UTILIZING MUSIC TO TEACH BASIC SPATIAL CONCEPTS TO PRESCHOOL CHILDREN: THE IMPACT ON ACQUISITION

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Utilizing Music to Teach Basic Spatial Concepts to Preschool Children: The Impact on Acquisition

Boehm (1986) refers to a concept as the “changeable common qualities of various objects.” Basic concept words include terms that refer to quantity, quality, position, or time/sequencing. Concept words are heavily used in instructions given by teachers to children as early as kindergarten. A child’s basic concept knowledge is central to academic performance (Boehm, 1986).

Uyanik-Balat and Guven (2006) examined the basic concept acquisition of children who attended pre-school compared to those children who did not. They determined that children who had experienced a school setting scored higher on basic concept testing. Because these words are considered high-frequency in school-based instruction, children who attend pre-school have more exposure to the concepts than those who do not. This finding is also applicable to children from lower class families who may not have the same exposure to concepts as children of a higher socioeconomic class. Uyanik-Balat and Guven also found that children who performed well on measures of basic concept knowledge typically came from higher socioeconomic status homes.

Typically, children begin developing knowledge of spatial basic concepts very young, beginning at approximately 24 months of age. Some of the earliest developing concepts include the words up, down, in, and on. However, among children with language impairments, these function words are often not easily acquired until later in age (Watkins & Rice, 1991). That said, studies have shown that various teaching methods (positive and negative exemplars, direction instruction, indirect instruction, and
incidental teaching) can elicit significant gains in concept understanding even when provided through large group instruction (Sefiert and Schwarz 1991, Wilson 2004).

In recent years, however, there have been a large number of products released aimed at parents and early educators suggesting that music is the best means to teach early developing concepts to children. The Baby Einstein company alone makes over one billion dollars from sales a year (della Cava, 2002). Advertisers suggest that toys, television shows, and DVDs that utilize music as a teaching tool help children learn to read, count, or perform any number of tasks quicker and more effectively than non-musical models. For example, McGuire (2001) researched the amount of music on the show Barney & Friends (HiT Entertainment, 2008) and found that 92.2% of the show contained music. This television show is aimed at preschool aged children and promoted as educational. This leads to the question of whether music is as therapeutic and educational as it is being portrayed or whether the typical experiences of children are enough to teach them concepts in their environment. Despite its seemingly recent popularity, music has actually been used as a therapy tool for years.

According to the American Music Therapy Association, Inc., music therapy is “the clinical and evidenced-based use of music interventions to accomplish individualized goals within a therapeutic relationship by a credentialed professional” (2007). Music therapists can be certified through more than 70 approved music therapy programs and must pass a national examination. This therapy includes several different aspects and is often only part of a larger interdisciplinary program. Typical therapy activities include singing, listening, moving, and playing.
Music therapy has been used to address many areas of development including behavioral, cognitive, physical, psychological, sensori-motor, emotional, communicative, and social. Typically, therapy based on music is used with children more often than adults (American Music Therapy Association, Inc., 2007). The American Music Therapy Association, Inc. suggests that music stimulates children on many levels and utilizes all of the senses, resulting in a multi-modal therapy that also encourages children’s emotional well-being. The association describes music therapy as being play-based, motivating, calming, relaxing, and success-oriented. Music has been used in therapy to not only address developmental skills but also to manage pain and stress and encourage socialization and self-expression. Music therapy advocates argue that music is processed in both hemispheres of the brain, suggesting it can therefore improve both cognitive functioning and speech and language skills (American Music Therapy Association, Inc., 2007).

Music therapy research has been identified as including a behavioral design approximately 15.8% of the time (Gregory, 2002). The behavioral approach in music therapy is often used to reverse inappropriate behaviors in children using consequences and reinforcement. Mostly, however, music therapy is used to supplement academic teachings. Register (2001) performed a study evaluating the effectiveness of a music curriculum for early intervention on pre-reading and writing skills. The experimental group spent their sessions learning thematic material only through music while the control group was taught through traditional multi-modality means. After an entire school year, the posttest revealed the experimental group had a slightly significant greater understanding of the prewriting and print concepts than the control group. The
experimental group also exhibited higher scores on logo identification and word recognition. Few studies exist in the literature regarding the effectiveness of music therapy on other areas of development.

