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# Listening to Music: Helping Children Regulate Their Emotions and Improve Learning in the Classroom

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*by Lucille M. Foran*

Music is a universal experience. With few exceptions, all humans perceive musical pitch, tone, timbre, and harmony (Sacks 2007). We listen to music to relax, to help us think, to celebrate, and to grieve. Our emotional responses to music have been noted in literature, poetry, and drama. The power of music to evoke an emotional response is used by advertising companies, film directors, and mothers singing their babies to sleep (Levitin 2006). Early education teachers are familiar with using music and rhythm as tools for learning language and building memory. However, the potential of music to help across all special education settings is largely unexplored.

Music as therapy was originally used in rehabilitation settings in the United States for returning veterans of World War II. From the first, music therapy was reported effective for persons with traumatic brain injury, neurological conditions and diseases, and battle fatigue, later termed *posttraumatic stress disorder* (PTSD) (Sacks 2007). Work with music has been widely judged helpful in cases of psychological trauma (Stien and Kendall 2004), yet we do not know why it's helpful. The origins of music as an emotional experience, how it's processed in the brain, and why it stays in the memory so long remain largely a mystery (Sacks 2007).

For children and adolescents who have experienced trauma, the resulting impact on the brain is connected with difficulties in emotional regulation, behavior problems, poor concentration, and deficits in verbal memory (Stien and Kendall 2004). Special educators who work with traumatized children need to understand the neurological underpinnings of their students' behavioral and learning challenges and how to enhance their learning potential. This paper

will explore various uses of music to enhance emotional regulation and improve learning in children with severe or chronic trauma.

Research on how emotions and the brain work together is relatively recent (LeDoux 1996). Psychologists and neuroscientists have debated about the interactions among our “thinking” brain, the cortex, and our emotional brain. In the 1960s, studies emphasized the role of the cortex in analyzing and evaluating emotions (LeDoux 1996). The cortex *is* involved in processing emotions; it helps us to evaluate a potentially threatening situation and to “look before we leap.” However, more recent research has shown that emotional reactions can take place without conscious awareness (Zajonc, cited in LeDoux 1996, 53). The limbic system of our brains has been found to be the center of emotional processing. Two parts of the limbic system, the hippocampus and the amygdala, appear to help us keep emotionally laden events in our long-term memory (Sousa 2007). Researchers have concluded that we experience emotional feelings when three events occur in our brains: activation of the amygdala; activation of our arousal system by neurotransmitters; and bodily feedback, such as heart-pounding or other physical reactions (LeDoux 1996). Therefore, the cortex, which helps with our ability to control our emotional reactions, is not necessarily involved in all emotional experiences.



Early interactions between parent and infant are regulatory experiences, i.e., experiences that help the young child manage stress and proceed through development. Repeated interactions with a responsive caregiver support secure attachment and help young children's brains organize sensory functioning and represent their social world (Calkins 2004).

Healthy emotional development requires each child to control personal feelings and behaviors as well as connect with caregivers. Developing the ability to manage behavior and feelings, that is, emotional regulation, is critical for a child's mental and physical health. Healthy emotional regulation is connected with higher academic achievement, lower levels of negative emotionality, higher levels of empathy, and higher levels of social competence (Eisenberg et al. 2004).

Schore (1994) studied the neurological bases for the development of healthy emotional attachment and regulation. He found that the development of an infant's orbito-frontal cortex, which has extensive connections with the limbic system, depends on interactive experiences with caregivers. He further discovered that positive emotional interactions between child and caregiver increased production of the neurotransmitter dopamine, which in turn led to growth spurts in the prefrontal cortex. Schore also found that norepinephrine helps in the growth of the pathways descending from the cortex to the lower brain in toddlers. Those descending pathways help exert cognitive control over emotional reactions arising from the limbic system (Schore 1994).

Patterns of emotional regulation are evident very early in development (Calkins 2004). On one hand, for example, securely attached infants appear to seek out other people when presented with a stranger or coping with removal of and reunification with their primary caregiver. On the other hand, insecure and avoidant children use self-soothing or solitary play more often, which does not predict success (Calkins 2004). Healthy children follow developmental steps that require continual learning, including development of receptive and expressive language, problem-solving skills, and social competence (Stien and Kendall 2004). For the child who has limited capacity for emotional regulation, the effects of insecure attachment and emotional dysregulation are pervasive. When lack of attachment and emotional regulation is due to trauma, the effects are literally written into the child's brain (Stien and Kendall 2004).

