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Shared Musical Performance as a Means of Facilitating Peer Interaction in the Classroom including a Child with Autism

BY

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EARLY RESEARCH PROJECT

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ABSTRACT

Based on a social-ecological approach to intervention, the present proof of concept study examined the potential of an Activity-based Musical Program (AMP) to facilitate peer interactions between a child with autism, Aaron, and four peers in an early grade school setting. This project was inspired by an existing music education program in Chile ("Creando a través de señas") that promotes interaction through a combination of gestures, physicality, and shared experiences between children with autism and professional musicians. It also builds upon the inherent musical interest/talent of many children with autism (Heaton, 2009; Overy & Molnar-Szakacs, 2009). Like the Chilean program, the Activity-based Musical Program designed for this study focused on using a shared interest in music to explore instruments, learn conducting gestures from each other, and develop a final performance that could be shared with the whole class. Leveraging the strengths of both single subject and qualitative methodologies, this study collected single-case data on the frequency of communicative offers during multiple probe across participants and conducted semi-structured interviews of child participants, classroom teachers, and Aaron's mother. In sum, the intervention appeared to be well-perceived by all participants and led to increased communicative offers between Aaron and 3 out of 4 peers during the course of intervention. The generalization of effects outside of the intervention were not supported by experimental data, but participants reported increased awareness of each other and positive changes in peer interactions. Clinically, this proof of concept study offers interdisciplinary implications for speech-language pathologists and related professionals in regard to how one might facilitate peer interactions for children with autism using a social-ecological perspective and shared interest in music.

CHAPTER I: LITERATURE REVIEW

Successful peer interaction is central to school-age (Dunn & McGuire, 1992; Guralnick, 1990; Kennedy & Shukla, 1994; Parker, Rubin, Erath, Wojslawowicz, & Buskirk, 2006; Whalon, Conroy, Martinez, & Werch, 2015). Difficulties in social interactions discourage peer approval and increase the possibility of being excluded, which in turn reduces the development of friendships (Bauminger & Kasari, 2000; Chamberlain, Kasari, & Rotheram-Fuller, 2007; Guralnick, 1990; Symes & Humphrey, 2010; Wolfberg, Mccracken, & Tuchel, 2008). In addition, segregation and the accumulation of negative social experiences increase the risk of mental disorders such as depression and anxiety as well (Bellini, 2004; Brinton & Fujiki, 2013; Chamberlain et al., 2007; Humphrey & Symes, 2010; Symes & Humphrey, 2010; Tantam, 2000; Thompson & Emira, 2011; Wolfberg et al., 2008).

Difficulties in Social Interaction for Children with Autism[1]

Difficulties with social interaction, exclusion, and mental health issues have all emerged as areas of concern for children with autism (DSM-5 American Psychiatric Association, 2013; Lord & McGee, 2001). Scott Robertson, a self-disclosed academic with autism and autism advocate states, "Diverse difficulties and strengths in language, communication, and social interaction constitute a major facet of the disability of autism. Consequently, it follows that challenges in forming and maintaining social relationships would likely present for autistic adults" (p. 9, Robertson, 2010). Specifically, researchers

[1] We have adopted person-first language here to be consistent with professional guidelines (Folkins, 1992); however, we recognize the different opinions in this regard (Sinclair, 2013) and support the right of individuals with marked differences to determine for themselves their own identity, including how they are referred to.

have focused on limited social interactions between children with autism and their peers, even when children are included in regular education classrooms (DiSalvo & Oswald, 2002; Smith-Myles, Simpson, Ormsbee, & Erickson, 1993; Whalon et al., 2015). In such settings, children with autism have experienced negative attitudes from their nondisabled peers (Campbell, Ferguson, Herzinger, Jackson, & Marino, 2005; Swaim & Morgan, 2001), and experienced more difficulties in making friends (Bauminger & Shulman, 2003; Chamberlain et al., 2007; Swaim & Morgan, 2001; Wolfberg & Schuler, 1999). Although studies have reported the ability of children with autism to establish a friendship with at least one peer, the characteristics of their friendships may be different (Bauminger & Kasari, 2000; Bauminger & Shulman, 2003; Chamberlain et al., 2007). Specifically, Bauminger and Shulman (2003) reported that children with autism have a smaller number of friends and their friendships are less stable than 'typical' peers. Researchers have reported poorer quality and fewer reciprocal friendships (Bauminger & Kasari, 2000; Chamberlain et al., 2007; Locke, Ishijima, Kasari, & London, 2010). Based on these potential difficulties in establishing warm and reciprocal relationships, interventions focused on facilitating peer interactions are warranted (Rogers, 2000; Whalon et al., 2015).

Medical Model Approach

Much of the literature within Communication Science and Disorders and related fields has approached the social challenges of children with autism from a medical-based model, also referred to as a deficit-focused view (Robertson, 2010; Straus, 2013). The medical model attributes difficulties in social interactions with impairments in an individual's skills that need to be fixed or improved. Consequently, associated

interventions focus on the development of individual's specific abilities such as eye contact, greetings, and initiations, often directed through the expertise of non-autistic specialists such as teachers or therapists (e.g., Charlop & Walsh, 1986; Dawson & Galpert, 1990; Rogers, 2000; Tiegerman & Primavera, 1984; Whalon et al., 2015). Occasionally, peers are also incorporated in the intervention. However, most of these peer-mediated methods are characterized by the training of peers to assist children with difficulties because, under this model, children with autism have deficiencies that we need to remedy and/or 'normalize' (Odom & Strain, 1984; Robertson, 2010; Rogers, 2000; Straus, 2013; Whalon et al., 2015).

Social-Ecological Approach

In contrast with the medical model, distributed models of disability explicitly acknowledge the role that contextual factors play in supporting and/or disrupting an individual's successful participation and interactions. The importance of context has been highlighted across different literatures, for example, the cultural-historic activity theory (CHAT; (Gutierrez & Rogoff, 2003; Hengst, 2015; Roth & Lee, 2007), as well as both social and social-ecological models of disability (Fisher & Shogren, 2012; Fisher, Shogren, & Halle, 2013; Wehmeyer et al., 2008). Given the overlapping contributions of these theoretical frameworks, this study aligns most closely with a social-ecological framework given its explicit focus on context and supports within the educational system. Although a social-ecological approach does not deny the role of the individual within interactions, it highlights the contribution of the environment, including the responsibilities of other persons within the interaction (Fisher & Shogren, 2012; Hengst & Duff, 2007; Wehmeyer et al., 2008). Specifically, DeThorne, Hengst, Fisher, and King

(2014) drew on the related social model to highlight that interaction is by nature a social accomplishment, distributed across people and resources, and situated within activities. I will highlight the role of both these concepts as related to facilitating social interactions involving children with autism.

