

Using Embedded Music Therapy Interventions to Support Outdoor Play of Young Children with Autism in an Inclusive Community-Based Child Care Program

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For young children with autism enrolled in community-based inclusive child care programs, outdoor play can be a major challenge. The aim of this music therapy intervention was to improve peer interactions and meaningful play on the playground for four boys with autism by adding an outdoor music center and using original songs composed for each participant. A collaborative approach was used to support the implementation of the intervention by the children's teachers, engaging classroom peers as formal and informal helpers. The effects of the interventions were examined using a multiple baseline design with four conditions replicated across the four children. The results indicate that the musical adaptation of the playground itself did not improve social interactions of children with autism significantly, but it facilitated their play and involvement with peers by attraction to the sound and opportunity to use the instruments. The song

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This article is based on the first author's doctoral dissertation completed at the University of Witten-Herdecke, Germany. This study is part of a series of single case studies investigating embedded music therapy interventions for the inclusion of young children with autism spectrum disorder in a community-based, university-affiliated Family and Child Care Program. The authors wish to thank Dr. Mark Wolery for sharing his expertise in this study. Special gratitude also goes to the children and families, teachers and colleagues who participated and collaborated in this study.

interventions produced desirable peer interaction outcomes, and the collaborative consultative approach enabled teachers to implement interventions successfully in ongoing playground routines. In addition, peer-mediated strategies increased peer interactions and meaningful play on the playground.

Children with Autism Spectrum Disorder (ASD) are increasingly being included in community-based early childhood programs (Handleman & Harris, 2001; National Research Council, 2001). The benefits of inclusive environments for children with special needs are at least fourfold: to offer realistic learning experiences, to increase naturally occurring learning opportunities, to provide peer models, and to find friends without disabilities (Wolery & Wilbers, 1994). Autism is a complex developmental disorder that affects verbal and nonverbal communication and social interaction, and is also associated with restricted and repetitive patterns of behavior, usually evident before age 3 (American Psychiatric Association [APA], 2000). Because of these deficits in social participation and engagement, a major therapeutic objective for successful inclusion in child care settings is to enhance the child's social interaction and play with their peers (National Research Council, 2001).

During the child care day, children should have daily opportunities to spend long periods of time in outdoor play (Bredekamp & Copple, 1997; Cryer, Harms, & Riley, 2003). Playground time is important for the learning and social development of preschool children, and offers a variety of play opportunities that distinguish it from indoor play (Flynn & Kieff, 2002; Ladd & Price, 1986). The free play component inherent in outdoor play is generally perceived and valued by typically developing children (Cullen, 1993). Attention has been given to playground safety aspects (American Society for Testing and Material, 2003; U.S. Consumer Product Safety Commission, 1997), accessibility of playgrounds for young children with disabilities (Ministry of Education, 1990), and playground supervision (Kern & Wakeford, 2004). General best practice guidelines have been proposed for playground activities (DeBord, Hestenes, Moore, Cosco, & McGinnis, 2002; Henninger, 1994), and for promoting interaction and inclusion (Flynn & Kieff, 2002; Nabors, Willoughby, & McMennamin, 2001). Several studies

have examined play behaviors and play styles on playgrounds (Cullen, 1993; Ladd & Price, 1986; Shim, Herwig, & Shelley, 2001), and some studies have investigated the social behaviors of typically developing children and children with special needs on playgrounds (Fujiki, Brinton, Isaacson, & Summers, 2001; Nabors & Badawi, 1997). Few studies have focused on evaluation interventions promoting interactions between children with and without disabilities on playgrounds (Hundert & Hopkins, 1992; Kern & Wolery, 2001), but those that did proposed clinical implications for encouraging peer interactions and inclusion of children with special needs on playgrounds, and suggest that teacher-directed activities are vital to increase social experiences and involvement of children with special needs on playgrounds (Flynn & Kieff, 2002; Fujiki et al., 2001; Nabors et al., 2001).

For children with ASD, large undefined spaces such as playgrounds, lack of predictable and structured play routines, and play styles inherent in outdoor play, can make playground time a challenging experience (Flynn & Kieff, 2002; Nabors et al., 2001). To utilize playground time to its fullest potential in enhancing inclusion, adaptations to the physical environment and materials along with specific strategies and individualized interventions generally applied to children with ASD are essential. However, though many inclusive child care programs enroll young children with ASD, a search of the literature revealed no studies related to promoting desirable outcomes in increasing positive peer interactions during outdoor play for preschoolers with autism are available.

Educational and therapeutic strategies that help children with autism improve their skills and use their strengths to act independently in classroom routines have been developed and evaluated. These strategies recommend a clear layout of the physical environment including identified play areas; comprehensive visual information; the establishment of predictable schedules and play routines; individual and structured teaching; and the use of integrated therapy, meaning the intervention is embedded in the ongoing classroom routine (Koegel & Koegel, 1995; Marcus, Schopler, & Lord, 2001; McWilliam, 1996). In an integrated therapy model, the therapists provide services along the continuum from direct services (where the therapist provides all therapy services) to consultative services (where the therapist provides guidance, information, and training to regular classroom teachers) (Kern, 2004;

McWilliam, 1995). The embedded music therapy interventions model presented here is a consultative service. Such an integrated model of service delivery supports normalization, continuity, maintenance, and generalization (Buysse & Wesley, 2005; McWilliam, 1996).

