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Music and Music Therapy and its Effects on Students with Autism Spectrum Disorders

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Chapter 1: Introduction

People have recognized and intentionally used the powerful effects of music for centuries. The idea of using music to affect health and behavior is found in the writings of Aristotle and Plato. Music affects brain activity, blood pressure, breathing, heartbeat, pulse rate, digestion, skin sensitivity, and emotions (Alberta Teachers' Association, n.d.). Music has been used in therapeutic settings since at least the 1920s. Music therapy techniques have been shown to help patients regulate emotions and improve behavior, communication, and social skills. As the field of music therapy continues to develop, the uses of music as a general teaching tool have become more varied and common. Since music affects the mind and body in ways that writing and speech cannot, music can be a pivotal intervention for those with autism spectrum disorder. Music provides a meeting place for those with autism spectrum disorder and the neurotypical world.

Autism Spectrum Disorder

According to the Centers for Disease Control (2016), autism spectrum disorder (ASD) is a neurological and developmental disorder that can cause social, communication, and behavioral challenges that affect academic achievement. ASD affects 1 in every 59 children, occurs in all racial and ethnic groups, and is three to four times more likely to occur in boys than girls. Many people with ASD have sensory difficulties; they may be sensitive to sounds, sights, touch, and other sensations. The cause of ASD is not known, however, researchers believe that environmental, biological, and genetic factors may make ASD more likely. Signs of ASD usually appear by age 3, but some children show typical development and later stop acquiring or lose previously acquired skills. There is currently no cure for ASD, but treatments are available

to address symptoms and improve specific skills affected by ASD (Centers for Disease Control and Prevention, 2016).

It is important to keep in mind that people with ASD are unique and different from one another. "If you've met one person with autism, you've met one person with autism," says Dr. Stephen Shore. That being said, there are three defining characteristics of people with ASD: behavioral, social interaction, and communication deficits. People with ASD often have difficulty interpreting their environment. Their attempts to communicate their feelings or cope with a new situation may appear as unusual behavior. People with ASD may use repetitive behaviors as a way to reduce uncertainty and maintain predictability within their environment. People with ASD often do not perceive non-verbal cues like facial expressions, physical gestures, and eye contact. This difference can make social interaction difficult and impair the ability to establish and maintain relationships. People with ASD sometimes struggle understanding and expressing their own needs and interpreting and understanding the needs of others. They can appear distant and aloof as a result. Some people with ASD have no speech deficit; some have speech impairments in varying degrees; others cannot speak at all. Speech, like other behaviors, can be repetitive. People with ASD may talk in depth about things that interest them with little attention for the person they are speaking with, making back and forth conversation difficult (Centers for Disease Control and Prevention, 2016).

Music Therapy

The American Music Therapy Association (2005) define music therapy as "a clinical and evidence-based use of music interventions to accomplish individualized goals within a therapeutic relationship." Music can influence human behavior by affecting the brain and other bodily structures in ways that are observable, identifiable, measurable, and predictable (Center of

Music Therapy, n.d.). It is the only sensory experience that can activate all areas of the brain at the same time. Music therapy is an established profession that focuses on the use of music to meet the physical, emotional, cognitive, and social needs of individuals. Music therapy techniques include creating music, singing, moving to music, and listening to music. Music can be used as a form of communication for people who find it difficult to express themselves. Research shows that music therapy is effective in improving physical rehabilitation by facilitating movement, increasing motivation for individuals to participate and actively engage in their treatment, providing emotional support, and providing an outlet for expressing feelings. Music therapy as a profession began during World War I when musicians were hired to play for veterans who were suffering physical and emotional trauma. The intentional use of music to heal continued during World War II. Music therapy is now an evidence-based health profession, recognized as a related service under the Individuals with Disabilities Education Act (IDEA) (American Music Therapy Association, 2005).

Music Therapy and Students with Autism Spectrum Disorders

According to the National Autism Center (n.d.), music therapy is an emerging intervention used for people with ASD. Music therapy is used to improve a variety of skills, including social skills, communication, motor/sensory ability, and cognitive functioning. Music therapy can help students with ASD express themselves in new ways. It can provide opportunities for people with ASD to connect with other people, ease anxiety, and promote self-expression. Music is multi-sensory which helps to enhance processing and motor skills. Music therapy techniques and specific teaching strategies can be individualized to meet specific needs, preferences, family values, beliefs, and priorities. Music therapy sessions provide familiar

settings, consistency, structure, and predictability—factors that support how people with ASD typically learn best.

Research Question

One question guided this literature review: How can music and music therapy be used to promote engagement and communication in students with ASD?

Focus of Review

The focus of this review is literature that examines the effects of music and music therapy on students with ASD. I reviewed studies that tested the effects of music and music therapy on engagement and communication (e.g., communication, attention in pairs and groups, social interaction), and how it can positively impact behavior.

This review includes studies conducted since 2006 that include a range of ages and settings of students with ASD. I used the Academic Search Premier database to find the 10 studies used in Chapter 2. These keywords and combinations were used to locate articles: autism, autism spectrum disorder, music therapy, music, behavior, communication, joint attention, social, and classroom.