Distributed across people. Based on a social-ecological model, peer interaction is a reciprocal process where the responsibility for success (and disruptions) of the interaction is shared across all participants (Bauminger, 2002; DeThorne et al., 2014; Kamps, Potucek, Lopez, Kravits, & Kemmerer, 1997). Consequently, interventions should consider the need to shape the interactions across participants, not solely through changing the individual skills of the child with autism. Most intervention studies have focused on what Fiske (1992) refers to as an "authority ranking model" of interaction. This kind of interaction is based on an asymmetric relationship between participants where there is an unequal power dynamic. Consistent with this type of interaction, interventions often focus on training peers to 'help children with autism'. An example of this approach is used in a study conducted by Pierce and Schreibman (1995), who trained peers to model social skills such as initiation and joint attention for children with autism. In contrast, a communal sharing relationship is characterized by an equality of power across people participating in the interaction (Fiske, 1992). Facilitating communal sharing is more consistent with a social-ecological model given its focus on supporting the interaction rather than fixing the individual. Interventions focused on reciprocal interactions across peers are based on the premise that both partners bring equal value to the interaction and both are likely to need support. As an example, the Integrated Play Group model proposed by Pamela Wolfberg (2008) brings together school-age children

with autism and their non-autistic peers within a dedicated playgroup to focus on activities that capitalize on the interests of the child participants. The role of the therapist is to scaffold the interactions across the children through strategies such as interpreting the actions of child participants to help them understand each other and directing situations within play routines to cater to the skills and interests of the participants. For example, Wolfberg and Schuler (1999) provided an illustration of scaffolded interactions that included Freddy, a 7 year-old boy with autism and some peers. In this case, the authors explained how the facilitator asked questions to capture the interest of the participants (e.g., select a game to play together) and suggested roles that catered to the children's interests (e.g., teacher suggests Freddy and two peers perform the role of workers in a grocery store). The Integrated Play Group has been recognized by the National Autism Center's National Standards Project (2009) as an example of Peer Training Packages that were considered "established treatments" with evidence of effectiveness.

Distributed across resources. In addition to peers, a social-ecological framework also anticipates that the frequency and nature of the interactions of children with autism will change according to other aspects of the context, such as the goals of the activity and the resources available (DeThorne et al., 2014; Roth & Lee, 2007). A common resource for children with ASD utilized across activities is alternative and assistive communication (Mirenda & Brown, 2009). Alternative and assistive communication (AAC), ranging from low-tech picture symbols to high-tech computerized displays, is defined as an explicit support for communication in children with marked speech-language impairments (Beukelman & Mirenda, 2013; Fisher & Shogren, 2012). AAC can

be used to support the comprehension and/or expression of intended messages, and has been documented as a powerful form of support for many individuals with autism, both by individuals with autism and the professionals who work with them (Durbin-Westby, 2010; Mirenda & Brown, 2009).

Although AAC has emerged as a critical resource for many children with autism, work by DeThorne and colleagues (2014) has emphasized the importance of acknowledging the inherent multimodality of all communicative interactions, and therefore implementing AAC as one of many resources available to support communicative interactions. Specifically, DeThorne, Hengst, Valentino, & Russell, (2015) implemented an ethnographic study of classroom interactions involving a preschool-age child with autism who used AAC, Aaron, who will be also the primary participant of the present study. Based on observational field notes of classroom observations, interviews with teachers and Aaron's father, and discourse analysis of a small group activity, the findings supported the importance of both presumed competence and flexible multimodality in supporting Aaron's classroom interactions. Consistent with the idea that interaction is distributed across people, presumed competence refers to the importance of taking up children's activities as meaningful based on the activity at hand, and flexible multimodality refers to the importance of using whatever resources (e.g., objects, gestures, facial expressions, AAC, speech) are available to effectively and efficiently accomplish one's communicative goal. Specifically within the discourse analysis of the "So happy together" video segment within DeThorne and colleagues (2015), the authors illustrate how the therapist coaches Aaron's peers to use flexible

multimodal communication to support their interaction during a small group Potato Head activity.

Focus on activity. Given the key role of context in distributed approaches, focusing on activity provides an important organizing principle for intervention (DeThorne et al., 2014). Activity Theory, developed by Luria and Leontiev (1962), highlights the importance of context within the learning process (Ukrainetz, 2006). According to this view, the development of abilities is acquired within contexts and are more apt to be successfully internalized if the activities are meaningful to the child and capitalize on his/her interests (Bricker & Cripe, 2004; Lave, 1996; Ukrainetz, 2006). Whether the activity is playing grocery store, collaborating to build a Potato Head figure, or balancing on a therapy ball, a shared focus on an activity allows participants in the interaction to align their resources toward a shared goal. The consideration of participants' interest, the goal of the activity, and the context where it is developed facilitates the transference of the learned abilities to daily life settings (Ukrainetz, 2006). A common theme across many of the activity-based interventions reviewed here is the selection of activities that integrate the interests and abilities of the children with autism and their peers. Although there is substantial heterogeneity in the interests and abilities of children with autism, music has emerged as a common theme across a variety of sources and applies to the participant in the proposed study.

Music and Autism

Many individuals with autism present a noticeable interest and talent for musical activities. This has been reported within the autism literature from the first works of Leo Kanner (Applebaum, Egel, Koegel, & Imhoff, 1979; Heaton, 2003, 2009; Overy &

Molnar-Szakacs, 2009). Numerous studies have documented that children with autism match or exceed non-autistic peers in areas such as attention and responsiveness to music (Heaton, 2009; Sherwin, 1953; Thaut, 1988), perception of musical stimuli (Edgerton, 1994; Heaton, 2009; Overy & Molnar-Szakacs, 2009), and production of musical patterns (Applebaum et al., 1979; Edgerton, 1994; Thaut, 1988). In addition to being an area of interest and strength for many children with autism, some have suggested that music is a useful intervention tool because it offers both a source of predictable patterns, as well as the potential for spontaneous improvisation (Edgerton, 1994; Gold, Wigram, & Elefant, 2006; Kim, Wigram, & Gold, 2008; Wigram & Gold, 2006). Consistent with the medical model, musical improvisation has been included in interventions aimed at training specific 'social skills' in children with autism (e.g., Finnigan & Starr, 2010; D. Wimpory, Chadwick, & Nash, 1995).

As an example, an intervention study by Kern, Wakeford, and Aldridge (2007) performed a single subject design to evaluate the effectiveness of using select songs to promote greeting skills in two 3-year-old boys with autism. With this purpose, a song was composed by the music therapist for each child, and it was taught to childcare teachers for its use during greeting routines. Authors measured the number of independent child responses to the songs during "morning arrival time." Results showed improved greeting skills in one boy, meanwhile the other one needed a modified intervention that eliminated the last part of the song that included saying goodbye to his caregivers.

Fewer studies have implemented musical interventions for children with autism using a social-ecological model that focuses on alignment between children and their environment within the context of specific activities (e.g., Aguirre, 2013; Kern &

Aldridge, 2006). One example of an activity-based intervention that uses musical performance as a mean to facilitate social interaction is the Chilean Workshop of Direction and Musical Improvisation: “Creando a través de señas” (Creating through signs). This workshop hinges on collaboration across school-age children with autism, a special education teacher, and professional musicians to explore musical instruments through improvisational experiences and to develop a shared repertoire of symbols that can be used to conduct a performance. Consistent with the concept that social interactions are distributed across resources, the workshop promotes communication and social interaction broadly through a combination of gestures, physicality, and shared experiences with sound (Aguirre, 2013). The workshop was developed within a musical education program at school and documented in a paper by Aguirre (2013). This workshop includes eight key phases that culminate in a final performance in which each child conducts a group of professional musicians: 1) auditory perception and sensitization, 2) recognition of musical instruments and their families (e.g., woodwind, percussion), 3) musical exchange between children and musicians, 4) performance of conventional gestures, 5) creation of individual repertoires of gestures, 6) assimilation of the assembly as a whole (integration of elements learned in the previous phases), 7) strengthening of the conductor role, and 8) personalization of the conducting experience (integration of every element to direct musicians in an improvisational piece).

Anecdotal outcomes, observed from the information available on the program’s website and the documentary “La lección de música” (The music lesson), suggested increased synchronization and social engagement of the interactions involving children with autism, both with musicians and peers. The collaborative and activity-based nature

of this program makes it distinct from most of the social interaction interventions currently available for children with autism. Based on the novelty and promising outcomes of this program, I have integrated elements from this workshop into the intervention developed specific to my project.

