of a range of non-musical skills and lead to other beneficial outcomes.

Research continues to explore the circumstances under which these benefits may occur. A recent review of the evidence from neuroscience suggests that early engagement may be important (before the age of seven), the length of musical engagement and commitment to it, the type of training, and the instrument learned. The quality of teaching is also crucial as to whether any benefits are realised. When teaching is poor there may be no benefits and negative outcomes.

The common characteristics of musical programmes which are beneficial are emerging. They need to be highly interactive and enjoyable with opportunities for: developing new skills and performing; acquiring cultural capital; developing interpersonal bonds and solidarity in pursuing shared goals; on-going intensity and frequency of contact; developing mutual respect; and recognition and rewards for excellence. Receiving positive affirmation from others relating to musical activities, particularly performance is crucial in enhancing self-beliefs whatever the age of the participants. If performances are in high status cultural venues the impact is enhanced.

Implications for education

The research undertaken to date suggests that:

- active engagement with making music should start early for the greatest benefits to be realised;
- engagement needs to be sustained over a long period of time to maximise the benefits;
- the activities need to include group work;
- opportunities need to be available for performance;
- the quality of teaching needs to be high;
- the curriculum needs to be broadly based including activities related to pitch and rhythm, singing, instrumental work, composition and improvisation, and the reading of notation;
- to have a positive impact on disaffected and at-risk young people, the musical activities need to be in a genre with which they can relate.