Importance of the Topic

Music therapy is a growing treatment option for students with ASD. Research supports the general idea that music enhances mood, attention, and behavior which optimizes a student's ability to interact and learn (American Music Therapy Association, 2005). Research also supports specific connections between music and behavior, including speech and singing, rhythm and motor behavior, memory for song and memory for academic material. As a special education teacher, I work with a variety of students with a range of needs and skills. I use music in my classroom for sensory and brain breaks. I see increased engagement, participation, and

contentment in my students, particularly those with higher needs, when I use music. Some of my students with ASD avoid participating in daily activities. When I turn on music, however, they get up and dance. I also noticed the effect of music on my grandmother. Music remained a way to connect with her as her memory and ability to communicate declined. Seeing the way we all react to music made me curious about how I could more effectively use music to meet the needs of my students. I want to keep an open mind and try new things so that every student can be successful.

Chapter 2: Review of Literature

In Chapter 1, I discussed the history of autism spectrum disorder (ASD), music therapy, and their history together. Due to the increase of people being diagnosed with ASD (1 in 59) (Centers for Disease Control and Prevention, 2016), there have been different interventions and treatments developed to help address the wide range of needs for these individuals. Music and music therapy can be used to help teach, modify, regulate, and eventually maintain desired behavior. In Chapter 2, I look at 10 studies that examine the effectiveness of music and music therapy on engaging behaviors in students with ASD.

Engagement and On-Task Behavior

Dieringer, Porretta, and Sainato (2017) compared the effectiveness of instruction only, music with instructional lyrics, and a combination of the two in increasing on-task behavior. The researchers observed students at a private integrated preschool specializing in children with ASD. They selected five study participants with significant motor delays who exhibited patterns of off-task behavior. Carter ran away from a presented task, yelled "no," and sat in refusal of the task. Rowan refused to engage by standing away from the group. Garrison showed repetitive hand and arm movements. Logan started to jump or spin when a task was presented. Ava engaged in spinning and verbal repetition during tasks.

The study took place in the lunch room of the preschool. The only items present during the sessions were poly spots, beanbags, a sound system, and video camera. The sessions were done individually—one participant and one instructor in each session.

The study followed a multiple baseline across participants with an alternating treatment design. The baseline condition was instruction only (verbal prompts and physical modeling) with no music although the instructor listened to the music through earbuds so the cadence of

instruction followed the rhythm of the music. The participants could hear the instructor but not the music. The second condition was music with instructional lyrics. Participants were asked to listen to the music and follow the directions given in the lyrics. There were no physical or verbal prompts in this condition. The third condition used the same music with instructional lyrics used in the second condition as well as the instruction (verbal prompts and physical modeling) from the first condition. Each participant attended four 10-minute sessions per week, for 10-13 weeks. The sessions were conducted at the same time each day. Each condition was tested once in turn, then conditions 2 and 3 were repeated.

The results (summarized in Table 1) show that four of the five participants engaged in a significantly higher percentage of on-task behavior during condition 3 (music plus instruction) than during the baseline condition (instruction only). The fifth participant, Carter, showed similar levels of on-task behavior in the baseline condition and Condition 3. All five participants were remarkably off-task during Condition 2 (music only). The increase in on-task behavior during condition 3 over the baseline condition supports the idea that the addition of music to instruction increases on-task behavior for ASD students.

Table 1

Participant On-Task Behavior

	% OF ON-TASK BEHAVIOR				
Participant	Baseline	Condition 2	Condition 3	Condition 2	Condition 3
Carter	53	15	54	9	53
Rowan	2	0	9	0	17
Garrison	8	0	23	0	29
Logan	40	0	57	0	53
Ava	76	68	93	65	92

There were a number of limitations to this study. While the researchers observed and rated off-task behavior, there was no formal assessment due to limited time for data collection.

There was no way to control the use of the test music outside of the study. Background data were not collected, which, if done, may have helped researchers determine how the results were influenced by where each participant fell on the spectrum. The study had a small sample size and included only one-on-one sessions, making the results difficult to generalize to other populations and across settings.

Paul et al. (2015) tested the hypothesis that sung directives are more effective than spoken ones. Three 3-year-old boys diagnosed with ASD participated in the study. Child A, the highest functioning participant, could communicate using a small collection of words and would sometimes echo words and phrases he heard. He displayed neutral affect but displayed joint attention skills when presented a task that was of high interest to him. Child B often made sounds without any attempt or intent to communicate. It was difficult for him to make eye contact, and he did not display joint attention behaviors. Child C showed little intent to communicate and avoided eye contact. He was described by the researchers as a "child in his own world."

The study used an AB design; the baseline condition was spoken directives (A), and the treatment condition was sung directives (B). The study included 18 sessions over 3 months for each participant. Each session was 3 to 4 minutes and included either spoken directives or sung directives given while the participant engaged in play activities. Similar activities and directions were used across conditions and randomized. The sessions were held in a private room with the participant, the therapist, and a caregiver who videotaped. Performance, social gestures, and eye contact were the dependent variables measured in this study.

The results (summarized in Table 2 below) show that Child A and Child B both performed with higher accuracy during the sung directives although Child A showed a marked

improvement while Child B showed a modest improvement. In comparison, Child C performed with less accuracy during the sung directives. All three participants showed increased use of social gestures and eye contact during the sung directives. The increase in these indicators of engagement and attention suggest that sung directives may help students with ASD develop communication skills.

Table 2

Sung v. Spoken Average Results (%)

Participants	Spoken Directives Performance	Sung Directives Performance	Spoken Directives Social Gestures	Sung Directives Social Gestures	Spoken Directives Eye Contact	Sung Directives Eye Contact
Child A	48	78	77	89	38	62
Child B	48	52	91	100	7.5	34
Child C	33	31	41	60	24	33

This study is limited by its small size and single-case design, making it difficult to predict whether these improved skills would generalize across settings and apply in a larger population. There was also a high level of variability of results; although the average scores showed improvements, the researchers found no stable trend in improvement over the 18 weeks of the study.

