

Bridging Music Neuroscience Evidence to Music Therapy Best Practice in the Early Childhood Classroom: Implications for Using Rhythm to Increase Attention and Learning

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ABSTRACT: Recent research efforts in music neuroscience indicate that rhythm can have an effect on attention in adults and engagement in young children. Research in clinical music therapy and on music enrichment also shows that music affects attention and learning in the early childhood classroom. The authors suggest that findings from the research in music neuroscience can be applied when exploring the effect of rhythm on learning in early childhood classroom settings. Forging a new line of research in which defined rhythm-based protocols are tested has important implications for both early childhood music therapy and education.

The influence of music on human behavior has been evident since the dawn of primitive societies (Mithen, 2007). The functions of music in human society have been as entertainment and in the context of medicine, religious rituals, and social gatherings (Merriam, 1964; Patel, 2008). Even socio-historical examinations of the lives of famous scientists reveal vital influences of music. Albert Einstein, the most famous physicist of 20th century once described his deep love of music: "If I were not a physicist, I would probably be a musician. I often think in music. I live my daydreams in music. I see my life in terms of music."

Not only did Einstein love music but he also described music as an extension of his thinking process, a method of allowing the subconscious to solve difficult problems (Hansen, 2001). The effect of rhythm on cognitive processes in humans has also become increasingly recognized by researchers (Patel, 2010; Thaut, 2005; Zentner & Eerola, 2010). Consequently, a confluence of educators, music therapists, and music neuroscientists is forging a way for investigations that explore how music can enhance students' academic achievement in educational settings.

Some of the more interesting music neuroscience findings indicate that rhythm-based protocols effect attention with adults (Thaut et al., 2009) and that very young children also are engaged more when they listen to steady beats (Zentner & Eerola, 2010). These findings are consistent with literature on music therapy best practice in classrooms that show that rhythm is used to engage children during academic lessons (Humpal & Colwell, 2006). The findings from these two lines

of research suggest a potential for further exploration into the relationship between rhythm and learning.

The evidence on the effect of rhythm on brain processes and learning has the potential to impact current practice in music therapy and education in a positive way. Therefore, the purpose of this article is to show how these two lines of research can promote development of innovative rhythm-based teaching practices in the classroom. This purpose will be accomplished by providing information to (a) heighten awareness of the effect of rhythm on attention behaviors, (b) demonstrate how the current evidence found in the music neuroscience research on attention can potentially inform and promote more early childhood music therapy research, (c) explain the need to develop, define, and test rhythm-based protocols to promote increased attentive behaviors and learning in the early childhood classroom, and (d) provide examples of how music-based protocols have been shown to effect improved early literacy and how specific rhythm-based protocols can have the potential to improve early mathematics learning.

Music Neuroscience Research

Leading researchers in music neuroscience are providing preliminary evidence on how music and rhythm can improve brain process by affecting various brain structures (Bengtsson, 2008; Conway, Pisoni, & Kronenberger, 2009; Patel, 2009; Thaut, 2005). These discoveries have led to inquiry into how rhythm optimizes increased attention behaviors for adults during group rehabilitation therapy settings (Thaut, 2005; Thaut et al., 2009). The evidence is also emerging on what brain structures are affected when humans listen to rhythmic stimuli such as steady beat (Grahn & Brett, 2007; Patel, 2008; Zentner & Eerola, 2010). As more research evidence on how the brain of a young child responds to rhythm emerges, this knowledge has the potential to inform us on how rhythm affects attention in young children.

The idea that steady beat has a significant physiological effect on brain processes is evident in the music therapy research area of Neurologic Music Therapy (NMT). For over 15 years, Dr. Michael Thaut and colleagues have studied how rhythm applied in a systematic manner can optimize brain functions. He found that patients with sensorimotor deficits who typically walked with an uneven gait would instantaneously synchronize their steps to a rhythmic steady beat stimulus (Thaut et al., 2007). As the preponderance of

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evidence on how rhythm facilitates improved cognitive processes became clear, Dr. Thaut and colleagues expanded their work to cognitive rehabilitation, including attention. Studies on how rhythm can improve focused, sustained, selective, alternating, or divided types of attention behaviors in adults and children are emerging (Kim, Wigram, & Gold, 2008; Mateer, 2000; Sohlberg & Mateer, 1989; Thaut et al., 2009). This groundbreaking evidence on improved attention in adults lays the groundwork for further study on how rhythm can affect brain processes involved when children need to maintain focused attention, just as in classroom activities.