Koegel, Dyer, and Bell (1987) describe that preschool children with autism interact more with one another when doing activities they enjoy, and DeKlyen and Odom (1989) suggest that more social interaction might be attributed to structure and access itself. Therefore, specific individualized interventions incorporating children's strengths and preferred activities need to be identified for both children with autism and their typically developing peers. Peer-mediated strategies in which typically developing children are trained to engage children who have autism, have proved to be powerful means of improving peer interactions in the context of classroom activities (DiSalvo & Oswald, 2002; Goldstein, Kaczmarek, Pennington, & Shafer, 1992; Laushey & Heflin, 2000).

An interest in and positive response to music, as well as improvements in core difficulties of children with autism through music, is extensively described in numerous descriptive case studies (e.g., Alvin & Warwick, 1991; Brown, 1994; Fisher, 1991; Gustorff & Neugebauer, 1997; Kaplan & Steele, 2005; Mahlberg, 1973; Nordoff & Robbins, 1977; Schuhmacher, 1994). Children with autism frequently exhibit a high interest in, and positive response to, musical stimuli, and music has been introduced to develop curiosity and exploratory interests in children with autism, and as a motivator for children with autism to participate in activities aimed at achieving therapeutic goals (Nelson, Anderson, & Gonzalez, 1984). In addition, children with autism have exhibited musical strengths and interests (e.g., Applebaum, Egel, Koegel, & Imhoff, 1979; Thaut, 1987, 1988), and music therapy interventions have potential benefits in supporting social skills for children with autism (Brownell, 2002; Pasiali, 2004; Stevens & Clark, 1969; Wimpory, Chadwick, & Nash, 1995). Such interventions offer treatment options for children with autism in community-based early childhood settings, as they have been shown to support and facilitate inclusion of children with special needs in various educational settings (Humpal & Wolf, 2003; Jellison, Brooks, & Huck, 1984; Wilson, 2002). However, few authors have documented the use of embedded intervention strategies and the collaborative and consultative

model of music therapy service delivery in working with children with autism (Furman, 2001, 2002; Snell, 2002). The majority of literature on this topic is not the result of scientific research investigations, but rather of formative best practices research.

The purpose of this study was to evaluate the effects of a musical adaptation of a child care playground and an individually designed music therapy intervention, implemented by the classroom teachers and subsequently by classroom peers, designed to increase peer interaction of young children with ASD on a playground. The specific research questions asked in the inquiry were as follows: (a) Does the musical adaptation of a playground (Music Hut) increase peer interactions on playgrounds for young children with autism? (b) Does the use of an individually composed song, sung by the teachers and peers, increase positive peer interaction on the playground for young children with autism? (c) Can classroom teachers learn the principles important to music therapy to increase peer interaction on the playground for young children with autism? and (d) Do peers participate and model targeted tasks?

Method

Participants

Four boys with autism, ages three to five, who were attending one of three different classes in an inclusive community-based child care program affiliated with a university, their classroom teachers ($n = 6$), and their classmates with and without disabilities ($n = 32$), participated in this study. The students with autism were diagnosed by external agencies using standardized assessment tools, and met the criteria for Autistic Disorder specified in the DSM-IV-TR (APA, 2000). On the *Childhood Autism Rating Scale* (Schopler, Reichler, & Renner, 1988), three of the target children were placed in the mild to moderate range, and one in the moderate to severe range. Three children were enrolled in the child care program 25 months, and one 12 months, prior to this study. All fall under two ethnic groups, African American and European-American. The children were selected for the study by the suggestions of their parents, classroom teachers, and therapists based on (a) the diagnosis of ASD, (b) the Individual Education Plan (IEP) goals, (c) the absence of specific peer-related interventions on the playground, and (d) the interest and positive responses to music. To become more

independent on the playground and in outdoor play, all targeted children needed to develop greater skills in interacting with peers, and be motivated to participate in ongoing playground activities. Descriptive information about the target children's age and typical behavior on the playground is provided in Table 1. Although all participants in this inquiry gave consent to publish this study, all names have been changed to respect the children's and family's privacy.

The target children's classmates participated in the study with parental permission. Classroom peers included both males and females from different ethnic groups, ages two to five years old. The class size ranged from 12 to 14 children (including the targeted children) and included typically developing children and children with autism and other disabilities. All children's participation in the study was voluntary. More specifically, children who came forward to interact with the targeted children were included in the intervention. Additionally, two peers were formally selected to perform as "peer buddies" for each targeted child. The "peer buddies" were selected for this study by their classroom teachers and therapists based on their (a) interest in music, (b) social skills, (c) relationship to the child with autism, and (d) motivation to participate. The particular "peer buddies" who participated each day varied based on the children's own actions and on class attendance.