Carnahan, Musti-Rao, and Bailey (2008) studied the use of interactive books with and without music on engagement of students with ASD**.** Six grade school students, ages 6 through 11, participated in the study. Alex spoke in two-word phrases and often echoed adults before responding to their directives or questions. He could not read but knew how to hold a book and could follow the text with his finger when an adult was reading. Ace spoke in four and five-word phrases. He was able to answer questions that had concrete answers and questions about text paired with pictures. Steve spoke using two- and three-word phrases and could also answer

questions that had concrete answers and questions about text when paired with pictures. Drew and Kerri both used voice-output devices and communicated in two- and three-word phrases. Both were developing sight word vocabulary and could name a few common or appealing items. Jack was diagnosed other health impaired and showed similar characteristics to the students with ASD. He communicated using a combination of picture symbols and spoken words.

The researchers used an ABCAC reversal design. The baseline condition (A) consisted of a teacher reading a picture book to the group who sat in a circle around an easel. The teacher stopped at the end of each page to ask questions related to the text. The second condition (B) followed the same procedure but used interactive books, which allowed the students to manipulate moving pieces on the page while the book was read. The third condition (C) again used interactive books but the text was sung to background music rather than spoken. The music was stopped at the end of each page for questions and interaction with the moving pieces.

The researchers measured student engagement by eye contact, appropriate use of materials, making verbal comments or noises related to the activity, and the absence of avoidant behaviors signaling disengagement. Results are summarized in Table 3. Although the mean level of engagement for the interactive book in Condition B was higher than the baseline picture book by 4%, individual results were inconsistent; three participants showed increased engagement and three showed decreased engagement. When music was introduced in Condition C, however, levels of engagement increased for all participants and by substantial levels. Engagement dropped for all participants when the baseline condition was re-introduced and spiked again at even higher levels for five of the six participants when researchers re-introduced music. The researchers concluded that the data supports the use of interactive materials and music together to promote engagement.

Table 3

Mean Levels of Engagement (%)

Participants	Baseline (A)	Interactive Books (B)	Interactive Books with Music (C)	Baseline (A)	Interactive Books with Music (C)
Alex	32	27	51	31	69
Ace	59	75	91	83	94
Jack	26	43	72	24	72
Steve	63	51	66	46	98
Drew	27	36	66	29	81
Kerri	40	36	67	26	91
Means	41	45	69	40	81

There were several limitations to this study. The study did not measure the effect of the intervention on performance. The materials used in the study were not age appropriate for all participants due to the wide range of ages and cognitive functioning levels. Sessions varied from 9 to 20 minutes but the study did not measure response time as a variable.

Mendelson et al. (2016) studied the impact of a proprietary music therapy program, Voices Together, on social and communicative behaviors in students with ASD and students with developmental disabilities. Voices Together uses music and multisensory experiences to teach social and communication skills. Three songs from the program were used in the study: Hello, a greeting song; Feelings, which asked participants to express how they were feeling; and Topic, a song that asked participants to respond to the lyrics by raising a topic of interest to the group. A licensed and trained music therapist led all sessions. Four special education classrooms (33 students) participated, two K-2 classrooms and two grades 3-5 classrooms. Two of the classrooms were randomly assigned to a long-term (15 week) program and two classrooms to a short-term (7-week) program.

Likert scales were used to rate verbal and social responses and the level of prompting required to illicit responses (from hand-over-hand to pause alone). The teachers were asked to

complete the Social Skills Improvement System-Rating Scale (SSIS-RS; Gresham & Elliot, 2008). The study focused on three subscales of the rating scale: assertion, communication, and engagement.

The researchers hypothesized that participation in the Voices Together program would lead to increased social and communicative behavior both during the program and in the general classroom setting. They believed that longer exposure to the Voices Together program would lead to more robust improvements. The researchers expected there to be no difference in improvement across the three songs.

Repeated measures ANOVAs were used to evaluate responsiveness and prompting required to illicit responses. Other repeated measures ANOVAs were used for each of the three songs, as well as one for all three songs together. When the ANOVA showed statistically significant differences, within-group t-tests were run to see if those changes were within the short, or long-term groups. Data were compared across three different time points: week 1, week 7, and week 15.

The results show that the participants in both the long-term and short-term groups performed better across time points on all but the Topic song. Although the improvements happened in both groups, the results were only statistically significant in the long-term group. While the targeted behaviors increased during the program, the results did not generalize to the classroom setting as predicted. There were no statistically significant differences across time points on any of the subscales on the teacher rating scale. There was an unexpected increase in prompts required during the Topic song for the long-term group.

One limitation of this study was a lack of individual information on the participants (age, IQ, diagnostic status). The researchers suggest that any future studies of the Voices Together

program should include personal information. The study was limited to live-coding. In future studies, recorded coding techniques would permit more in-depth scoring of behavior. The study is limited by its small sample size.

Kern, Wolery, and Aldridge (2006) evaluated the effects of original songs on independent behavior. Two 3-year-old boys (Phillip and Ben) participated in the study. Both boys were in the mild-moderate range on the Childhood Autism Rating Scale (Schopler, Reichler, & Renner, 1988) and had limited speech. Transitions were difficult for both, especially the morning arrival. Phillip would refuse to enter the classroom, crying, screaming, or laying on the floor. Ben would hold on to his caregiver, cry, and ignore teachers trying to coax him into the classroom.