Built upon a social-ecological model and inspired by the Creando a través de señas program, we developed an Activity-based Musical Program (AMP) to promote social interaction involving a child with autism and his classmates. The primary participant of this study, Aaron, engaged in intervention with four different peers (two at a time), while the social interaction of Aaron with all four peers was monitored continuously during intervention and during one weekly classroom activity (i.e., performance time).

The main goal of this study was to assess the efficacy of the AMP in facilitating peer interactions. According to this aim, the specific research questions related to this intervention were as follows:

1. Is there a functional relation between the implementation of the AMP and the rate and nature of communicative offers between a child with autism and his peers?
2. If there is a functional relation between AMP and the frequency of communicative offers, does it appear to generalize to classroom performance time?
3. What are participant perceptions of the intervention?

CHAPTER II: METHODS

Design

This study used a convergent mixed method design[2] to examine the effects of AMP on peer interactions in a classroom involving a child with autism. The study combines a single-subject multiple probe across participants design in conjunction with ethnographic methods of interview and video observation aimed at addressing the complexities of social interactions and the social validity of findings (Brantlinger, Jimenez, Klingner, Pugach, & Richardson, 2005). Both qualitative and single-subject methodologies are well suited for individualized intervention studies aimed at children from low incidence and heterogeneous populations, such as autism. Moreover, such methodologies provide the flexibility to work within ecologically-valid settings such as schools and to adapt procedures as needed for individual children (Brantlinger et al., 2005; Horner et al., 2005).

Research Team

Primary investigator background. I am a Chilean female with interdisciplinary interests. I participated in a singing program of the Catholic University of Chile when I was in high-school, and I have a master in neuroscience and a professional degree in the field of communication disorders. When I finished my professional degree, I worked for one and a half years at a special school for children with autism, which was my first known experience with individuals with autism. During my stay at the school, I could see

[2] This design, also referred as "convergent parallel design" or "concurrent design", (see Creswell & Clark, 2007; Onwuegbuzie & Collins, 2007) refers to the utilization of qualitative and quantitative methods simultaneously during the investigation (Creswell, 2014).

differences in their physicality when they danced, in the way that they expressed music, and in their perception of the world. It was interesting to me because I realized that they do not lack communication, they just use a different way to communicate with others. One of the activities that children had in this special school was music therapy. I did not have any knowledge about the theoretical basis of music as a therapy and its effectiveness. However, I found it very interesting. It was surprising to me how the children responded to this experience, how they seemed to enjoy it, and how they could connect with the world through it. Since this early experience, the idea of including music as a way to learn and connect with the environment was in my mind, but it was vague and ambiguous until I became familiar with the program "Creando a través de Señas" (Creating Though Signs). I became aware of this program after my schoolmates created and promoted it on social networks. Afterwards, I met with them to discuss the program. In particular this program brought together my interest in music as a therapy tool and my emergent understanding of distributed models of disability.

Research collaborators. In addition to myself, the research team for this study included Dr. Laura DeThorne, and five undergraduate research assistants. The five undergraduate research assistants were all majoring in speech and hearing science. Most of them had prior experience working with children, including those with disabilities. Dr. DeThorne is an Associate professor and my primary research mentor. She is also a certified speech and language pathologist with 13 years of experience conducting research in the field of communication disorders. Following her sabbatical, a year that focused on scholarship within Disability Studies, she has become increasingly interested in reconceptualizing speech-language interventions from a social-ecological framework,

particularly as it relates to children with autism. Furthermore, Dr. DeThorne brought her expertise on single subject design to assist in the development of the method section of this study.

Student research's committee. In addition to Dr. DeThorne, Dr. Cynthia Johnson and Dr. Julie Hengst were involved in this project as members of the student research's committee. Dr. Johnson is an Associate professor, and certified Speech-Language Pathologist. She has conducted research in the field of communication science and disorders for 37 years. Her expertise in language disorders in school-aged children has provided valuable insights for the development of this project. Finally, Dr. Hengst is an Associate professor, and certified Speech-Language Pathologist. She has conducted research for 20 years in the field of communication science and disorders. She is interested in the development of interventions for individuals with communication disorders based on a distributed communication model, which shares many attributes with the social-ecological model as conceptualized in my study. Her experience with activity-based approaches, and multimodal interventions have been relevant to this project, as well as her expertise in ethnographic methods.

Setting

The study was developed at Campus Early Elementary school (CEES) associated with a Midwest University where Dr. DeThorne had conducted previous research. In fact, Aaron, the primary participant of this study, was the focus of a prior case study completed by DeThorne and colleagues (2015; see also Russell & Vallentino, 2013), and his family approached Dr. DeThorne with interest in obtaining speech-language services for Aaron. During this same school year, I was conducting weekly observations of Aaron

at CEES during classroom performance time (November -March), given my specific interest in music therapy and autism. In particular, I had observed Aaron's positive response to music which led me to believe that music could be used to increase Aaron's peer interactions in the classroom. Both Aaron's mother and head teacher were receptive to this idea.

At the time of this study, Aaron was enrolled in a combined 2nd/3rd-grade classroom at the Campus Early Elementary School. According to material on its webpage, this small lab-based school, affiliated with a Midwestern university, was dedicated to supporting diverse talents and abilities through differentiated instruction. The website also noted the use of children's choices as a means to capitalize on inherent curiosity and love of learning. Aaron's classroom included a head teacher, two personal aids, and the school employed a special education coordinator. Particularly relevant to the present study, the weekly class schedule included a performance activity. It was a semi-structured activity, lasting 30 minutes, where each child was given the opportunity to perform in front of the class. Performances were self-elected either as a solo or with classmates, and often included playing an instrument, telling jokes, or providing a brief puppet show. Performance activities were conducted in the primary classroom space. This classroom contained four tables and approximately 24 chairs where children completed their assignments, a space with computers that included the teacher's desk, and a common space with a rug where children came together for group activities. The room had shelves and bookcases with didactic materials, textbooks, and notepads. The intervention took place at the Campus Early Elementary School in the school's library

space. It was a space outside the classroom, with a dimension approximating 10 x 10 feet that contained two lounge chairs, a rug, and multiple bookcases.

At the time of this research, Aaron received individual instruction at school from two personal aids who were directed by a special education coordinator. The special education coordinator adapted the general classroom activities to Aaron and provided some specific activities according to Aaron's needs. Based on Aaron's school portfolio and information provided by the head teacher, special education coordinator and his two personal aids, Aaron's academic work included literacy activities (such as reading comprehension, vocabulary, introduction to letters, and spelling words), math (e.g., counting activities, matching up numbers and geometric figures, following numeric sequences, and sums of two units), visuospatial skills (e.g., construction of complex geometrical figures from simple geometrical figures), and music (color code reading of scores to play his keyboard).

Participants

Primary participant. Aaron is a White[3] boy with diagnoses of autism and Childhood Apraxia of Speech (CAS) made by a developmental pediatrician based on a report written when Aaron was 2:11 years old. He was 7:10 years old at the start of our study. According to information provided by his mother ("Dana"), Aaron lives with her, his father ("Roger"), and his two brothers. According to Dana, Aaron's development was typical across his first year of life; and he was "hitting all those milestones." She noted

[3] Racial description of most participants were based on parental and self-report. Because of the lack of this information, Rachel's and Lucia's racial description was done based on their physical appearance.

that at fourteen months old, he started to have a regression in some areas of his development: “He went from speaking normally to not being able to speak”; “He didn’t even turn to look” when someone said his name. Because of these changes, Dana mentioned that she and Roger started to consult with physicians and others professionals. When was 4:5 and 6:11 years old, he passed both a visual and hearing exam, respectively to rule out sensory impairment.