Three lead teachers and three assistant teachers, all female, participated based on their interest in the study and schedule. Diverse educational backgrounds, ranging from high school diploma to master's degree with certification in early childhood education, were represented as well as various years of teaching experience (from 2–5 years). Half of the teachers participated in previous studies related to music therapy and therefore had prior experience with music therapy interventions using a collaborative consultative approach.

Setting

Child care staff (teachers and therapists) used the integrated therapy model. The daily preschool schedule included two blocks of outdoor play, adjusted to the needs of the children. All experimental sessions occurred during morning outdoor play on the target children's child care playground. The playground (35 m × 47 m) contained different areas of play such as a large climbing

TABLE 1

Descriptive Information About the Target Children with Autism

Participant	Age	Typical behavior on the playground
Eric	3 years, 4 months	Eric's peer interactions on the playground was limited, although he approached his peers frequently. Most of the peer interactions initiated by him were inappropriate (e.g., taking toys away). Peers rarely initiated playing with him. He most often would ride a tricycle or dig in the sandbox.
Ben	4 years	Ben rarely interacted with peers on the playground. He most often would stroll and run around aimlessly, unless an adult assisted him with meaningful play. Frequently he turned around in a repetitive pattern while singing and signing familiar songs or lay on a bench.
Phillip	4 years, 9 months	Phillip showed interest in his peers, but did not always know how to approach them appropriately. At times he became physically rough with peers as play progressed and peers viewed him negatively or were afraid of him. He most often engaged in behaviors such as wandering aimlessly, spinning a leaf, or sitting on a bench, unless adults involved him in meaningful activities (e.g., riding a tricycle). Phillip attended the same class as Ben.
Lucas	3 years, 9 months	During playground time, Lucas frequently twisted objects (e.g., a ball) and followed moving objects (e.g., tricycle) around the playground. He sought motor activities such as running around and body rocking. His peer interaction on the playground was minimal, often occurring only when he was interested in an object used by peers.

and sliding structure, three sandboxes, a wooden playhouse, a tricycle path, a green play field, two small and two large trees surrounded by wooden benches, three raised flower and garden beds, and the Sound Path, a musical stimulation path originally designed for a child with visual impairments (Kern & Wolery, 2001). The building and a 2 meter high chain-linked fence bounded the playground. Additionally, a separate fenced area was provided for infants and toddlers. The playground contained common play-

ground toys such as tricycles, wagons, large plastic building blocks, sand toys, balls, hoops, and large toy trucks.

In addition to the three classes participating in the study, two other classes, enrolling seven 2-year-old children each, were on the playground at staggered but overlapping times. As a result, the number of children during morning outdoor play varied, based on the classroom schedule, classroom activities, attendance, and weather conditions.

Materials

An outdoor music center (Music Hut) was added to the largest sand box on the playground. It was constructed to expand learning opportunities and therapeutic playground activities of young children, especially those with autism (Kern, Marlette, & Snyder, 2002). A Chinese Lion Wind Gong, three Tubanos in different sizes, a Kid's Floor Drum, Kid's Bongos, a High Head, a Mini Cabasa, three Sound Tubes made out of PVC pipes of different lengths, one Marching Drum, and Ocean Drum, and a CD player were attached to steel arches, wooden beams, and Plexiglas walls. The instruments were located on a 3 m × 2.5 m hardwood deck, covered with a 6.2 m × 8.2 m green fabric canopy and were wheelchair accessible. The Music Hut was designed and built by the first author in collaboration with a university architect and employees of the university carpentry shop. Design and construction met the guidelines of U.S. playground safety regulations (American Society for Testing and Material, 2003; U.S. Consumer Product Safety Commission, 1997).

To structure activities and engage children in the Music Hut, the first author composed songs unique to each target child. The themes of each song supported the target children's growth by incorporating their strengths and individual education goals such as improve turn taking, increase choice making, use appropriate body contact, which were identified by the interdisciplinary intervention team prior to the study. A CD recording containing each song and a sing-along were given to teachers and parents together with the song transcriptions in advance.

Staff Development Activities

Initially, the first author collaborated and consulted with teachers, specialists, and parents to define the problem, to identify in-

intervention goals, to plan the intervention, and to discuss how the intervention could effectively be embedded in the ongoing playground routine. She trained all participating teachers in a one-to-one format to use principles of music therapy and the materials designed for this study. Instructions included the following:

- how to take the subject and a chosen peer to the Music Hut, by holding hands and preparing/motivating the children verbally for the musical activities that would follow;
- how to initiate play and include children on their level, by using the ISO-Principle (Benenzon, 1997), including children's ideas and strengths in the procedure;
- how to involve the children in singing the song and playing the instruments by inviting the children to sing the particular intervention song while playing the named instruments in the Music Hut, and giving verbal praise as reinforcer;
- how to continue to play in the Music Hut for 10 minutes at a time by engaging the children and motivating them through the activity;
- how to assist peers in developing a play routine by identifying their preferences and strengths and asking or suggesting how to play with the target child;
- how to train the peers to model the tasks, by modeling the tasks, developing and practicing a play routine, clarifying questions and misinterpretations, mediating challenging moments, and giving verbal praise;
- how to gradually reduce the verbal and physical prompting by giving the lead to the peers, stepping out of the Music Hut, and reducing verbal guidance as much as possible; and
- how to communicate a positive attitude toward the child by anticipating the intervention with enthusiasm and emphasizing the strengths of the target child.