Recent music neuroscience research indicates that rhythm, specifically a steady beat, does affect engagement behaviors in children. Zentner and Eerola (2010) found that 120 infants, ages 5–24 months, were more engaged with rhythm only stimulus (e.g., dry steady beats) versus speech only stimulus. They spontaneously moved to the rhythm and smiled more when they were in synchrony with the steady beat. The results of this study indicate that children have the potential to be more rhythmically engaged when listening to steady beats rather than when listening to verbal only instructions. Therefore, it is conceivable that when listening to a steady beat rhythmic pattern during teaching activities in the early childhood classroom, children most likely will be more engaged, more specifically show increased levels of focused attention.

Music Research in Early Childhood Classrooms

Although clinical research in early childhood music therapy has not yet considered specific musical elements such as rhythm and steady beat, clear links have been established between music and learning. For example, developmentally appropriate music therapy techniques have been shown to improve children's attention in the early childhood classroom. Standley and Hughes (1996) provide evidence on how children in an inclusive preschool classroom environment attended better during music therapy intervention vs. typical teaching strategies without music. Results indicated that 97% of students had sustained attention and 90% of the students completed teacher directed tasks accurately during music therapy intervention. In addition, in Robb's study (2003) young children with visual impairments were shown to attend significantly better with music intervention vs. a play-only condition.

The music research is also showing how music therapy techniques can support learning outcomes, such as in literacy and mathematics. Register (2001) found that adding developmentally appropriate music therapy sessions for children in an early intervention program improved aspects of word recognition. Dr. Deforia Lane and colleagues helped children from low socioeconomic status (SES) homes learn literacy skills, mathematical concepts, and appropriate social interaction with peers with music therapy techniques (Lane & Gallagher, 2008). A "Programmatic Music Therapy Service Delivery" model, developed by Furman and Humpal (2008), clearly outlines how music therapy can support various areas of early childhood educational standards, including learning objectives in literacy and mathematics.

Another area of research in early childhood specifically focuses on music enrichment studies to improve academics. These studies, designed to investigate the benefits of integrating the arts into instruction, have yielded particularly interesting evidence regarding early mathematics outcomes. For example, Harris (2007) found that a music-enriched educational program for children ages 3–5 increased math scores on the Test of Early Mathematical Ability (TEMA-3). In this study, an experimental group received a music-enriched Montessori experience that was designed to teach concepts of pitch, dynamics, duration, timbre, and form as well as skills in moving, playing, listening, singing, and organizing sound. Students who received the treatment had a higher level of mathematics achievement than those who did not receive the music instruction. According to Edelson and Johnson (2003), music also enriches the mathematical learning environment for children because such activities are infused with a degree of pleasurable intensity, promote the fun of learning, and allow the child to be an active participant.

Bridging Neuroscience Evidence to Classroom Practice

In a keynote speech to music therapists, Dr. Aniruddh Patel, a leading music neuroscientist, spoke of the need for music therapists to conduct studies that link laboratory evidence to outcomes in real-world settings (Patel, 2009). Early childhood music therapy researchers can now begin to establish a link from how rhythm affects brain processes in children to its effect on improved learning in the early childhood classroom. There is preliminary evidence that shows that steady beat has an effect on attention and engagement in children (Kim et al., 2008; Zentner & Eerola, 2010). We also know that music therapy and music enrichment can support improved attention and learning (Edelson & Johnson, 2003; Furman & Humpal, 2006; Harris, 2007; Lane & Gallagher, 2008; Register, 2001; Robb, 2003; Standley & Hughes, 1996). What we need to discover is if there is a specific music-based stimulus that facilitates improved attention and learning. Could it be rhythm?

The implications of confirming this hypothesis are potentially powerful. Imagine what might happen when a teacher simply adds a repeated rhythm, such as a steady beat, as an auditory stimulus when teaching. If the evidence in the research holds true, we would see children exhibiting improved attention and engagement while learning. Also, as disruptive behaviors of nonattentive students decrease, it is conceivable that we would then observe stress-related behaviors of teachers also decrease, allowing for a more enjoyable learning environment for both students and teachers.