As Dana informed us, once the autism diagnosis was established, she and Roger focused on the development of Aaron’s communication and social skills and Aaron began to work with a speech language pathologist. Based on the speech-language pathologist’s recommendation Aaron’s parents decided to obtain an AAC device, specifically, a Vintage Lite, which he has owned since he was 3 years old. Since the device has broken more than once and repairs are expensive, Aaron’s parents and educational team decided to develop a comparable low-tech picture book with printed sheets from the Vintage Lite as an alternative system. According to initial adult interviews, at the time our study began, Aaron was using both AAC supports, with access to the Vintage Lite being limited to more controlled contexts (e.g., performing specific activities at school, asking food in a restaurant or clarifying when the communication is not effective with the book or any other communication method). Dana reported that although Aaron vocalized more when using the communication book, she felt that the Vintage Lite provided a more efficient means of communication. Based on initial interviews with adults in Aaron’s classroom, Aaron used his AAC devices mostly for academic work and for socialization with some adults.

For the purpose of this study, Aaron's mother completed the MacArthur-Bates CDI: *Words and Gestures* (see Table 1). Based on this inventory, Aaron had a comprehension of 253 words of which he produced 13, and a repertoire of at least 18 gestures (see Table 1). In addition, an assessment performed by a certified speech-language pathologist just 11 months before the beginning of this study provided a profile of Aaron's motor and language abilities as measured by formal assessment; see Appendix A. The original report was shared with us by Aaron's mother. Results were consistent with significant impairments across the domains of oral motor planning, sensory processing, and communicative skills.

In addition to communication challenges, Aaron's mother, Dana, has stated that Aaron displays some behavioral difficulties. Dana described Aaron as a sweet and funny boy who has shown episodes of aggressiveness (toward others and self-injury) for two years, at both home and school. Based on the information from Dana, including the medical report, and teacher interviews, Aaron's aggressive episodes were described as unexpected situations provoked by different causes such as frustration, confusion, physical play, or need for more space. One of the children interviewed commented explicitly about Aaron's potential to hit. Specifically, Phoenix, commented: "If he's like in a bad mood where he's hitting not smiling I don't think you should go near him. Cause you can still get hit". Another child, Brittany, noted in regard to Aaron, "He's been really good. And he's been saying sorry if he hits somebody." At the date of this study, Aaron was receiving ABA therapy every week day and speech language therapy once per week to reduce hitting and improve communication.

According to adult participant interviews, Aaron enjoyed swimming, reading books, swinging, and participating in outdoor activities. Importantly for the purpose of this study is his interest in musical activities. His personal aids, Kelly and Rachel, described playing the keyboard as one aspect of his music interests. Dana added that he enjoyed listening to CDs, and listening to live bands. The special education coordinator, Lucia, also stated he liked to watch musical videos. According to Kelly, Aaron showed clear signs that he is delighted by music. She mentioned during the initial interview: "during the PE [Physical Education class] when there's dancing and music involved in it, (…) he can't control himself. He just jumps up and down and smiles and kinda squeaks a little bit". During Aaron's initial interview when asked whether he likes music, Aaron pressed "want music" on his talker and jumped up and down in his chair. In addition to the keyboard, Aaron had experience with additional musical instruments. According to Kelly, he has had the opportunity to explore the xylophone, some drums, and rattle instruments. In addition to the interest in music, Dana, Rachel, Kelly, and Lucia all mentioned that Aaron shows discomfort when he is exposed to loud sounds.

In regard to friendships, Drago, Brittany, Phoenix, and Michael, the four target peers that participated in this study, mentioned that Aaron primarily interacts with adults in the classroom. When asked directly who his friends were prior to the intervention. Aaron selected: "Jesus (…) Mom, Dad, Aaron". Also he named 3 girls in the class, none of whom were enrolled in our intervention.

Secondary participants. Secondary participants included 4 child classmates and 5 adult participants who interacted with Aaron daily.

Child Participants. In addition to Aaron, we consulted with the head teacher, special education coordinator, and one of the Aaron's personal aids to select four classmates without autism to participate in this study. Peers were selected based on their (a) perceived interest in music, (b) receptivity to Aaron, and (c) consistent attendance.

Drago. Drago was reported by his mom as a White/Caucasian 8:10-year-old boy. Based on Drago's initial interview, he had been learning to play instruments for four years, and he had been participating in a band for two years. He reported experience playing the violin, harmonica, recorder, keyboard, and horn. He said that he liked to play "old tunes" and "some songs". Drago mentioned that he does not enjoy "loud and annoying" music. Drago also reported having several friends in the class with whom he plays with. Specifically, he mentioned three other child participants from this study: Brittany, Michael and Phoenix but not Aaron. When asked whether he had played with Aaron, Drago described an interaction with Aaron that occurred a long time ago. He described: "[we] were playing that game where Aaron rolled it down the slide and (...) I rolled it back up for him."

Brittany. Brittany was reported by her mom as a Caucasian 8:0-year-old girl. During her initial interview, Brittany mentioned she "really like[s] music." She reported that she enjoys tap dancing, step Africa, and violin music. She mentioned having some experience playing the piano and the recorder and that there is no specific music that she does not enjoy. When asked about who she likes to play with, she said that she likes to play with some girls in her classroom, but she did not mention any of the child participants from this study. Brittany reported to know Aaron from preschool; nonetheless, she stated she is "hardly ever with him."

Michael. Michael was reported by his mom as an African-American interracial 8:7-year-old boy. During his initial interview, Michael reported that he likes "all the music" and he does not like "none of them." Michael reported experience playing the piano and the drums. He also described having experience "reading notes for the recorder." Regarding Michael's play partners, he mentioned having friends inside and outside of the school. Michael stated that he usually plays with most of his classmates including Brittany and Drago. He also reported playing with Aaron but not frequently.

Phoenix. Phoenix was reported by her dad as an Asian 9:3-year-old girl. Based on Phoenix's initial interview, she had been learning to play violin since she was three-years-old. She also reported she has received recorder and piano lessons. She stated that she dislikes "really loud rock music." When asked about who she likes to play with, she mentioned some classmates and then she said: "I'm friends with about just about everybody in this class", but she recognized that she "mostly play[s] with girls." According to Phoenix, she has known Aaron since they were in Kindergarten. She considers Aaron her friend, but she mentioned she has "never really interacted with him."

Adult participants. In addition to the secondary peer participants, this study included five secondary adult participants who interacted regularly with Aaron during his school day (see Table 2). Adult participants included the 2nd/3rd grade classroom head teacher ("Violet"), two of Aaron's personal aids ("Rachel" and "Kelly"), the special education coordinator ("Lucia"), and Aaron's mother ("Dana"). Each adult participant provided information about Aaron's developmental and academic history, as well as their expectations and impressions about the intervention.

Violet. Violet identified as a White 59-year-old woman who had worked as a teacher for 19 years. She had worked in CEES for ten years. She had been the head teacher of the 2nd/3rd grade class for four years. Violet had never had Aaron in her classroom until the year of the study. During her initial interview, she reported: "our contact isn't (uh) it isn't parallel to the other kinds of contacts I have with the students because I don't instruct him. (Um) but since he has his one on one who does the instruction. But I simply try to make contact ya know I talk to him and I am with him sometimes but not as his instructor."

Rachel. Rachel identified as a White woman of 23 years of age with no formal credentials in Education. Based on her initial interviews, she served as a personal aid who had supported Aaron daily in the classroom for 2 years. Rachel reported and was also observed supporting Aaron in school activities during the morning, and playing with him during breaks. Rachel attended most of the intervention sessions, and helped me to include Aaron in the AMP activities.