Kennelly, Hamilton, and Cross (2001) showed many parallels between vocal skills and speech/language development and emerging music skills. This leads one to believe that the disciplines of speech language pathologists and music therapists could work well together to facilitate rehabilitation of some patients, especially since children learn faster through play, which music utilizes well (Birkenshaw, 1982). Kennelly, Hamilton, and Cross (2001) described case studies in which music therapists and speech language pathologists provided services as an interdisciplinary team to children with acquired brain injury. Joint therapies included the areas of vocalization facilitation, enhancement of vocal quality, improved breath support, prosody (the rhythm and intonation of speech), social uses of language, and speech rate. In the case of a 12 year old girl, speech activities were targeted by the music therapist using the girl’s favorite musical group, the Spice Girls. Because of the familiarity of the songs, the patient exhibited increased motivation and enjoyment compared to typical speech activities. She also increased her rate of speech and furthered her pitch and intonation range. Throughout the remainder of the girl’s hospital stay, music therapy focused on emotional support and motivation while speech therapy focused on language skills. This case study exhibited the benefits of adding music therapy to an already established speech therapy program. While quantified data was not provided, it was further suggested that improvements occurred more rapidly than would have been expected via traditional treatment methods.
Music has also been used by speech language pathologists alone in therapy plans for certain patients in hospital or rehabilitation facilities including those exhibiting aphasia (word-finding difficulties) or apraxia (word-forming difficulties) following a stroke. Most of speech is a combination of melody, rhythm, and gestures, so music lends itself for use in this field (Hoshizaki, 1983). Melodic intonation therapy (MIT) encompasses three elements: melodic line, rhythm, and word stress (Sparks & Holland, 1976). Short phrases are presented to the patient using only three to four repeated musical notes with appropriate stress. The patient is encouraged to repeat the utterances in the song-like manner. This therapeutic activity has been shown to increase the functional vocabulary of the previously mentioned patients. It is also used to aid in articulation due to its slow, lyrical quality. The use of rhythm and melody has been found to improve organization, sequencing, and verbal memory skills (Kennelly, Hamilton, & Cross, 2001). Additional clients that may receive a musical form of therapy from speech language pathologists include those emerging from a coma, presenting with dysarthria, having acquired head injuries, or exhibiting problem solving or abstract thought difficulties (Kennelly, Hamilton, & Cross, 2001). With patients in a coma, music is an effective yet gentle way of providing stimulation therapy.

When adults or children begin to produce long or complex sequences such as those in speech or music, they must plan what is to be produced next and when to produce it. These planning decisions are called the serial order problem and the timing problem, respectively (Palmer & Pfordresher, 2003). Because of the predictability inherent in rhythm, musical sequences are easy to remember. Palmer and Pfordresher (2003) stated that the higher order units (the musical phrases) help in retrieving the lower
level units (the words of the phrase), leading to a more efficient use of short-term memory. This provides more evidence that utilizing music in speech therapy can aid in learning and remembering concepts.

Zoller (1991) stressed the nonverbal benefits of using music in speech therapy activities. She suggested that “musical activities surpass physical, cultural, intellectual, and emotional limitations (p. 272) and benefit clients wholistically”. She noted that speech language pathologists have used music outside of hospital or rehabilitation settings to address deficits in the following: auditory attention, perception, memory, spatial relationships, vocabulary development, gross motor movement and planning, socialization, imagination, creativity, and body image.