Recent development in neuroscience has shown that brain development is ongoing: life experiences affect brain circuitry. Connections between neurons in turn affect behavior. About

one-fourth of human genetic material depends on environmental stimulation for its activation. Interactions with the environment can produce either positive or negative changes in gene expression. By activating genes, positive experiences can strengthen healthy neural connections and promote cognitive and emotional development. In contrast, neglect and abuse bring about chemical and hormonal changes that prevent the development and integration of brain systems (Stien and Kendall 2004).

Martin Teicher and Bruce Perry both found inferior verbal abilities in children with known histories of abuse or neglect (Teicher, Perry, cited in Stien and Kendall 1994, 123). An underdeveloped left hemisphere interferes with the development of language and higher-reasoning skills (Stien and Kendall 2004). By affecting children's thinking styles, trauma also creates rigidity that interferes with cognitive development. The brains of children with a history of trauma show reduced blood flow to the cerebellum, a smaller corpus callosum, and less-integrated activity between the hemispheres (Stien and Kendall 2004). When the two hemispheres aren't working well together, thinking and emotional processing are both impaired (Hoptman and Davidson, cited in Stien and Kendall 2004, 109).

The emotional effects of trauma can be observed in the interactions and behaviors of children with PTSD. Bruce Perry noted that trauma sensitizes the brain's fear system, causing hyperarousal and damaging the hippocampus and particularly the left hemisphere. Primitive behaviors, such as temper tantrums and other reactive behaviors, persist beyond age-appropriate expectations when the brain's fear system is activated and oversensitive, not mediated by a well-developed cortex (Perry, cited in Stien and Kendall 2004, 111). A neurological explanation has also been found for the intrusive and persistent negative emotional memories associated with PTSD (Stien and Kendall 2004). Several researchers have found a decrease in the volume of the hippocampus in adults with histories of child abuse (Bremner, cited in Stien and Kendall 2004, 104). It's thought that too much cortisol, produced in times of stress, damages the neural networks and affects the hippocampus so that it is less able to regenerate neurons (McEwen, cited in Stien and Kendall 2004, 134).

There is general agreement on the emotional and behavioral symptoms associated with PTSD. Dissociation, amnesia, flooding of memories and feelings, flashbacks, numbing or feeling emotionally constricted, inability to plan for the future, poor self-esteem, tendency to self-mutilate, tendency to repeat being a victim of abuse, and depression are all recognized as part of the PTSD diagnosis (Herman 1997). Of those symptoms, emotional dysregulation and

hyperarousal are among the most frequently cited and almost always the focuses of early phases of treatment (Stien and Kendall 2004).

Bessel van der Kolk and others found that emotional dysregulation is the most far-reaching effect of children's trauma. Constant dysregulation creates nervous system crises, which activate the body's calming mechanisms (van der Kolk and Fisler, cited in Stien and Kendall 2004, 113). The process creates a repeating mechanism as the child learns to create crisis to experience fleeting calm.

LeDoux (1996) frames psychotherapy as a process in which the cortex is helped to gain control over the amygdala. How does treatment for trauma "rewire" the brain? Stien and Kendall (2004) recommend helping children process experiences through as many modalities as possible, including visual images, thoughts, movement, emotions, and sensations. Children in treatment are taught to use relaxation methods, meditation, and comforting routines. Recall that not all emotions are processed through the cortex (LeDoux 1996). Emotionally dysregulated children seem to "go from zero to sixty" in seconds. Frequently, we expect traumatized children to learn quickly new ways to express their feelings. Research has shown that it takes repeated efforts to re-wire the brain to experience and manage feelings more consciously, so that the thinking part of the brain can come into play (Stien and Kendall 2004).

An important method of establishing emotional regulation in trauma survivors involves music and movement (Stien and Kendall 2004). Recently, Daniel J. Levitin (2006), a neuroscientist and former musician and record producer, has investigated in detail how music affects brains, thoughts, and emotions. The regions of the brain that develop into the auditory cortex, the sensory cortex, and the visual cortex are all undifferentiated in the human infant. Levitin finds that music engages all the sensory areas and facilitates their differentiation and development. By engaging the cerebellum, the motor cortex, and the frontal lobes, music also plays an important role in language development (Levitin 2006). Music activates both hemispheres of the brain and helps with transferring information from one side to another (Stien and Kendall 2004). According to Sacks (2007), listening to music activates the motor cortex, subcortical structures, and the cerebellum. Research has shown that children with high levels of music training have increased ability to manipulate information in working and long-term memory. Children who practice music have better skills in geometric representation and reading (Gazzaniga 2008). Children appear to process music in both hemispheres, regardless of whether they are formally trained (Levitin 2006).