Kelly. Kelly identified as a White/Caucasian woman of 27 years of age. She graduated with a degree in Elementary, Special and Early Childhood Education. She had worked at CEES for 3 years as a teacher and a personal aid. Based on her initial interview, Kelly had served as a personal aid in the classroom supporting Aaron during the afternoon and during literacy activities. She reported having worked with Aaron for two years and being responsible for adapting classroom activities for him.

Lucia. Lucia, a White woman of 38 years who had been serving as the special education coordinator for the school for two years. She reported knowing Aaron since the beginning of her work in the school. During Lucia's initial interview, she noted she was

responsible for planning/coordinating his academic activities, "increasing sort of his academic programming", adapting classroom activities, and training any support staff that specifically work with him.

Dana. Dana identified as a White 41-year-old woman who worked as a physician. During her interview, she provided valuable background information on Aaron's developmental history. At the time of the study, she worked as a physician at a local hospital and shared that her husband ("Roger") interacted the most with Aaron at home. However, she added that she and Aaron frequently went to the pool together. A summary of participant information is provided in Table 2.

Data Collection

Interviews. As the primary investigator, I conducted semi-structured interviews of all child and adult participants. These interviews consisted of a set of open-ended questions previously established based on an ensemble of topics of interest of the research team (Seidman, 2013). Particularly, the researcher team selected four topics to explore: (a) social environment, (b) communication patterns, (c) music experience, and (d) intervention process. The semi-structured interviews were conducted before and after the intervention (initial and final interviews, respectively).

Specifically, initial interviews with adult participants had the objective of collecting information on Aaron's developmental and academic history, the frequency and nature of his communicative interactions, his prior experience with music, and current goals and priorities (see Appendix B). Meanwhile, initial interviews with child participants (the primary participant and the four target peers) aimed to gather

information about friendship, kind of interactions between Aaron and his peers, children's interests, music experience, and their expectations about the intervention.

In addition, final semi-structured interviews with child and adult participants gathered information about peer interactions in the classroom and general perceptions about the intervention. Specifically, the caregiver, the personal aids and the head teacher were asked about the nature and effect of the intervention, including observations about the children's feelings toward the intervention, useful elements, and suggestions for improvement (see Appendix B for detailed questions). Similarly, children were asked directly about their feelings toward the "music lessons", who they like to play with, and the genres of music they enjoy.

Interviews were approximately 15-minutes long for children and 30-minutes long for adults. All interviews were video-recorded and conducted in the new library space at the CEES. Specifically for Aaron, access to visual supports and AAC was provided to facilitate the communication process as needed (Harrington, Foster, Rodger, & Ashburner, 2014).

Videotaped observation across key activities. An undergraduate research assistant and I collected data during performance time, once per week, and across all the intervention sessions, conducted two to three times per week. Performance Time was recorded to obtain Aaron's interactions with peers inside of the main classroom. Specifically, I stationed a SONY model #PV-GS400 camcorder at the primary classroom on top of a tripod, with a smaller flip camera available as needed when Aaron oriented away from the main camera or moved across rooms. An undergraduate research assistant

and I implemented faux recording three weeks prior to the beginning of the intervention in order to familiarize children and examiners with the process, thereby decreasing the likelihood of reactivity and data loss (Ratcliff, 2003). In the same way, intervention sessions were video-recorded to gather information about communicative offers between Aaron and the target peers during the intervention process. For this purpose, I stationed the same camcorder at the library space on top of a tripod. A smaller flip camera was also used as available to have different perspectives of the library room and capture better the facial expressions and other relevant communicative gestures of the different participants.

Phases of Data Collection

Procedures of this study focused on the implementation of AMP and its impact on social interactions between Aaron and the target peers. For this purpose, we carried out this program in three phases: Baseline, Intervention, and Maintenance; each are described below. For each phase, children were grouped in triads, although data analysis was conducted by dyads. Specifically, triad one included Aaron, Michael, and Phoenix and the second triad included Aaron, Drago, and Brittany.

Baseline phase. Prior to the initiation of intervention, baseline data (four sessions for triad 1 and five sessions for triad 2) were collected to have a reference for the amount of communicative offers between Aaron and target peers before the implementation of the intervention. During this period, children were invited into the library space and had available a variety of instruments. No instructions were delivered during this period other than to play. Collection of baseline data helped to differentiate therapist-led intervention from the potential effects of the small group setting and availability of the instruments.

Intervention phase. Once baseline data demonstrated consistency through visual inspection, intervention began on the first of the two target triads (Aaron, Brittany and Drago) as follows.

The proposed Activity-based Musical Program was performed twice per week for approximately 30 minutes. Inspired by the "Creando a través de señas" workshop (Aguirre, 2013) and incorporating methods from the Integrated Playgroup Model (Wolfberg et al., 2008), AMP focused on common interests in music to develop a co-constructed performance that could be shared with the class during the weekly performance time. As the Primary Investigator, I performed the role of instructor who conducted AMP in triads (Aaron and two peers) for a period of approximately 4 weeks with the first triad and 2 weeks with the second triad (incomplete intervention phase)[4]. The full intervention consisted of three stages: (a) Exploring through Sounds, (b) Connecting through Sounds, and (c) Interplay through Sounds.

***Exploring through sounds*.** In this exploratory stage (2 sessions for triad 1 and 1 session for triad 2), Aaron and his peers had opportunities to directly explore eight musical instruments (keyboard, guitar, pan flutes, harmonica, maracas, tambourine, ankle bells, and xylophone) in order to become familiar with the instruments and each other. I selected instruments based on availability, diversity of instrument families, and ease with which Aaron could manipulate them. According to the objectives presented in the "Creando a través de señas" workshop, this stage included auditory sensitization, sound perception, sound exploration and sound manipulation with musical instruments. I introduced each instrument by labeling it (name and musical family), associating it with

[4] Intervention for the second triad had to be compressed and truncated because of the absence of participants and the end of the school year.

the object and its picture, and modeling how each instrument is played. There was a minimum of one turn per child for each instrument to practice playing with prompting as needed (verbal and gestural prompt with time delay followed by hand-over-hand support with minimum assistance necessary). In this process, I encouraged Aaron and his peers to note and interpret each other's behaviors. I encouraged children to pay attention to the behavior of their peers and to attribute preferences, interests, and communicative meanings to these behaviors (Wolfberg et al., 2008). For example, Aaron sometimes covered his ears with his hands when his peers played an instrument, I highlighted the reaction and encouraged interpretation (e.g., "Do you think Aaron likes that instrument? He is covering his ears."). Consistent with this practice, the children and researcher discussed their impressions of the instruments at the end of practice, and categorized each instrument as like/disliked/mixed according to each child's preferences. The pictures used during the sessions were taken from the icons displayed through Aaron's Vintage Lite. New pictures also were introduced during intervention and incorporated later to the Aaron's AAC devices. Each session finished with a Wrap-up/brief review. This phase ended after the instructor introduced eight different instruments.

Connecting through sounds. In this second stage (3 sessions for triad 1 and 2 sessions for triad 2), children worked toward connecting sounds with movements. As presented in the "Creando a través de señas" workshop, this stage focused on the exploration of different sound parameters and on the gradual understanding of music as a means of social interaction. Each session started with an introduction to the activity. Then, I verbally introduced the roles of conductor (performer of gestures) and musician (player of instruments) along with gestural and visual support. In addition, across

sessions, I presented a minimum of 4 "conventional" conducting gestures associated with pitch, intensity, and duration. Each gesture was modeled and introduced with a spoken label (e.g., *forte* represented by hands spreading apart) and a picture that included a written label. The pictures were displayed on a gesture repertoire board. Each child had the opportunity to take turns using each gesture to direct a musician with prompting from me as needed. Each session finished with a recap about what was covered during the day's session. This stage ended when at least 8 gestures were introduced.