The study took place in each boy's classroom. Phillip's classroom consisted of six other students, five who were developing typically and one who had a disability. Ben's classroom had seven other students, five who were developing typically and two who had disabilities.

The study used a single subject research design modified to meet the needs of the participants. The baseline condition was an established morning routine consisting of five steps: (1) the participant entered the classroom independently; (2) the participant greeted a person either verbally or using picture symbols; (3) the participant greeted a second person in the room; (4) the participant said "good-bye" or waved as the caregiver exited the room; and (5) the participant found a toy and began to play appropriately. Condition B added an original song that matched each of the five steps of the routine. The teacher would start singing as the student entered the room.

The results show an increase in independence for both Phillip and Ben when music was used. Phillip was completing two steps independently during the baseline sessions. When music was introduced, his independence initially dropped but after two days of intervention, it returned

to baseline and after four days his independence increased. After the tenth session of music intervention, Phillip's performance was categorized as consistent (three consecutive sessions with four independent steps completed), and the intervention was withdrawn. His independence dropped, and by the second day he was back to where he initially started. When music was re-introduced, Phillip's independence immediately increased. Ben consistently completed the first step independently in the baseline condition. After music was introduced, his independence was inconsistent. When his independence did not improve after 12 sessions, the researchers modified the routine (Condition C) by removing the "good-bye" step and having the caregiver leave as Ben entered the room. Ben's independence increased. After consistently completing three or four steps independently, the music intervention was removed. As with Phillip, Ben showed a decrease in independence. When the intervention was re-introduced, Ben showed a sharp increase in independence and was completing all four steps.

The introduction of music also increased engagement and participation by other class members and an easing of discomfort overall as reported by teachers and students. Phillip's peers had reported feeling intimidated by his inappropriate behavior during the morning greeting. After the intervention began, one parent reported her son hurrying to school hoping to arrive before Phillip so that he could participate in the new greeting routine. The introduction of music also resulted in an increase of peers greeting Ben without adult prompting.

This study has several limitations. Only two participants were studied and the second condition was modified for one of the participants during the study further limiting comparisons. It is unknown whether the modified intervention would have been successful if Ben had not experienced the original intervention. Original songs were composed for each child by a music therapist. The data does not show whether a teacher, without help from a music therapist, could

adapt a pre-existing song with the same results. There is no data on whether the independence seen in both participants could eventually be maintained without the music, and whether this strategy could be adapted to other situations.

Communication

Kim, Wigram, and Gold (2008) measured the effects of improvisational music therapy on joint attention behaviors in children with ASD. Ten boys, ages 3 to 5, participated in the study. Five of the participants were non-verbal and the other five had varying degrees of language skills.

The study was conducted in Jinah Kim's private practice clinic in Seoul, Korea. The research team consisted of two music therapists, one play therapist, and three music therapy graduate students. To limit the influence of personal familiarity, the two therapy trials were overseen by different therapists.

The study used a repeated measures comparison design between conditions and within subjects. The researchers used repeated measures ANOVAs to study eye contact and turn-taking, and how each was affected by play and music therapy. Each child participated in 12 weekly 30-minute music therapy sessions and 12 weekly 30-minute play sessions. The participants were divided into two groups randomly assigned to receive either music therapy followed by play therapy or play therapy followed by music therapy. During each 30-minute session in both conditions, the first 15 minutes were undirected and child-led and the second 15 minutes were directed and led by a therapist. The Pervasive Developmental Disorder Behavior Inventory-C (PDDBI; Cohen & Subhalter, 1999) and the Early Social Communication Scales (ESCS; Mundy et al., 2003) were used before, during, and after the sessions to measure

responsiveness and non-verbal communication skills. The PDDBI was completed by both the therapists and the mothers of the participants.

The results of the PDDBI from the therapists indicated that both groups showed a higher degree of joint attention behaviors after the music therapy sessions than they did after the play sessions. The results from the mothers were divided—one group saw larger increases after music therapy sessions while the other reported the same degree of change after both sessions. The ESCS showed overall improvement for both groups which appeared to be greater after the music therapy sessions than after the play sessions. The results of the ANOVA suggest that the interaction between time and group is statistically significant ($p=0.01$), indicating that music therapy is considerably more effective than play therapy. The participants made eye contact for longer periods and also had longer turn-taking times during the music therapy sessions. The major limitation of this study is its small sample size.

Sandiford, Mainess, and Daher (2012) tested whether Melodic Based Communication Therapy (MBCT) would provoke speech in non-verbal children with ASD. MBCT is a type of speech therapy that assigns a standard and distinct melody to each target word. The researchers selected 12 participants who had received a minimum of one year of speech therapy before the study and who had nonfunctional vocabularies of 10 words or less that were not used consistently. The participants were between the ages of 5 and 7.

The study used a randomized control design. Participants were randomly divided into two groups—the treatment group that received standard speech therapy and the experimental group that received MBCT. The participants attended four 45-minute sessions each week for 5 weeks. The researchers selected 25 target words that were paired with stimulus items and used

in both groups. Participants who learned all of the target words were encouraged to use two-word phrases. Participants in both groups were rewarded with items that were desirable to them.

Mixed factorial ANOVA were used to determine changes over time. The results showed significant improvement in number of correct words, verbal attempts, and imitative attempts for both the traditional and MBCT groups. The MBCT group showed significant improvement over the 5 weeks of the study while the traditional group made significant improvements only after week 4. Overall, there was little difference in progress be week 4. The researchers speculated that the quick increase in performance of the MBCT group may have been due to right hemisphere strengths of the participants. The researchers noted that the increases in both groups could be due to the reinforcers offered rather than to therapy. The researchers also noted that the MBCT group showed a higher increase in verbal attempts and imitative attempts than the treatment group.