Sacks (2007) believes that music has a special relationship to memory. He argues that music embeds and activates sequences of knowledge and action when other forms of information fail. Levitin (2006) points out that the brain processes music components in a unique way: musical pitch is directly mapped in the brain. Electrodes placed in the brain show exactly what pitch a person is listening to because the electrodes emit activity at the exact frequency of the sound being played. Levitin explains that when someone is listening to music, the sound first enters the cochlear nuclei, the brain stem, and the cerebellum, and it then moves up the auditory cortices on both sides of the brain. Following along with familiar music brings in the hippocampus and the inferior frontal cortex. Tapping along with the music activates the cerebellum's timing circuits. Performing music involves the frontal lobes and the sensory and motor cortices, and trying to recall lyrics of familiar music brings in the language areas (Levitin 2006). Music exercises more parts of the brain than almost any other single activity. Especially for children with learning problems, listening to music appears to help students access parts of their brains that function poorly or not at all.

Levitin finds that a predictable beat is needed for music to move us. Levitin used functional magnetic imaging to analyze which neural pathways were followed when listening to music. He found that the auditory cortex was activated first; then the frontal lobes; then the limbic system, transmitting dopamine; and finally the nucleus accumbens, the center of the brain's reward system. Based on the brain's pathways, listening to music is wired to improve our mood (Levitin 2006).

Fran Herman (1996), a music therapist, described a case in which a nine-year-old boy with a trauma history responded to music therapy after other therapies had been unsuccessful. Severe depression, aggressive acting out, and emotional dysregulation had prevented the child from participating in school. Initial music-therapy sessions focused on increasing his attention span and helping him to enjoy self-expression. Gradually, he improved his ability to take turns and curbed his impulsivity. Herman reported that after completing the formal music-therapy sessions, the boy was able to attend school and learn to read. Another music therapist reported the case of a thirteen-year-old rape victim who had low intellectual functioning and PTSD. Five sessions of music therapy that encouraged her to improvise music were found to have improved her confidence and helped her manage her extreme anxiety (Henderson 1996).

Music's brain pathways are rich and multiple. Music processing, which involves both ancient and new structures in the brain, may

have preceded the development of human speech (Levitin 2006). It appears to encode so deeply that people with amnesia, aphasia, stroke, depression, and other disorders can use music to improve their moods, recall lyrics, and manage anxiety (Sacks 2007).

Teachers are seldom music therapists, and very few of them are trained musicians. How can they add music to classroom experiences for children with PTSD? Some classrooms start the day with three to five minutes of classical music as a soothing and attention-focusing tool (Gold 2008). Other classrooms are learning math using “Math Songs” or practicing reading with music and movement (Prescott 2005). Classical music such as that of Mozart, Haydn, Vivaldi, Bach, or Handel can help students concentrate; more-romantic classical music, such as Debussy’s or Ravel’s, is suggested for creative assignments. Popular music and jazz, as long as they possess predictable rhythms and dissonant notes are not used, can also aid attention, emotional regulation, and memory.

The need to regulate emotions in children’s trauma recovery is paramount (Herman 1997). Failure to self-regulate affect has been connected with later diagnoses of major mental illnesses, including psychosis, borderline personality disorder, and drug and alcohol abuse, among others (Schoore 1994). In contrast, developing or repairing emotional regulation brings great rewards for the child or adolescent trauma victim. Children’s ability to self-regulate predicts high social competence, high academic success, low levels of negative emotion, and even higher SAT test scores (Eisenberg et al. 2004).

We are fundamentally emotional and social creatures (Immordino-Yang and Damasio 2007). The role of emotion in education is gaining increased attention as neuroscience demonstrates what good teachers already know: emotions affect student performance. Researchers agree that emotional processes are required for the skills and knowledge taught in school to enter into long-term memory and to transfer to real-life situations (Immordino-Yang and Damasio 2007). When a student is anxious, stressed, and emotionally reactive, the amygdala responds by blocking the absorption of sensory input (Willis 2008). Under those circumstances, information taught cannot enter long-term memory processed in the hippocampus. Teachers are learning that they need to activate the brain’s emotional systems to help students remember and apply what is being taught (Willis 2008). Students with trauma histories are primed to over- or under-react to emotional experiences; their immediate tendency is to make connections to their trauma experiences (Herman 1997). The enormous challenge of teaching students with PTSD is to help them manage their emotional responses when they are asked

to focus their attention, call up relevant memories, and make associations in order to learn (Immordino-Yang and Damasio 2007). If a classroom music program could help improve emotional regulation for those students, the benefits would support increased learning and better outcomes as adults. The evidence to date supports music's positive role in helping traumatized children, particularly in therapeutic and classroom settings, manage their emotions, activate brain pathways, and learn new cognitive and emotional information.

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