In her article, Zoller described the process for incorporating music into speech-language therapy sessions. Music can be played in the background to promote relaxation, facilitate verbal expression and language development, address gross motor movement, or provide accompaniment for other activities. She advised, however, that it is best to address concepts through music only after initial training through traditional therapy activities. When choosing songs, Zoller listed the following criteria:

1. Select simple songs with easy rhythms and a small vocal range
2. Start with songs in a lower pitch range and then expand
3. Choose songs that encourage movement
4. Pick songs with repetition of words and melody
5. Use concrete songs that involve activities familiar to the children
6. Make sure the children know the other words in a song when introducing a new one
7. Choose songs with common names and syntax

8. Select songs in advance and teach them early (p. 274)

Two methods in particular are promoted by Zoller: calling melodies and call and response singing. Calling melodies, during which the speech language pathologist uses the names of children in or after the songs, can improve eye and body contact. Call and response singing involves echoic singing between the speech language pathologist and students and may increase auditory perception abilities. Breathing and vocalization can be addressed by having children string together syllables and repeat them in a rhythmic fashion, almost like a baby babbling. She suggests that a multi-modal approach to therapy which involves many senses is the most likely to produce results.

Verhallen, Bus, and de Jong (2006) performed a subsequent study to judge whether the use of multimedia stories versus typical stories in book form would increase the ability of a child to remember details. They argued that adding music and sounds may provide children an additional set of tools with which to process and synthesize incoming information. The results of their study showed that the vocabulary of the children who experienced the multi-modal stories increased but the vocabulary of the children who only experienced the static stories did not. Children were also able to recall 55% of the details from the multimedia stories, while only 39.12% of the static story elements were recalled. This increase in vocabulary and detail memory was also noted in a group of “at-risk” children studied.

Despite the few studies noted, relatively little research has been conducted to discern the effect of music on learning among children. Because of increased popularity, it is necessary to study the possible benefits of using music for teaching purposes. As
basic concepts are the building blocks of an early education, investigation regarding the impact of musical teaching methods on this skill acquisition is imperative. Previous studies have shown the benefits of using music to improve vocal functioning, cognitive skills, and speech. It is therefore hypothesized that music will have the same impact on spatial concept acquisition. The purpose of this study is to judge whether concepts taught through music are learned more effectively than those taught through play alone. This finding would add to the approaches typically used by teachers and speech therapists for teaching concepts and would help to validate the treatment methods already being used by music therapists. It is theorized that there will be a difference in score improvements between the two presentation modes of music and play with music leading to a greater knowledge gain.
Method

Research Design

This study incorporated a pre/post-test design. The relationship examined was whether the presentation method of basic spatial concepts (either through music or play) impacts concept knowledge. Each relationship (the impact on concept knowledge from both music and play presentation modes) was examined separately within each child. The post-test results of the two presentation methods were also compared within each child. A final correlation between presentation mode and concept knowledge was drawn for the group of children as a whole. This design fostered evaluation of the impact of the independent variable (the presentation method of the spatial concepts) on the dependent measure of concept knowledge. This study was reviewed and approved by the Internal Review Board (IRB) of Ball State University.

Participants

Nine children between the ages of two and five participated in this study. Eight participants were students in a pre-school class at a Head Start facility in Muncie, Indiana. This class was chosen because it was a class for children who were typically developing, without known communication disorders and the teacher was willing to accommodate the researchers. One child was enrolled in sessions at the Ball State University Speech Language Clinic for therapy not affecting his performance in the study. Parents received written information describing the study and provided signed permission allowing their children to participate. All children were formally evaluated previously by either the speech pathologist at the Head Start facility or the student clinician at the Ball State University Speech Language Clinic in the area of receptive
language and exhibited scores within normal limits. These nine children were chosen from among their peers due to their lack of concept knowledge prior to intervention.

*Instruments*

The researcher developed a pre-test utilizing three picture scenes. Each picture scene tested the knowledge of one concept pair (three concept pairs total: behind/in front, over/under and top/bottom). Children were called to identify an object in space by pointing to the object (i.e. “show me the ___ on the top”). Responses were marked as either correct or incorrect. No cuing or prompting was used. The same three picture scenes and question sets were used as the post-test to judge improvement after the intervention. For the intervention portion of the study, the researcher developed two songs per concept to be used for teaching. The songs all followed the tunes of popular, public-domain children’s songs such as “Row, Row, Row Your Boat.” The songs can be viewed in Appendix A and were written to include multiple presentations of the target concept. The concepts taught through play involved improvised, child-led activities and interactions involving much repetition of the chosen concept.