Interacting through sounds. At this stage (3 sessions for triad 1 and 1 session for triad 2), like in the "Creando a través de señas" workshop, each member of the triad worked on developing an individualized repertoire of conducting gestures (according to individual physicality) related to specific sound parameters and developing a joint performance shared with the class. The goals of this stage were to explore individual ways of musical interaction through gestures and movements, to improve the understanding between Aaron and his peers, and to gradually increase the amount of interaction between Aaron and his peers through musical experience.

I introduced each session by explaining the activity. Each child developed one individualized gesture per session, according to his/her own physicality. I mediated this process by highlighting salient movements that I observed each child produce and collaborating to determine relevant meanings (e.g. flapping one's hands could mean play the instrument quickly). I modeled each gesture, assigned a spoken and written label, and explained to the children what each gesture meant. Each child took a minimum of two turns per session being both conductor and musician by selecting an instrument on the board to play and by completing at least two conventional gestures and one

individualized gesture while conducting. Both Aaron and his peers were assisted with prompting as needed. Each session finished with a Wrap-up/Summary of elements covered in the session. For triad 1, this final stage ended after 3 sessions were completed. In the case of triad 2, this stage finished earlier because of the end of the school year.

At the end of the intervention, children from triad 1 had the explicit opportunity to perform a musical activity together via the roles of both musician and conductor. One final performance was recorded by each child in the role of conductor, and I encouraged children to perform the activity during the weekly classroom performance time within their classroom, either live or through showing the video recording. Triad 1 decided to show the videos instead of live performance. Triad 2 did not get an opportunity to show the performance because of the end of the semester.

Maintenance phase. After the intervention concluded, the first triad started the phase of maintenance to assess whether any potential intervention effect was maintained once intervention stops. This phase lasted four sessions and consisted of the same activity as the baseline phase with instruments available. I encouraged the children to engage in free play during this time. Due to time constraints maintenance was conducted for triad 1 only. Table 3 provides an overview of the study's procedures.

Intervention Fidelity

To assess the fidelity of the key components of the intervention, an undergraduate research assistant reviewed a video tape of all the intervention sessions and completed a fidelity checklist; please see Appendix C. The percentage of key elements observed during each session was divided by the total number of key elements expected that session. Accordingly, the intervention fidelity for all observed sessions was 88% (range =

70-96%) for triad 1 and 83% (range = 70-94%) for triad 2. When viewed specifically by intervention stage, the fidelity was 89% (range = 83-96%) for Exploring through Sounds, 90% (range= 87-95%) for Connecting through Sounds, and 75% (range= 61-92%) for Interacting through Sounds phase.

To document the nature of the interpersonal supports provided by the clinician, I completed a post-hoc review of all intervention sessions to identify the key strategies that were used to support peer interaction. First, the primary investigator and one research assistant viewed a couple key sessions and described what the therapist did to support peer interactions. Then, the lab team met as a group to discuss these examples relative to intervention literature on supporting social interaction for children with autism (e.g., Antia & Kreimeyer, 2001; Kryzak & Jones, 2014; Prizant, Wetherby, Rubin, Laurent, & Rydell, 2006; Wolfberg et al., 2008) in order to name and develop operational definitions for the interpersonal supports provided (see Appendix D). Using these definitions, two research assistants separately reviewed each intervention session and documented the frequency of each specified strategy for peer interaction, before coming together to complete a consensus pass. Discrepancies and questions that could not be resolved during the consensus pass were discussed with the larger lab team. The average and range of each strategy per session was as follows: Interpretation (X = 4.08, range = 1-11); Direct Prompt (X = 22.33, range = 10-37), Positive Reinforcement (X = 11.67, range = 1-29); Scaffolding (X = 29, range = 3-86); Environmental Arrangement (X = 1.83, range = 0-5).

Quantitative Measure

Communicative Offers. The number of communicative offers served as the primary dependent variable for the single-subject design, which was specifically focused

on interactions between Aaron and each peer (dyads) during intervention sessions and performance time. In all cases, beginning with baseline, recordings of Aaron during both intervention sessions and performance times were reviewed and coded for a frequency count of peer communicative offers (defined below). I developed the materials for the coding process and practiced the implementation of both measures within Aaron's classroom for 6 weeks prior to the beginning of the study. Additional coders were trained over a period of at least two weeks (4 sessions of 1 hour each). For additional coders and I, the procedure of training was as follows. First, the coding definitions were reviewed, and examples were watched together. Then, at least two sessions were coded independently; the results were compared; and disagreements were discussed.

Once training was completed**,** an undergraduate research assistant and I completed a live coding for the frequency of communicative offers involving Aaron and each one of the four secondary peer participants during the intervention sessions and performance time; see Appendix E for the live recording sheet. Although social interaction is often conceptualized as a bidirectional initiation-response sequence (Bauminger, 2002; Kamps et al., 1997), for the purpose of this study, we focused primarily on communicative offers as a critical precursor of social interaction (cf. DeThorne et al., 2015). Communicative offers were conceptualized as possible communicative initiations, defined through a combination of at least two simultaneous behaviors (verbal and nonverbal or two nonverbal) directed toward another, whether intentional or otherwise. Consistent with prior literature, such behaviors included eye contact, smiling, sharing objects, spoken information, conventional gestures, increased

proximity, and physical contact (Fisher et al., 2013; Kamps et al., 1997; Uvnäs-Moberg, 1998; Vaughn, Vollenweider, Bost, Azria-Evans, & Snider, 2003).

In terms of segmenting extended turn sequences, the research team considered an action as a new communicative offer if it followed a pause of at least 3 seconds or when someone new entered the interaction. In the case of multiparty initiations, we considered an action as a new communicative offer when directed towards a new member. Also, a new communicative offer was coded if there was a pause of at least 3 seconds in between both interactions, if someone left the interaction, or if someone new entered the interaction. Data were dyad specific, and represented communicative offers between Aaron and each of the two peers within each specific triad. Given that our goal was to facilitate social interaction generally rather than initiations by a particular individual, communicative offers within a dyad were collapsed together in the same frequency count whether they were initiated from or towards Aaron. Such data was coded "live" whenever possible across baseline, intervention and maintenance by a member of the research team. The data was reviewed by the initial coder and a second research team member independently while watching a video recording of the session. Only behaviors visible on the video recording and agreed upon by the two coders were counted in the analysis. In addition to the primary dependent variable, two research team members took weekly data of classroom performance time to evaluate whether or not the intervention, with its focus on musical performance, might lead to observed changes in peer interaction during this time. Coding procedures for communicative offers during performance time were the same as previously stated for baseline, intervention, and maintenance using a combination of live coding and paired with video review.

Inter-Observer Agreement. To estimate the reliability of the dependent variable, inter-observer agreement was calculated for 24 of 25 sessions across all project phases (note: one session was excluded due to its use as a training session). Specifically, the original coding (prior to consensus) was compared to an independent coding of the video by a second examiner. Point-by-point agreement was derived by dividing the number of agreements (between me and a second independent coder) by the sum of opportunities (number of communicative offers coded by me). The result was multiplied by 100. Mean inter-observer agreement was 72.16% (range = 67.3-97.72%).

Data Analysis

Quantitative Analysis via Visual Inspection. To assess the impact of the AMP on social interactions between Aaron and his classmates, I completed visual inspection of the data gathered through the frequency of communicative offers during intervention sessions and performance times. In both cases, I used visual inspection to examine if there were systematic variations across the phases of the study (Kazdin, 2011). Specifically, I assessed the a) mean variations of rate of communicative offers across baseline and intervention phases b) trending variations across phases, d) latency of changes across phases, and e) the percent overlapping data points across phases. For data analysis, I considered the total number of communicative offers per session between Aaron and each target peer, and calculated a rate of communicative offers per two minutes. I anticipated that peer interactions would increase following intervention with relatively limited delay and that changes in the mean level of interactions across baseline and intervention for all four peer participants would be observed.