Additionally, she introduced the songs to all participating children during circle time prior to the intervention. Staff training ended when teachers indicated that they were comfortable with the particular song and the intervention procedure.

Design

A multiple baseline design across participants (Alberto & Troutman, 1995; Aldridge, 2005; Kazdin, 1982) was used. The experi-

mental design in this study involved the following four sequentially implemented conditions.

Baseline condition (A). In the baseline condition, except for the already existing Sound Path, no additional musical adaptations to the physical environment and materials were made (i.e., The Music Hut was not present). Additionally, no instruction was given to either the target child or peers then entering the playground. Staff were asked not to interact with the child, unless it was necessary (i.e., when the child needed help) or the child initiated the interaction. The purpose of this was to evaluate the natural, unstructured, and unsupported peer interactions and engagement of the child occurring on the playground.

Adaptation of the playground (B). After the musical playground adaptation (Music Hut), the teacher walked the child to the Music Hut when entering the playground, gave him a drumstick, and asked him to play in the Music Hut. This was done to document the changes related to the outdoor music center.

Teacher-mediated intervention (C). In this intervention condition, a predictable routine and structure was established for each child. Prior to outdoor play, each target child chose at least one of the two "peer buddies" to play with. Then, the teacher followed a sequence of five steps: (a) entering the Music Hut with the child and at least one peer buddy; (b) initiating play, including both children on their level; (c) singing the unique song and playing the instruments in the Music Hut; (d) modeling the content of the song (e.g., choosing an instrument, naming peers, waiting for turns, and making appropriate body contacts); and (e) continuing to play in the Music Hut for 10 minutes at a time. Teachers trained the formally selected "peer buddies" to mediate the same sequence of steps in intervention condition D.

Peer-mediated intervention (D). The goal of this peer-mediated intervention condition was to have the "peer buddy" and the target child interact and play with each other independently. The procedure was similar to that in the teacher-mediated intervention phase. The only change was that teachers withdrew their support gradually after the "peer buddies" and the target children learned the song and play routine. First teachers reduced the physical prompting by stepping out of the Music Hut and giving verbal prompts from outside, and second by just giving prompts when necessary. The four conditions were implemented for all target

children, except intervention Condition D, in which only three children (i.e., Phillip, Ben, Lucas) participated. The peer-mediated intervention was not implemented for Eric due to his teacher's time commitment based on classroom schedule issues. Procedural fidelity data were recorded on both teachers' and peers' task behaviors.

The first two conditions (baseline without Music Hut, and Music Hut) serve as baseline conditions for this study. The Music Hut was introduced to all participants at the same time; it could not be introduced in a time-lagged fashion (as in a multiple baseline design) or withdrawn (as in a withdrawal or reversal design), because of the cost, effort, and time involved in the installation. These first two conditions do not allow an experimental evaluation of the Music Hut, but do provide some data on the effects of simply adding the Music Hut to the playground. The remainder of the design is a multiple baseline across participants. The Music Hut condition serves as the baseline condition, and the teacher-mediated intervention ("C") condition was introduced in a time-lagged fashion across four participants (multiple baseline across participants). This allowed an evaluation of the existence of a functional relation between the teacher-mediated intervention and children's interactive behavior. The "D" condition (peer-mediated intervention) also was implemented in a time-lagged fashion across three participants, which also allowed an evaluation of the existence of a functional relation between (Condition D) and children's interactive behavior.

Measurements

Categories of interaction behaviors and play/engagement were coded by analyzing 10-minute videotaped segments using a 15-second momentary time-sampling recording procedure. Data were collected one time daily for each child during morning playground time, typically between 10:15 and 11:45 a.m. During baseline condition the observation started when the target child and his classmates entered the playground, in Condition B when the target child entered the Music Hut, and in Conditions C and D when the target child and at least one "peer buddy" entered the Music Hut. The momentary time sampling system was employed as follows: (a) the observers used a CD recording cuing them every 15 seconds to the time for observation/recording; (b) at each 15-second point, each observer made a judgment about the occurrence of behaviors

in each category for both peers and subjects at that point in time; and (c) the observers recorded the results for each category on a specially designed data sheet.

Each observation lasted 10 minutes a day over a period of 8 months. Eric was observed for a total of 30 sessions, Ben for a total of 56 sessions, Phillip for a total of 63 sessions, and Lucas for a total of 71 sessions.

The operational definitions for each category of interaction and play/engagement as presented in Table 2 are similar to those used in the early intervention literature. Additionally, the five steps of teachers' task behaviors in Condition C, and peers' task behaviors in condition D, were recorded on a separate data sheet. A judgment was made whether or not the sequence of tasks was completed during the 10 minutes of data collection each day.