Based on the neuroscience evidence that a rhythm can facilitate improved attention and the educational evidence indicating that music promotes attention and learning, Geist (2008) conducted a study to observe the effect of a steady beat stimulus on engagement and learning. Teachers of 3- and 4-year-old students were asked to teach mathematics lessons with and without implementing a rhythmic stimulus. Prior to the math/music group lessons, the teachers were trained to implement the following steady-beat protocol. The procedures were defined as beginning the group instruction by chanting,

"Let's keep a beat" and the teacher would then begin patting her lap to a beat of a song that she was about to chant or sing. When all the children in the group were tapping the beat on their laps or looking at her, she would then begin the mathematics lesson by chanting or singing the words created for the activity, while simultaneously continuing to tap the steady beat on her lap. The study included 30 children (two classes, 15 students in each) and five teachers (two for each class & one instructional assistant for a student with special needs). Engagement was evaluated through documentation of observed behaviors. The analysis indicated that students showed more active engagement, focused and sustained attention, during the math/music lessons as compared to math only instruction. Teacher journal analysis comparing pre math/music intervention to post math/music intervention entries indicated that teachers were impressed and surprised at the level of attention of children when the steady beat stimulus was used. When interviewed individually, all but one child either tapped the beat and/or sang a song as part of an answer when was asked to explain a particular mathematics concept (see also Geist, Geist, & Kuznik, 2012).

Based on these results, a rhythmic stimulus could be used to facilitate increased attention and optimize learning in an early childhood classroom setting. In fact, follow up quantitative inquiries could then determine to what degree steady beat positively effects attention in children. Future studies could not only test the feasibility of the rhythmic protocol described but could then provide a replicable protocol that could be implemented and tested in any early childhood classroom. This new line of research could also help music therapists further define their work and represent best practice. This potential is only overshadowed by how important it will be to provide an easy-to-learn teaching strategy that any teacher could use in their classrooms for any child.

Summary

Currently, music neuroscience researchers are providing evidence on how the brain reacts to rhythmic stimulus, such as steady beat, with significant results in regards to facilitating improved attention. Music therapy clinicians commonly use rhythm-based techniques to promote improved attention and learning in the early childhood classroom. In addition, music therapy and music enrichment research is showing that music can have a positive effect on attention, and improved literacy and mathematics. These findings suggest the need for a new line of research in early childhood music therapy. The purpose of this research would be to consider the current evidence and transfer this knowledge in order to observe the effect of rhythm on attention and learning with young children.

Possible Challenges

The challenges we face as we explore this new line of research are two-fold. In order to provide studies that test the effectiveness of specific rhythm-based protocols, the research methodology needs to be of an experimental design. This requires the researcher be trained in these methods and have access to a setting with a sample appropriate for this type of inquiry. Once the evidence of best practice is available, we as

music therapy clinicians will need to be ready to promote ourselves as more than service providers for students diagnosed with special needs. Our scope of practice would appropriately expand to serve all children.

By reviewing the early childhood music therapy research studies from 1995 to 2005, the authors determined that most studies were conducted by music therapy clinicians at their own particular facility. Also, most of the studies were designed as qualitative case study design, or involved a small subject sample (Humpal & Colwell, 2005). While these types of research designs are valid and certainly add to the knowledge of the literature, they are not the best research designs to test the effectiveness of a treatment protocol. Effectiveness studies will need to be conducted by researchers trained in advanced research methods and optimally set at schools with large sample sizes of subjects in order to observe the effect. The authors do recognize that single case design studies also have the potential to demonstrate an effect without, of course, the ability to generalize to the population.

The potential to serve more children in early childhood education can be realized if music therapists are willing to consult with teachers on how to use music effectively. Teachers could then be trained on how to use rhythm-based interventions, such as steady beat, in large group classroom settings. Children from low socio economic status (SES) homes who are not diagnosed with a disability but exhibit attention difficulties will then be able to reap the benefits of music therapy. Trained by a music therapist, teachers would be able to deliver the rhythm-based protocol in the classroom themselves on a daily basis, allowing for many more children to benefit from the rhythm-based facilitation for increased academic performance.

Conclusion

The authors hope that the reader has achieved a heightened awareness of the current literature regarding how rhythm affects attention and learning with young children. We also hope that the reader has come to his/her own conclusions on how important it is that we as music therapists practice with this knowledge in mind. Conducting systematic inquiry in order to develop best practice rhythm interventions will not only improve the lives of students but will also heighten the awareness of the importance using music to support improved academics. The authors also hope that the reader will have gained insight and appreciation for the need to research the effect of music on early mathematics with children. As Albert Einstein recognized how powerful music can be to thinking, we, as the carriers of the music, must continue to conduct evidenced-based inquiry to advance and improve our practice for all those in need of music therapy services.

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