*Procedures*

The researchers traveled to the Head Start facility to work with most of the children. The student clinician of the child chosen from the Ball State University Speech Language Clinic administered both the pre- and post-tests and the intervention. Pre-testing was completed in one day (Friday). Interventions were conducted with each child on both the following Monday and Wednesday. Post-testing was concluded that Friday. One child received her second intervention Friday morning while the remaining children were post-tested. Her post-test followed the final child. All children in the Head Start
classroom were pre-tested on all three concept pairs to determine their pre-existing knowledge. Children were included in the study if they received a score of 50% or less on questions regarding at least one concept pair. After pre-testing, nine children met the established criteria. Each child was assigned the concept pair on which they scored the poorest. Participant/target concept pairings were assigned in this manner to allow for as much improvement as possible.

The intervention portion of the study consisted of two one-on-one sessions per child. Each session was approximately 15 minutes long. The concept taught using music was introduced in the first half of each session and the concept taught through play was targeted during the second half. During the music portion, the researcher sang each song for that concept multiple times. The children were encouraged to sing along. As the songs were being sung, the researcher was also playing with appropriate toys as mentioned in the songs. The second half of the session involved toys of the child’s choosing. The researcher participated in parallel play with the child while providing multiple models. The main researcher (a graduate student in speech-language pathology) was the sole interventionist. Assistants during the pre-test were also graduate students. This study was performed under the supervision of a licensed and certified speech-language pathologist.

_reliability & validity_

Each child received the same songs and play materials according to their assigned concept pair. To further ensure reliability, a sole researcher performed every intervention, excluding the one child from Ball State University. Performing the study in this manner ruled out any possible interjudge errors. Interjudge reliability was also improved by the use of pre- and post-tests with clearly defined questions and responses. As was previously
explained, all concept pairs chosen were age appropriate to ensure validity. Parents and teachers were told to avoid specific teaching of the given concepts until the post-test was completed to ensure that all results were indicative of the child’s response to intervention from the study and not from outside direct instruction. The short length of the study decreased threats to internal validity that may have arisen from typical maturation.

Results

A two-factor ANOVA with replication was completed to determine any significant differences between concept presentation mode and learning. No statistical significance was determined between the two presentation modes (p=.88). Seven out of nine children made gains through the musical presentation mode. The average score among these children went up by 1.71 with a low gain of one and a high gain of three. The effect of teaching concepts through play resulted in six of nine children making gains. The average score among these children went up by 1.67 with a low gain of one and a high gain of three. See Figure 1 for a graph detailing child-specific results. As is shown, gains between both presentation methods were almost equal, resulting in the low significance. One finding unrelated to the topic of this study is important to note, however. It was found that the improvement in scores combining both presentation modes from pre- to post-test was statistically significant (p<.01). After the intervention period for all concepts (without separating the two presentation modes), scores went up an average of 2.44 per child.
Discussion

Summary of Results

As was shared in the previous section, there was no statistical significance relating to presentation mode and its impact on learning concepts. These results show that concepts presented in these different ways result in the same amount of learning. The difference between average score improvements was a slight .04 more for music. Although it is not believed to be the case, some concepts may have been beyond certain children’s grasps due to their developmental levels. While it was not possible to determine a meaningful difference in the impact of teaching style of concept acquisition, it is important to note that significant learning gains were displayed. After two sessions of intervention, almost all children (seven out of nine) made significant gains in understanding of both concept pairs.

Clinical Implications

The clinical implications of these results are extremely encouraging and important. First, teachers and speech language pathologists who may not like teaching concepts through music or play alone may react positively to the determination that no significant difference in the outcome of these varying presentation modes exists. These professionals may choose whichever method of teaching they prefer without concern for compromising client learning. Second, it was found that through only two sessions of approximately 15 minutes each (30 minutes total) significant gains in concept knowledge were made. This is exciting news for teachers, parents, and speech language pathologists, as results show that concepts can be taught quickly and effectively without absorbing too much time from other curriculum or intervention plan goals.
Limitations of Current Research and Future Directions

This study contained a small number of participants and few concept pairs were utilized. Participants were mostly taken from only one facility of a type where many children are of low socioeconomic status. This means that the variance between children in the study was likely to be low.