Reliability

Interobserver reliability data were collected on the interaction and play engagement behaviors of target children, peers, and teachers. Agreement between the scores of three observers was calculated for each target behavior before the baseline condition by using 10 minute videotaped segments to establish an acceptable level of agreement of greater than 85%. During the study, reliability checks were carried out on an average of 36.8% of the total observations within each phase and for each child. Interobserver agreement levels for each code category were calculated by dividing the number of agreements by the total number of agreements plus disagreements multiplied by 100. Aggregated interobserver reliability was 98.2% (range 93.8% to 99.8%).

Results

The results of this study are presented in the following order: children's positive peer interactions as presented in Figure 1, teachers' and peers' task behaviors as displayed in Figures 2 and 3, presence in the Music Hut as depicted in Table 3, and the target children's play and engagement with equipment and materials as outlined in Table 4.

Positive peer interactions

Eric. In the baseline condition, Eric's positive peer interaction was quite low and variable, ranging from 0% to 18%. In four ses-

TABLE 2

Operational Definitions for Categories on Interactions and on Play and Engagement in the Music Hut

Participants	Category	Definition
Peers	Initiates interaction	The peer makes the first step toward an interaction.
	Positive interaction	The peer initiates a positive interaction with the target child or responds positively to the interaction initiated by the target child. If the peer's intention of interaction is positive, but receives a negative response from the target child, it is evaluated as a negative interaction and not coded. Negative interaction is defined as inappropriate behavior of peers and the target child (e.g., pushing, taking something away, screaming, and scratching).
	Stays in the Music Hut	The chosen peer stays in the Music Hut for the period of data collection in condition C and D.
Target children	Initiates interaction	The target child makes the first step towards the interaction
	Positive interaction	The target child initiates a positive interaction with a peer or responds positively to the interaction initiated by a peer. If the target child's intention of interaction is positive, but receives a negative response from peers, it is evaluated as a negative interaction and not coded.
	Stays in the Music Hut	The target child stays in the Music Hut for the period of data collection in condition B, C and D (to determine whether the interaction is tied to a musical activity).
	Play and engagement with material and equipment	The target child manipulates a material and uses the equipment (e.g., digging in the sandbox, sliding, riding a tricycle, walking purposely to a location, activating the instruments in the Music Hut or Sound Path).
Teachers	Supported interactions	The teachers prompt the target child and his peers verbally/musically (e.g., "Gentle, stop scratching!" or "Play the drum") or physically (e.g., the teacher puts her hand on either child in order to facilitate positive interaction).
	Unsupported interactions	The teachers do not prompt the target child and his peers in any way. Positive interactions are solely performed by the target child and his peers.

sions out of 11, no positive peer interaction was observed, and in the majority of observations positive peer interaction was below 6%. The adaptation of the playground (Music Hut, Condition B) resulted in an increase of Eric's positive peer interactions, but the level of these interactions was quite inconsistent from day to day, ranging from 3% to 40%. The teacher-mediated intervention (Condition C) resulted in increased positive peer interaction, with a range from 33% to 68%. For the last four observations, the positive peer interaction was stable in a range from 40% to 45%.

Ben. In the baseline condition, Ben's positive peer interaction was very low and fairly stable, with a range from 0% to 13%. Positive peer interaction was observed in only two out of 11 sessions. The adaptation of the playground (Music Hut, Condition B) resulted in a small increase in Ben's positive peer interaction, whereupon the subsequent readings were variable. All data points were still 13% or less (range 0% to 13%), but some positive peer interaction was observed in seven out of 15 observations. The teacher-mediated intervention (Condition C) resulted in an abrupt and sharp increase in positive peer interactions, although day to day performance fluctuated considerably. In all observations, Ben's percentage of positive peer interaction was greater than 53% (range 53% to 93%). In nine out of 18 observations, peer interaction was greater than 80%. The peer-mediated intervention (Condition D) resulted in a small decrease in supported positive peer interaction. The percentage of supported positive peer interaction continued at a very high level, however, ranging from 43% to 80%, with all but one observation above 65%. The peer-mediated interventions resulted in a greater percentage of unsupported positive peer interaction, compared with Condition B, and day to day interactions were quite variable, ranging from 0% to 30%. The majority of observations were over 20%, and during only two observations were no unsupported positive peer interactions noted.

Phillip. In the baseline condition, Phillip's positive peer interaction was quite low. All data points were 15% or less (range 0% to 15%). In five out of eight sessions, no positive peer interaction was observed. The adaptation of the playground (Music Hut, Condition B) resulted in a small increase in Phillip's positive peer interaction, and subsequent readings were quite consistent. During the first 15 observations, peer interaction was below 7% with one exception. During the last 9 observations, readings were variable and

ranged from 0% to 23%. The teacher-mediated intervention (Condition C) resulted in an abrupt and sharp increase in the level of positive interactions, although it was variable across days. Phillip's percentage of positive peer interaction ranged from 33% to 93%, with all but the first observation above 64%. In nine out of 22 observations, his peer interaction was greater than 80%. The peer-mediated intervention (Condition D) resulted in an increased percentage of unsupported positive peer interaction compared with Condition B, and interactions were quite variable. All data points were above 8% (range 8% to 33%), with the majority of observations were above 23%.