Qualitative analysis. I used ethnographic methods to inform all three research questions, with a focus on the nature of potential changes in social interaction and the teachers and children's perceptions of the intervention. Data was collected through semi-structured interviews of all adult and child participants. After final interviews were conducted, an undergraduate research assistant transcribed all video recordings of interviews in Microsoft Word using sequential methods that capture both spoken language and conventional gestures (see Hengst, 2003). As the primary investigator, I provided a second pass on each interview, comparing it to the transcription and resolving any perceived discrepancies with the original transcriber through consensus. Disagreements were discussed with the original transcriber, a second research assistant, and Dr. DeThorne. All adult participants had the opportunity to review the initial and final interview transcripts for correction/clarification, and I made revisions accordingly. Consistent with Henwood and Pidgeon (1995), the research team met weekly to discuss the interview data, in particular, how it related to prior literature and quantitative measures that were also being collected.

Consistent with our research questions, transcripts were reviewed for: (a) background information, (b) speech-language skills, (c) social interaction, and (d) intervention; see Appendix F for operational definitions of each of these categories established through an iterative process amongst the research team. An initial coding pass through the transcripts was made by one of two research assistants, and then a second pass on all interview transcripts was made by me as I entered the codes into Atlas.ti (a qualitative data analysis software). Given the coding parameters of the software, codes were delineated according to sentences. Consequently, if three adjoining sentences

addressed background information, then they were delineated as three background information codes. In addition, categories were not mutually exclusive. In other words, the same sentence could be coded as two distinct categories. A total of 1,907 codes were derived from the interview data (see Table 4). Background information, Speech-language skills and Social interaction categories were used mostly to describe study participants. Intervention codes, which totaled 306 (16.05% of total transcribed sentences), were utilized to inform the research questions: 233 (12.22% of total transcribed sentences) came from the adults, and 73 (3.83 % of total transcribed sentences) came directly from the child participants.

CHAPTER III: RESULTS/FINDINGS

Q1: Functional Relationship between AMP and the Rate and Nature of Communicative Offers.

To address the question regarding a functional relationship between AMP and the rate of communicative offers, Figure 1 displays the rate of frequency of Aaron and his target peers' communicative offers before, during, and after the intervention process. Each one of the four panels represents the observed rate of frequency of communicative offers between Aaron and one of the four peer participants (Aaron and Brittany, Aaron and Drago, Aaron and Phoenix, and Aaron and Michael, respectively). The y-axis represents the frequency of communicative offers per 2 minutes and the x-axis represents observational phases (sessions in baseline, intervention, and maintenance phases).

Visual inspection of Figure 1 reveals support for functional changes in the rate of communicative offers during AMP for at least three of the four dyads based on consideration of means, latency, and % non-overlapping data (PND). First, changes in means between the baseline and intervention phases were observed for the Aaron-Brittany dyad (.16 to 1.18), for Aaron-Drago (.08 to 1.09), for Aaron-Phoenix (.31 to 1.57) and to a lesser extent for Aaron-Michael (.33 to .58). In essence, during intervention, Aaron's communicative offers with his peers increased by approximately one offer every two minutes on average within all dyads except his interactions with Michael, which increased one offer every eight minutes on average. Second, in terms of latency, the same three dyads demonstrated immediate increases in communicative offers following the onset of AMP. Specifically, Aaron-Brittany increased from 0.13 communicative offers/two minutes at the last baseline point to 0.74 offers during the first

intervention point; similarly, Aaron-Drago increased from 0 to 0.54, and Aaron-Phoenix increased from 0.36 to 1.63. In contrast, Aaron-Michael demonstrated a very small decrease from 0.36 to 0.2 communicative offers/two minutes.

Finally, in regard to % non-overlapping data points between baseline and intervention, three dyads (Aaron-Brittany, Aaron-Drago, and Aaron-Phoenix) presented no overlapping data points (PND scores of 100%), with Aaron-Michael demonstrating PND of 35% (1/3). Based on effect size guidelines (cf. Scruggs & Mastropieri, 1998), 100% PND corresponded to a "very effective" treatment effect for the first three dyads, with the 35% PND in indicative "ineffective" treatment for Aaron-Michael Dyad. In sum, evidence across visual inspection of means, trends, latency, and % non-overlapping data support increased rates of communicative offers within three of the four dyads as a result of AMP. Although data regarding the maintenance of increased communicative offers is limited to two dyads, results from Aaron-Brittany and Aaron-Drago suggest that the increase observed during intervention was not fully maintained after intervention. Specifically, the mean frequency of communicative offers dropped to .40 offers/two minutes for Aaron-Brittany during the maintenance phase and to .32 for Aaron-Drago. Such means were higher than mean baseline measures but lower than during intervention. In addition, the decrease was observed immediately during the first maintenance session in both cases: 2.24 to 0 in the case of Aaron-Brittany dyad and 2.42 to .18 in the case of Aaron-Drago.

We offer two explicit examples here to illustrate the nature of observed peer interactions between Aaron and his peers during the intervention phase. The first example is taken during the eighth intervention session including Aaron, Brittany, and Drago

during the third intervention stage, conducting through sounds. Specifically, Aaron was standing in the middle of the room in the conductor role, while Rachel prompts him to try different conducting gestures. Brittany and Drago are seated and oriented toward Aaron while playing instruments. However, when Rachel assisted Aaron with the closed fist gesture for stop, Brittany stopped blowing the harmonica, but Drago continued playing the keyboard while looking directly at Aaron and Rachel. Brittany looks at Drago and says "Drago stop!" Drago smiles while looking toward Rachel and continues playing for a couple seconds. This example was coded as a communicative offer between Aaron and Brittany because she demonstrated two simultaneous nonverbal behaviors directed toward Aaron (she looked at him and stopped playing) and as a communicative offer between Brittany and Drago because Brittany showed two simultaneous behaviors, one verbal (she talked to him) and one non-verbal (she looked at Drago). It also provided an explicit example of Brittany interpreting Aaron's behavior for a peer.

A second example comes from the third intervention session including Michael, Phoenix, and Aaron which corresponded to the second intervention stage: connecting through sounds. Michael, Phoenix, and Aaron were all sitting on the couch with Phoenix in the middle. Michael was strumming the guitar and singing alone. Phoenix was shaking the maracas with two hands. Aaron vocalized, looked at Rachel, and pointed to his talker. In response, I held the talker in front of him, and Aaron selected "nachos" on his device, which activated the electronic pronunciation. I verbally repeated: "nachos", and I asked aloud why Aaron pressed "nachos". Michael began singing the word "nachos" while strumming the guitar. Facing Aaron, I asked him, "are you hungry?" Then, Aaron approached his talker, and Phoenix stopped playing and watched him as Aaron pressed

"nachos" again. Michael was still strumming the guitar and singing. Phoenix started to sing "nachos" too while shaking the maracas with her two hands, looking at Michael and smiling. I asked Aaron: Do you hear?" He replied: "Yeah" and smiled. I joined in the singing: "nachos for Aaron". Michael smiled and sang also: "nachos for Aaron" while strumming the guitar, looking toward Aaron, and smiling. Phoenix was still playing, and Aaron started playing the keyboard and smiled at me. This series of interactions was coded as one communicative offer for each of the following dyads: Aaron-Phoenix, Aaron-Michael, and Phoenix-Michael.

Q2: Generalization of effect to Classroom Activity.