It would be beneficial to repeat this study using a more randomized sample and a larger number of participants. It would also have greater clinical implications if the study was replicated using a repeated measure design using more concept pairs and longer periods of intervention.
References


Appendix A

**Under**

**Song 1** (to the tune of “Twinkle, Twinkle Little Star”):
Under, under, where did he go?
Under, under, wait! I know!
He went under, under there.
He went under that big chair.
Under, under, where did he go?
Under, under, now we know!

**Song 2** (to the tune of “Old Macdonald”)
Watch the cat go under the dog!
Under, under, under.
Now he’s going under the mouse!
Under, under, under.
He goes under the pig and under the horse.
Under the barn and under the fence.
Watch the cat go under the dog!
Under, under, under.

**Over**

**Song 1** (to the tune of “Hickory Dickory Dock”)
Over and over the house.
The man jumps over the house.
The house is big but he jumps high!
The man jumps over the house.

**Song 2** (to the tune of “Here We Go Round The Mulberry Bush”)
You and I can jump over the stick
Over the stick
Over the stick
You and I can jump over the stick
Over the stick all day!
**Bottom**

**Song 1 (to the tune of “Merrily We Roll Along”)**
The ball is in the bottom of the bucket
The bottom of the bucket
The ball is in the bottom of the bucket
We should get it out.

**Song 2 (to the tune of “Do You Know the Muffin Man”)**
Let me see the bottom of your shoe
The bottom of your hand
The bottom of bucket
Let me see the bottom of the car
Everything has a bottom!

The floor is on the bottom of the room
The cat is in the bottom of the pile
The ball is in the bottom of the bucket
All of them are on the bottom!

**Top**

**Song 1 (to the tune of “Jingle Bells”)**
Touch the top, touch the top,
Touch the top of your head.
Pat the top, pat the top,
Pat the top of my head.
Tap the top, tap the top,
Tap the top of the table.
Jump to the top, jump to the top,
Jump to the top of the door.

**Song 2 (to the tune of “London Bridge”)**
He is on the top of the chair
The top of the table
The top of my hair
He is on the top of your head
He goes up top!
**Behind**

**Song 1 (to the tune of “Rock-a-Bye baby”)**
I am behind you, you can’t see me.
Now you’re behind me, where could you be?
The dog is behind you, he’s very small.
Now you’re behind him, you’re very tall!

**Song 2 (to the tune of “Row, Row, Row Your Boat”)**
What’s behind my back?
Maybe it’s a dog.
Behind my back is my dog, Jack!
He was behind my back.

Who’s behind your back?
Maybe it’s a cat.
Behind your back is your cat, Sprat!
He was behind your back.

Jack and Sprat are behind their house
They’re hiding right behind.
They are right behind their house
Let’s go get them now!

**In Front**

**Song 1 (to the tune of “Mary Had a Little Lamb”)**
Put the horse in front of the barn,
In front of the barn,
In front of the barn.
Put the horse in front of the barn,
He is in front of the barn.

Put the pig in front of the horse,
In front of the horse,
In front of the horse.
Put the pig in front of the horse,
He is in front of the horse.
Song 2 (to the tune of “Here We Go Looby-Loo”)
The cat is in front of the dog.
Now the dog is in front of the cat.
The cat is in front of the dog.
Now what do you think of that?

I jump in front of the chair
You jump in front of the chair
I jump in front of the chair
We both jump high in the air!
Figure Caption

*Figure 1.* Pre- and post test scores for each child (n = 9). Concept 1 was taught through play and concept 2 was taught through music. Six children made gains through play (average = 1.67, minimum = 1, maximum = 3). Seven children made gains through music (average = 1.71, minimum = 1, maximum = 3).