Lucas. In the baseline condition, Lucas' positive peer interaction was very low and stable. All data points were 5% or less (range 0% to 5%). In six out of 13 sessions, no positive peer interaction was noted. The adaptation of the playground (Music Hut, Condition B) resulted in a small increase of Lucas' positive peer interaction with a range from 0% to 10%. In 13 out of 29 observations no positive peer interaction was observed. The teacher-mediated intervention (Condition C) resulted in a sudden and acute increase in the level of positive peer interaction, though his behaviors varied substantially across days. On all observations, Lucas' percentage of positive peer interaction was greater than 28% (range 28% to 80%), with the majority of observations above 58%. The peer-mediated intervention (Condition D) resulted in an increased percentage of unsupported positive peer interaction compared with Condition B, but with substantial variability. All data points were above 13% (range from 13% to 40%), and majority of observations were above 20%.

Teachers' Task Behaviors

Procedural fidelity data were collected on teachers' task behaviors during the teacher-mediated intervention (Condition C). With only one exception, all teachers implemented the intervention at a very high level. All data of the teachers' task behavior were consistently high, except for Eric's teacher's data, which dropped abruptly to a low level of data after the first half of Condition C. Interestingly, the teachers' task behavior correlated with the positive peer interaction as presented in Figure 2. That is, when the teachers' task behavior was on a high level, the peer interaction was also on a high level.

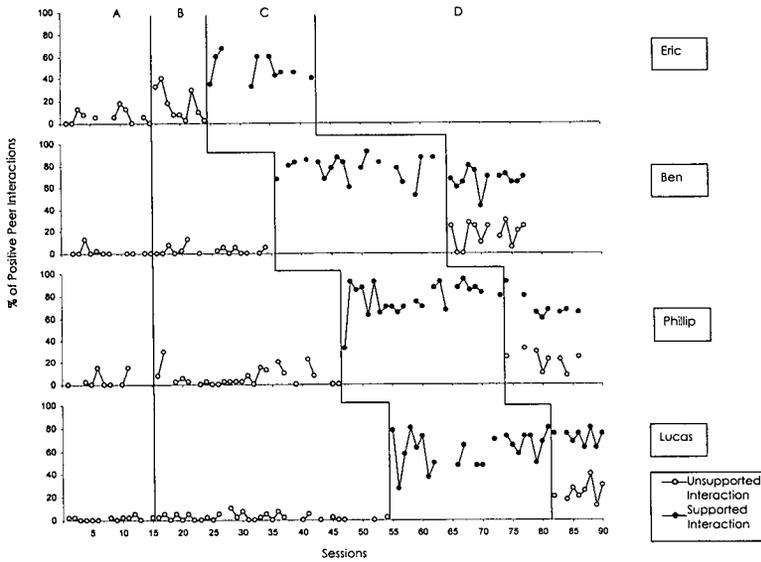


FIGURE 1.

Percentage of positive peer interactions for each target child, by each condition of the study.

Peers' Task Behaviors

Procedural fidelity data were also collected on peers' task behaviors during the peer-mediated intervention (Condition D). The data related to peers' task behavior as shown in Figure 3, suggests that all peers implemented parts of the five steps of the peer-mediated intervention procedure correctly. The data of Phillip's and Lucas' peer buddies were consistent and on a high level. The data of Ben's peer buddies were variable, however, ranging from two steps to five steps. No data were collected on Eric's peers' task behavior, because condition D was not implemented.

Stays in the Music Hut

As presented in Table 3, with the original playground setting (Condition A) the target children had few interactions with their peers. When the outdoor music center was available (Condition B), the target children spent at least some time almost every day in the Music Hut. However, the data bear witness to only a small in-