The study is limited by its small sample size as well as a lack of follow-up. The researchers attempted to follow-up with little success. No analysis could be done on whether the results were maintained. The researchers suggested that the study be repeated in a program that was less concentrated.

Thompson, McFerran, and Gold (2013) conducted a parallel randomized controlled study examining whether music therapy promotes social engagement in children with ASD. The study included 23 participants who met the following criteria: (1) confirmed diagnosis of ASD; (2) between the ages of 3 and 6; (3) limited functional or verbal communication, and (4) enrolled in an early intervention program. The participants were randomly divided into control and treatment groups. The control group participated in their early intervention program only. The treatment group received family-centered music therapy in their own homes once a week for 16

weeks in addition to their early intervention program. The sessions ranged from 30 to 40 minutes and were conducted by a trained music therapist. They focused on shared attention, focus on faces, turn taking, response to joint attention, and initiation of joint attention. The participants in the control group received an average of 1.71 hours weekly of contact time with their early intervention program and one hour of other private therapy (speech therapy, occupational therapy, and applied behavior analysis).

Quantitative measures used in the study were: The Vineland Social Emotional Early Childhood Scales (Sparrow, Balla, & Cicchetti, 1998); The Social Responsiveness Scale Preschool Version for 3-year-olds (Constantino & Gruber, 2005); The MacArthur-Bates Communicative Development Inventories, Words, and Gestures (Fenson et al., 2007); The Parent-Child Relationship Inventory (Gerard, 2005); and Child Engagement in the Music Therapy Sessions: The Music Therapy Diagnostic Assessment-Clinician Observation Measure (Oldfield, 2006). There were no statistically significant differences between the control and treatment groups through the measures in the baseline data.

The results show statistically significant improvements in the treatment group on the Vineland Social-Emotional Early Childhood Scales and the MacArthur Bates Communicative Development Inventories; the parents of the participants in the treatment group saw an increase in their children's social interactions at home and in the community and increased engagement during the in-home sessions. There were no statistically significant differences on the Social Responsiveness Scale Preschool Version for 3-year-olds, showing that the broader measure of social responsiveness did not change. Both the treatment and the control groups made advances in speech and language skills as reported by their parents although no statistically significant scores showed this result. Although the music therapy treatment may have had positive effects

on parent child relationships, these effects were not large enough to measure on the Parent-Child Relationship Inventory. During semi-structured interviews, parents reported positive feelings about participation in the music therapy sessions including increased opportunities for interacting with their children, feelings of being "interconnected, bonded, or attuned" to their child, gaining a sense of the power of music to motivate, and a sense of hope for the future.

One limitation of this study is its small sample size; positive effects in the study may have been significant in a larger sample. A second limitation is the use of parent reports as a primary form of assessment. It is difficult to know whether perceived changes were due to changes in behavior of the child or changes in the outlook or behavior of the parents. Although the participants were recruited from seven different early intervention centers, only one music therapist participated in the study making it hard to generalize results and findings.

Vaiouli, Grimmet, and Ruich (2015) studied the effects of music therapy on joint engagement and emergence of social communication behaviors in children with ASD. The study included three participants. Bill was 7 years old. With adult prompting, he could communicate his full name and phone number, talk about the weather, and ask simple questions like "how are you?" He was not interested in back-and-forth interaction with his peers and showed aggressive behavior when stressed or presented with a new routine. Erick was 5 years old and communicated using picture symbols, American Sign Language, or a simple yes or no to show what he needed. Erick did not participate in back-and-forth interaction with peers or adults in the classroom. Ann was 5 years old. She occasionally used two-word sentences to communicate but more often simply pointed to objects that interested her. Ann needed staff support to take turns during classroom activities and sometimes exhibited aggressive behavior when interacting with peers.

A mixed-method design was used, consisting of case studies and a multiple baseline across behaviors. Quantitative and qualitative data measured focus on faces, response to joint attention, and initiation of joint attention. Each participant received 30-minute music therapy sessions weekly for 9 months. The sessions were conducted by a music therapist in the school's music room. Data were collected once weekly during a 10-minute one-on-one session between the participant and classroom teacher. Field notes were made during weekly observations in the classroom.

Baseline condition data were collected in three to five sessions for each participant. When a steady baseline was established, the music intervention began. Each music therapy intervention used four specific parts: (1) a greeting/welcome song, which helped the children get comfortable with their surroundings; (2) a child-led segment used to encourage the child to share and initiate joint engagement behaviors during which the therapist would mirror the child's music structure; (3) an adult-led segment during which the researcher used music to promote joint attention; and (4) a goodbye song that marked the end of the session and helped the participant make the transition to the next part of the day.

The results (summarized in Table 4) show that all three participants made positive improvements in the categories of focus on faces, response to joint attention, and initiation of joint attention. A follow-up assessment showed that all three participants were able to maintain the improvements. The researchers analyzed the qualitative data and concluded that the intervention dramatically helped the participant's communicative behavior. The children started to smile and move closer to the circle; Ben even held hands with another student during one of the songs. The researchers noted that the interactions between the participants and their peers improved after the intervention was introduced. Bill independently approached a classmate who

was crying and told her not to be sad; later in the year, he chose to sit next to a classmate instead of his teaching assistant. The researchers also noted that Bill and Erick's experiences went beyond the classroom and generalized into their lives outside school.

Table 4

Average Occurrences of Engagement Behavior

	CONDITION	EYE CONTACT	RESPONSE TO JOINT ATTENTION	INITIATION OF JOINT ATTENTION
Bill	Baseline	.86	1.5	.5
	Intervention	3.73	7.6	2.3
	Follow-Up	7	8	2
Erick	Baseline	2.2	.86	.4
	Intervention	3	1.9	2.2
	Follow-Up	8	3	2
Ann	Baseline	2.4	1.4	.46
	Intervention	4.4	3	2
	Follow-Up	10	3	2

The study is limited by its small sample size and by the improvised nature of the intervention which would be difficult to replicate. The researchers were only able to collect follow-up data once due to the end of the school year.

Finnigan and Starr (2010) studied the effects of music therapy on social responsiveness in a student with ASD. Anna was 3 years, 8 months old at the start of the study. Anna showed significant deficits in social and communication skills when assessed using the Mullen Scales of Early Learning and Vineland Adaptive Behavior Scales-Second Edition. Anna scored in the severely autistic range on the Childhood Autism Rating Scale (CARS) and in the autistic range on the Autism Diagnostic Observation Scale Schedule (ADOS)-Module 1.

The researchers used a single-subject alternating design. During the baseline phase (A), a music therapist sat on the floor with Anna and offered her one of six toys. Anna was given opportunities to imitate the therapist's behavior and to take turns playing with the toy but was not

prompted or instructed to do so. The alternating phase (B) included both music and non-music conditions. Three of the toys were used in each condition. During each condition, the therapist offered each of the toys to Anna and again provided opportunities for Anna to imitate behavior and take turns. The therapist prompted engagement when needed. In the music condition, the music therapist interacted with Anna by singing simple melodies accompanied by a guitar. The third phase (C) used the music condition from Phase B with the toys from the non-music condition of Phase B. Follow-up (D) occurred 1 and 2 weeks after the final intervention using the baseline phase procedure. The study included four 15-minutes sessions weekly, eight sessions in Phase A, 12 in Phase B, seven in Phase C and two follow-up sessions.

The results (summarized in Table 5) show that the music intervention increased Anna's social responsiveness while reducing avoidance behavior. Anna made eye contact only during the music sessions; she made eye contact in five of six sessions in Phase B and six of seven sessions in Phase C. Anna more accurately imitated the therapist's behavior during the music condition of Phase B and during Phase C than she did in the baseline condition and the non-music condition of Phase B. Music was not included in the follow-up sessions; eye contact returned to zero although imitation and turn taking were at levels above the baseline and below the music condition. The researchers noted that Anna seemed to have a happier demeanor during the music conditions as well.

Table 5

Levels of Measured Behavior (%)

	BASELINE	PHASE B NO MUSIC	PHASE B MUSIC	PHASE C	FOLLOW-UP
Eye Contact	0	0	1.5	3.43	0
Imitation	7.2	37.2	83	68.1	41.7
Turn Taking	1.5	27.4	87.5	78.6	47.1

Although the results are encouraging, this study had only one participant so the results are necessarily limited. The researchers are unsure if the results would transfer to the classroom or other non-music therapy settings. They suggest observation in additional settings to gain more knowledge about the effectiveness of the intervention.

Summary

Music and music therapy increase engagement and communication skills in children with ASD. Music and music therapy can increase independence, eye contact, and joint attention, allowing children with ASD to learn and connect with the world around them. Music, when paired with existing teaching methods, can enhance the classroom experience for all participants.

Table 6

Summary of Reviewed Studies

AUTHORS	STUDY DESIGN	PARTICIPANTS	PROCEDURE	FINDINGS
Kern, Wolery, & Aldridge (2006)	ABAB ABCAC	2 boys with ASD and limited speech 3 years old	Researchers measured independence when sung music was added to established morning greeting routines.	Independence increased for both participants. Researchers noted increased engagement by classmates.
Kim, Wigram, & Gold (2008)	Repeated measures comparisons between conditions and within subjects	10 boys with ASD Ages 3 to 5	Researchers measured joint attention behaviors after music therapy sessions and play therapy sessions.	Joint attention increased to a higher degree after music therapy sessions than after play sessions. Eye contact and turn-taking lasted longer during music therapy sessions.
Carnahan, Musti-Rao, & Baily (2008)	ABCAC reversal design	6 students with ASD (5) or OHD (1) Ages 6-11	Researchers measured engagement while a teacher read aloud from a picture book, an interactive book, and an interactive book paired with music.	Engagement was highest when music was used with the interactive book. Engagement was variable between the picture book and interactive book.
Finnigan & Starr (2010)	Single-subject alternating design	1 girl with ASD Age 3 years, 8 months	A music therapist offered toys and provided opportunities for the participant to imitate the therapist's behavior. The study included a baseline condition with no music, an alternating phase with and without music, and an all music phase.	Eye contact, imitation, and turn taking all increased when music was introduced. Social responsiveness increased and social avoidance decreased with music.
Sandiford, Mainess, & Daher (2012)	Randomized controlled design	12 students with ASD Ages 5-7	Six of the participants received standard speech therapy and six received melodic based communication therapy for 5 weeks.	Correct words, vocal attempts and imitative attempts increased for both groups. The MBCT group made faster improvement than the standard group but plateaued at Week 4. Both groups made similar progress by the end of the study.