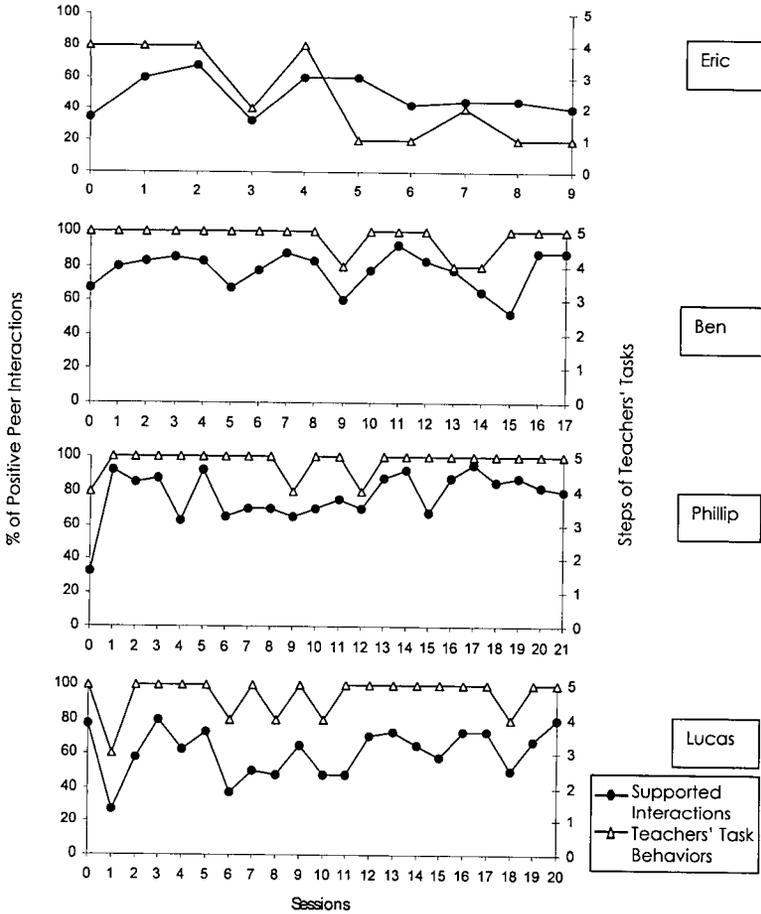


FIGURE 2.

Teachers' task behaviors and positive peer interactions in condition C for Eric (top panel), Ben (second panel), Phillip (third panel), and Lucas (bottom panel).

crease in positive peer interactions over the previous condition, and then at a very low level. During the teacher-mediated intervention phase (Condition C), the target children spent more time in the Music Hut. In this scenario the peer interaction spiked to a high level and stayed high through the entire condition for all children. During the peer-mediated intervention (Condition D), the

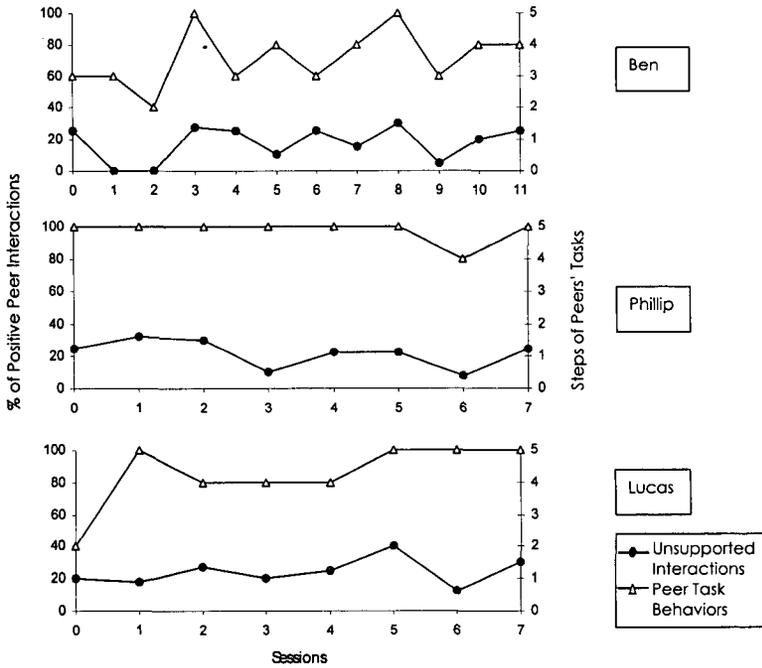


FIGURE 3.

Peers' task behaviors and positive peer interactions in condition D for Ben (top panel), Phillip (middle panel), and Lucas (bottom panel).

target children continued to stay in the Music Hut. The positive peer interaction appeared slightly lower than in Condition C, but remained at a high level nonetheless.

Play and engagement with material and equipment

Play and engagement with material and equipment was defined as actively manipulating material and using the equipment in a meaningful way. In Conditions A and B, Ben's, Phillip's, and Lucas' percentage of play and engagement with material and equipment was on a low level and variable across days. As presented in Table 4, in Conditions C and D, their play and engagement abruptly increased to a very high level while variability continued to be a hallmark of post intervention readings. Eric's play and engagement

TABLE 3

Range (Min % & Max %), Mean (M %), and Standard Deviation (SD) of Stays in the Music Hut for Each Target Child in Conditions B, C, and D

Con- dition	Eric				Ben				Phillip				Lucas			
	Min	Max	M	SD	Min	Max	M	SD	Min	Max	M	SD	Min	Max	M	SD
A	2.5	90.0	28.1	34.5	0.0	50.0	15.7	12.8	2.5	62.5	16.9	15.7	2.5	80.0	23.0	20.7
C	27.5	77.5	52.3	18.8	85.0	100	98.1	4.0	70.0	100	96.1	7.9	50.0	100	90.8	15.9
D	N/A	N/A	N/A	N/A	65.0	100	92.3	10.7	95.0	100	97.8	2.1	82.5	100	92.8	5.4

was variable across all conditions, and in condition A was on a higher level than the other children's play and engagement.

Discussion

There are several findings that result from this study. First, the data during baseline condition reflect common characteristics of autism and complements previous research findings demonstrating that children with special needs engage less in meaningful play and peer interactions on the playground than their typically developing counterparts (Fujiki et al., 2001; Nabors & Badawi, 1997). Hence, specific individualized interventions including strategies generally used with children with autism are necessary to support children's learning and development on the playground.