Table 6 continued

AUTHORS	STUDY DESIGN	PARTICIPANTS	PROCEDURE	FINDINGS
Thompson, McFerran, & Gold (2013)	Parallel randomized controlled	23 children with ASD enrolled in early intervention programs. Ages 3-6	All the participants attended early intervention programs. The treatment group also received family-based music therapy in their homes for the 16 weeks of the study.	Engagement and communication increased in the treatment group. Both the treatment and control groups made advances in speech and language skills as reported by their parents.
Paul, Sharda, Menon, Arora, Kansal, Arora, & Singh (2015)	Single subject research design	3 boys with ASD 3 years old	Researchers compared sung and spoken directives given during play time. They measured performance, eye contact and social gestures.	Performance was more accurate for 2 of the 3 participants during sung directives. Eye contact and social gestures increased for all participants during sung directives.
Vaiouli, Grimmet, & Ruich (2015)	Mixed method: cases studies and multiple baseline across behaviors and within subjects	3 kindergarten students with ASD Ages 7, 5, 5	Participants received individual sessions with a music therapist weekly for nine months. Researchers measured engagement and joint attention behaviors.	Focus on faces, response to joint attention, and initiation of joint attention increased after music therapy sessions. Improvements transferred to the classroom and were maintained through follow up.
Mendelson, White, Hans, Adebari, Schmid, Riggsbee, Goldsmith, Ozler, Buehne, Jones, Shapleton, & Dawnson (2016)	Quantitative	33 students in four special education classrooms Grades K-5	Two classrooms received 7 weeks and two received 15 weeks of a proprietary music therapy program. Researchers measured social and communicative behavior between the groups.	Social and communicative behavior increased in both groups. Improvements were more robust for the long-term group. Results did not generalize to the classroom.
Dieringer, Porretta, & Sainato (2017)	Multiple baseline across participants, alternating treatment design	5 participants with ASD and a history of off-task behavior Preschool	Researchers compared on-task behavior during (1) instruction, (2) music with instructional lyrics, and (3) instruction and music with instructional lyrics combined.	On-task behavior was higher for 4 of the 5 participants when music and instruction were combined.

Chapter 3: Conclusions and Recommendations

This paper evaluated the effectiveness of music and music therapy on engagement and communication in children diagnosed with autism spectrum disorder (ASD). Chapter 1 reviewed the history of music therapy, discussed ASD, and reviewed their history together. Chapter 1 also explained the importance of this topic. Chapter 2 examined literature studying the effectiveness of music and music therapy on engagement, communication, and related behaviors in children with ASD. Chapter 3 discusses the findings of the research, along with recommendations and implications from the studies.

Conclusions

Ten studies were reviewed. Five studies focused on engagement and on-task behavior, and five studies focused on communication although there was some overlap in the behaviors studied. The studies had diverse designs and data collection methods. Sample sizes in the studies were small, ranging from 1 to 33 participants. All studies included participants diagnosed with ASD, but not all studies were limited to participants with ASD. A majority of participants were diagnosed with ASD.

Social Development. Music and music therapy encourage social development in students with ASD. Thompson et al. (2013) reported increased social interactions at home and in the community by children who received family-centered music therapy in addition to an early intervention program and other private therapies. Vaiouli et al. (2015) implemented a music therapy intervention designed to increase social communication and joint engagement. All three participants showed increased focus on faces, response to joint attention, and initiation of joint attention. The researchers observed the children smiling and moving closer to the circle. One student held hands with another during one of the songs. Finnigan and Starr (2010) reported that

a music intervention substantially increased the participant's social responsive behaviors and decreased her avoidant behaviors. Eye contact, imitation, and turn taking increased when music was used. Mendelson et al. (2016) reported an increase in social and communicative behavior in grade school students with ASD in response to a music therapy program. Kim et al. (2008) found that music therapy is considerably more effective than play therapy in increasing joint attention behaviors in children with ASD. Study participants made eye contact for longer periods and also had longer turn-taking times during the music therapy session of the study.

Music with Instruction. Music paired with instruction or other sensory materials appears to be the most successful strategy for promoting engagement in students with ASD. In Dieringer et al. (2017), music with instructional lyrics produced almost no on-task behavior when used alone but was effective when paired with instruction (verbal prompts and physical modeling). Four of the five participants showed a significantly higher percentage of on-task behavior when music and instruction were combined than they did when instruction was given without music in the baseline condition.

Carnahan et al. (2008) compared levels of student engagement when a teacher read a picture book, an interactive book, and then an interactive book with music. The use of the interactive book produced mixed results; some students showed increased engagement with the interactive book while others did not. All six participants, however, showed higher levels of engagement when the interactive book was paired with music. The mean increase was 12% higher than the results for the interactive book alone and 41% higher than the results for the picture book.

Two of the studies addressed the simple addition of sung rather than spoken directives. Paul et al. (2015) compared spoken and sung directives given while the participants were playing. Although the performance measure showed mixed results, all three participants showed increased use of social gestures and eye contact during the sung directives. In Kern et al. (2006), a music therapist set the steps of each participant's morning arrival routine to music. When the participant arrived in the classroom, the teacher began to sing the song. Both participants were able to complete all steps in their routines independently and consistently at the end of the study. Prior to the introduction of the song, the participants performed only one or two steps independently. A complicating factor in analyzing the study results is that the music therapist composed an original song but used existing words and routine as the lyrics. This use of the familiar may have increased the success of this intervention on producing independent behavior in the participants.

Unsuccessful strategies. Some of the studies included strategies that, at least in the context of the study, were unsuccessful, perhaps because of the unstructured nature of the activities or the complexity of the music. Participants in the Dieringer et al. (2017) study were asked to listen to music and follow directions given in the lyrics without physical or verbal prompts. Only one of the five participants was able to perform with results close to the baseline measure. Three participants showed no on-task behavior during this phase of the study. There are several possible explanations for these results. Participants with sensory processing deficits may not be able to process the directives in lyrics while also listening to music. On the other hand, students with ASD have been found to have equal or superior musical skills in the areas of pitch processing and identifying emotions in music when compared with typically developing peers. Superior skill could have caused the participants to focus on the music to the exclusion of

the lyrics. It is also possible that many listeners would be unable to process directional lyrics on the first hearing.

The researchers in the Mendelson et al. (2016) study hypothesized that there would be no difference in results for each of the three songs they selected to use in the study. There was, however, an unexpected increase in prompts required during the Topic song. Paul et al. (2015) compared sung and spoken directives. The sung directives had no accompaniment. While all three participants in the study showed increased use of social gestures and eye contact during sung directives, only two of the participants performed with better accuracy. Child A showed marked improvement (30%), Child B showed modest improvement (4%), and Child C showed a decrease in accuracy (2%).

Sandiford et al. (2012) compared the use of Melodic Based Communication Therapy (MBCT) and standard speech therapy to provoke speech in non-verbal children with ASD. The results showed significant improvement in correct words and attempts in both groups but no significant difference in results between the groups. An interesting result, however, was that the MBCT group made significant early improvements but plateaued at week 4, while the standard speech therapy group showed steady improvement throughout the study.

Music and well-being. Music and music therapy promote engagement in students with ASD, which may allow classmates, siblings, and parents the opportunity to connect with them. Kern et al. (2006) concluded that music was beneficial in increasing independence in a classroom setting. When the teacher incorporated song, it added a calming element to the pre-existing routine, allowing the participants to engage. Not only were the participants more involved in the classroom activities, but their peers also were more comfortable when music was used. Peers reported feeling intimidated by the participants' inappropriate behavior during the

morning greeting. After the music intervention began, one parent reported her son hurrying to school hoping to arrive in time to participate in the greeting song.

Two additional studies include lengthy researcher notes regarding the impact of the music intervention on people other than the study participants. Thompson et al. (2013) noted that the parents in their study reported positive feelings about participating in the music therapy sessions including increased opportunities for interacting with their children, feelings of being "interconnected, bonded, or attuned," gaining a sense of the power of music to motivate, and a sense of hope for the future. Vaiouli et al. (2015) noted similar reactions from parent reports after a music therapy intervention designed to increase social communication and joint engagement behaviors. One of the parents commented, "Bill is now singing in the car…he does well and this time spent in MT makes him more comfortable with new things and communicating in a new way."

Two studies suggest that longer interventions foster a sense of belonging that in turn increases social communications. Mendelson et al. (2016) reported increased social and communicative behaviors in a group participating in music therapy for 15 weeks when compared with a group participating for only 7 weeks. Vaiouli et al. (2015) reported similar increases in a 9-month study. Their notes include several examples of students with ASD showing empathy and interacting with other students without prompting.

Recommendations for Future Research

Perhaps due to the one-on-one nature of working with students with ASD, all 10 reviewed studies had relatively small samples (1, 2, 3, 3, 5, 6, 10, 12, 23, and 33). Small sample size leads to a higher level of variability and can affect the reliability of results. With small samples, it is almost impossible to apply the results to a larger population. A related limitation is

the lack of control groups in all but two of the reviewed studies. All of the researchers suggested that their studies be re-conducted with larger sample sizes.

Future studies should include older participants and include measures of performance and academic functioning. Most of the studies reviewed in Chapter 2 included participants that were under 10 years old and most focused on preschoolers. While the reviewed studies show that music and music therapy have a positive effect on engagement, particularly in preschool children, there is little research on whether music continues to engage students as they age and how it might be used to improve performance. Research with older students might lead to more engaging and productive classroom experiences for all students.

Implications for Current Practice

Music can promote togetherness and heighten engagement leading to better experiences for everyone in the classroom. Music can be incorporated into any type of lesson or used during transitions. Teachers should consider pairing music with instruction and other teaching methods, such as tactile materials and visuals. These combinations give students alternate ways to process the information presented and remain engaged. Music can be added to familiar routines to ease anxiety and create connections between students with ASD and their classmates. Music used in the classroom can be shared with visitors and sent home to parents and families to further strengthen connections.

We should learn from unsuccessful strategies and keep trying new ones. Some students with ASD may be sensitive to sounds. A song that fails to engage may need to be simplified, replaced, or sung without background music. Changes may need to be made slowly, however, since familiar settings and predictability are important for students with ASD. Students with ASD may also need a longer time to engage and to make connections with other students.

Teachers should seek out music therapists for inspiration. Music therapy is a distinct practice that may be able to lend ideas to special education teachers.

Summary

Music and music therapy can help bridge the social, communication, and behavioral deficits experienced by many students with ASD. The most promising strategies for promoting engagement are music paired with instruction, other sensory materials, or familiar routines. Music increases engagement and focus and, when paired with other methods, allows students to process and perform in situations where one teaching method alone may fail.

Unsuccessful strategies provide details and insights. Students with ASD show right hemisphere strengths and may have a hard time both listening to music and processing information from lyrics.

Music and music therapy create positive responses to those interacting with students with ASD and the opportunity to connect with them. Further research with larger sample sizes and older participants would be beneficial for special education teachers. Integrating music into the curriculum would benefit many classrooms.

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