A second finding is that all of the target children were attracted by the sound produced in the Music Hut and explored the instruments for short periods of time. However, the musical equipment itself did not generate desired outcomes in terms of the children's peer interactions. For the participants in this study, the combination of environmental adaptations and individualized interventions were necessary to meet their learning needs. This supports studies investigating the efficacy of ecological variations for increasing social interaction of young children with autism (McConnell, 2002), and is described in the literature related to playground activities for children with special needs (Flynn & Kieff, 2002; McConnell, 2002; Nabors & Badawi, 1997). Nevertheless, the attraction of the Music Hut, the proximity to peers, and the opportunity to engage in joint musical activities facilitates the involvement and motivation of the children with autism to interact with peers on the playground.

Table 4

Range (Min % and Max %), Mean (M%), and Standard Deviation (SD) of Play and Engagement with Equipment and Materials for Each Target Child, by Each Condition

Con- dition	Eric				Ben				Phillip				Lucas			
	Min	Max	M	SD	Min	Max	M	SD	Min	Max	M	SD	Min	Max	M	SD
A	25.0	97.5	52.7	22.9	0.0	37.5	13.6	12.8	0.0	97.5	20.0	33.4	0.0	20.0	4.0	6.7
B	25.0	80.0	52.8	14.9	0.0	60.0	20.8	15.2	0.0	60.0	15.3	12.9	0.0	57.5	18.0	13.6
C	37.5	95.0	65.3	19.1	40.0	95.0	72.9	14.6	47.5	95.0	71.4	12.6	17.5	57.5	40.7	12.2
D	N/A	N/A	N/A	N/A	40.0	67.5	59.2	8.2	47.5	85.0	61.6	11.6	10.0	50.0	28.8	12.3

A third major finding is that the composed songs unique to each target child incorporating specific therapeutic goals, produced desirable outcomes. This finding is consistent with earlier studies in which songs were used to assist individuals with autism to improve social skills (Brownell, 2002; Pasiali, 2004; Stevens & Clark, 1969), and supports the clinical application of songs for skill development in early childhood settings.

The fourth finding relates to the collaborative consultative approach to music therapy, and its effectiveness in enabling teachers to successfully implement the interventions in ongoing playground routines. This study illustrates that individualized interventions based on music therapy principles can be embedded by teachers in ongoing playground routines, when staff development activities and ongoing consultation are provided. With only one exception, the teachers' accuracy in implementing the intervention was very high, as evidenced by the procedural fidelity data. The level of teacher fidelity to this intervention is closely associated with its effect on the target children's skill improvement. Towards this end, the fidelity ratings in this study introduce a preliminary measure of how effective the collaborative consultation component can be in imparting intervention partners with adequate tolls for short-term intervention sustainability. Another important implication of this finding is that high-quality on-site staff training and ongoing collaborative consultation by a certified music therapist is crucial for appropriate and successful implementation of teacher-mediated interventions using music therapy principles. There is a need for music-therapy-based on-site staff development activities to ensure both teachers' comfort level and the sharing of professional knowledge, as other authors also suggest (Chester, Holmberg, Lawrence,

& Thurmond, 1999; Furman, 2002; Register, 2004; Snell, 2002; Warwick, 1995). Although there are many ways of providing therapeutic services to young children and their families, the collaborative consultative model of service delivery is desirable, because it incorporates recommended practice and policy in early childhood education (Buisse & Wesley, 2005; McWilliam, 1996; National Research Council, 2001).

Peer-mediated strategies were effective in increasing peer interactions and meaningful play on the playground, and thus constitute a fifth key finding in this inquiry. The songs were relatively easy to learn by the "peer buddies" and other classmates, and facilitated social involvement between the peers and the children with autism. However, ongoing mediation by the teachers in interpreting the meaning of the target children's uneven patterns of behaviors and communication styles was continually needed to facilitate positive peer interactions.

In general, playgrounds need to be viewed as therapeutic settings and part of the overall curriculum along with classrooms (Cullen, 1993; DeBord et al., 2002; Nabors et al., 2001), particularly in early childhood programs applying an integrated therapeutic approach. Consequently, playgrounds are important and appropriate settings for implementing music therapy interventions to facilitate learning and development for both children with and without special needs.

There are several limitations related to this inquiry. For example, a clear limitation imposed by the application of a single-case experimental design is the small number of participants. Another limitation is that no maintenance and generalization measures have been applied. It is not known whether the teachers' and peers' accurate implementation of the interventions would maintain once the intervention (including ongoing collaborative consultation) is no longer in place. Nor do we know if the child's skill acquisition would generalize across settings.

More research is warranted to provide additional validity to the use of an outdoor music center as a motivational environment for learning and development for both children with and without special needs. Future research should also evaluate the effects of a variety of peer-mediated strategies on playgrounds, and examine children's skill generalization in different environments. Additional research illustrating the benefits of the music therapy collaborative

consultative model of service delivery in early intervention/early childhood special education is needed.

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