To examine the possible generalization of treatment effects to classroom activity, Figure 2 shows the frequency of Aaron and his target peers' communicative offers during classroom performance time. Like Figure 1, each one of the four panels represents the observed frequency of communicative offers between Aaron and one of the four peer participants (Aaron and Brittany, Aaron and Drago, Aaron and Phoenix, and Aaron and Michael, respectively). The y-axis represents the frequency of communicative offers/two minutes and the x-axis represents the weekly performance time sessions.

As shown in Figure 2, mean differences between baseline and intervention were minimal across all four dyads. Specifically, Aaron-Brittany increased from 0.04 to 0.12 communicative offers/two minutes offers between baseline and intervention phases. Similarly, Aaron-Drago increased from 0.08 to 0.18. In contrast, Aaron-Phoenix and Aaron-Michael demonstrated a small decrease from 0.18 to 0.14 communicative offers/two minutes in the case of Aaron-Phoenix, and from 0.18 to 0.06 in the case of Aaron-Michael. Although positive trends were observed during the intervention phases

for both the Aaron-Brittany and Aaron-Drago dyads, the restricted number of data points prohibits meaningful interpretation. The percentage of overlapping data between baseline and treatment ranged from 50-100% across the dyads, which ranged from questionable to very effective according to the classification provided by Scruggs and Mastropieri (1998). Similarly, the means and slopes for data taken during the maintenance phase for both the Aaron-Brittany and Aaron-Drago dyads were not suggestive of generalized treatment effects. In sum, the limited amount of experimental data related to the generalization of treatment effects to classroom performance time is negative.

Although the behavioral analysis did not show any generalization effect, three of the four adult final interviews mentioned their views on some generalization effects across settings and/or participants. For example, Rachel was asked whether she has noticed some changes during the breaks or the way that Aaron plays with peers. She stated: “he’s playing more with them. Instead of just taking away something, he’s playing like maracas or piano with the other kids, playing guitar with Michael, and that kind of thing.” The head teacher and the two personal aids described Aaron as more willing and attentive to his classmates after the intervention was implemented. Furthermore, they described that peers were more interested in interacting with him after the intervention. For instance, Kelly was asked if she noticed any changes in Aaron’s interaction with peers. She mentioned: “So when he’s doing his own work, there’s a lot more peers that are coming over. Very interesting after we played that video of them that one week um, you see more of them showing more interest in him.” Another example came from the head teacher, Violet. When asked what have you noticed about the intervention? Violet shared: “So our classroom tradition is everybody makes a page for the birthday book, and

they write something to the student whose birthday it is. So they made Aaron's on Thursday. Uh their response, their comments that they made him were just beautiful. A classmate said um 'you are so smart you can talk without using words', which is lovely."

Q3: Teacher and child's perceptions about Intervention

The categorical coding revealed general impressions and specific effects of the program. In regard to general impressions, the four adults interviewed at the end of the process reported positive perceptions about the intervention. For instance, when asked if she considered the intervention useful, Rachel stated: "Yeah yeah. Aaron's just approach to being around his peers has changed (...) Ya know he's okay with being in the classroom around the kids, even when they're making noise most of the time." In the same way, when Kelly was asked about some changes observed, she mentioned: "they've been talking to him too. And Phoenix's been asking to go down to the sensory room with him and kind of play and hang out."

Adults also reported that children had a positive attitude toward AMP. Specifically, Rachel stated "They mostly seem pretty excited for it (…) I think they've been really excited for it." Furthermore, the two peers that participated in the final interviews described the intervention positively. Specifically when asked what she felt when she played with Aaron, Brittany responded: "I feel happy. Mm because I'm playing with some of my friends." Aaron also seemed to respond positively to the program although his interview was more difficult to interpret. When he was asked if he liked the music activity, he replied "music" with his AAC device and smiled.

In regard to the nature of the effects of the program, four themes emerged from child and teacher data. Interviewees mentioned an increased awareness of each other among

participants, positive changes in interaction, an understanding of communication as a broader concept, and increased familiarity with musical instruments (see Table 5). However, for the purpose of this project we focused on the first two themes (increased awareness and positive changes), which were supported with convergent evidence across data types (i.e., interviews and behavioral data) and across participants. Specifically, these themes were consistently noted in interview data from adult and child participants and related directly to our dependent variable, communicative offers.

Increased awareness. All four adults when asked about the potential effect of intervention mentioned an increased awareness from target peers toward Aaron, as well as from Aaron toward target peers. For example, Violet mentioned: "I do think that it gave the students who participated just a, a deeper awareness of Aaron and ya know a close relationship because they shared that [program] with him". Kelly said: "Well I have noticed that he's been it seems like he's been playing more close attention to his peers." Two of the three child participants interviewed also showed this increased awareness of each other. For example, during the initial interview (before the intervention), Brittany could not describe any play that Aaron likes. However, after the intervention, she said: "he likes to play ball sometimes. He um well he also likes to ride the bike sometimes. Um well he likes to play catch."

Positive changes in interactions. In addition to an increased awareness, the four adult participants also described positive changes in the interactions between Aaron and target peers. Specifically, when asked about possible effects observed from the intervention, Rachel mentioned: "there's little things like little Phoenix coming up and giving him a big hug. And he'll just hug her back and smiles. And he's a little bit more

open to peers initiating contact." Interview data from the children did not mention positive changes in interaction directly, but two of the three interviewed children were more apt to name each other as play partners after the program. For example, at the beginning of the process, Aaron, was asked: Who do you like to play with? At this time, he answered "Jesus, mom, dad, and Aaron." When the same question was asked after the intervention was implemented, Aaron selected: "Friends. Phoenix".

CHAPTER IV: DISCUSSION

In sum, this project represents a "proof of concept study" demonstrating the potential of an intervention, AMP, designed according to a social-ecological framework to facilitate social interaction involving a child with autism. Specifically, AMP led to an increased frequency of communicative offers between Aaron and three of his four peers. In essence, during intervention, Aaron's interactions with his peers increased by approximately one interaction every two minutes on average within all dyads except his interactions with Michael, which increased one interaction every eight minutes on average. In addition, qualitative analyses of interview data across adult and child participants supported positive outcomes, with themes focused on increased awareness of each other and positive change in peer interactions. The discussion here will focus on how the key elements of the intervention were consistent with a social-ecological framework (in comparison to prior studies), consideration of null findings, limitations in the study design, and ideas for future directions.

Key Elements of the Intervention

Distributed across People. AMP was consistent with a social-ecological framework in at least three key ways that differ from many prior intervention studies focused on children with autism. Consistent with the view that communication is *distributed across people*, AMP supported the interaction between Aaron and his peers rather than explicitly focusing on Aaron's behavior as many past studies have done (e.g., Coe et al., 1991; Zercher et al., 2001). Even when peers have been included in the past interventions, they are often socialized into a role of co-therapist for the purpose of

"helping" teach the child with autism (Coe et al., 1991; Zercher et al., 2001), which tends to promote an unbalanced power dynamic. In the present study, all child participants were supported in interpreting and communicating with each other, and all children were given the opportunity to serve in the 'expert' conductor role. Accordingly, the dependent variable within the single subject data focused on communicative offers between children within a dyad and did not differentiate who initiated the potential interaction. The example of Brittany interpreting Aaron's gesture for Drago highlights this point. In addition, the example of the children singing about nachos demonstrates an example of how I modeled responses to Aaron's communicative offers for his peers within the framework of the ongoing activity. Aligned with this focus of intervention across communicative partners, a key theme from the interview data was increased awareness *across* peers, both Aaron of his peers and vice versa.

Distributed across Resources. A second way AMP was consistent with a social-ecological framework was its explicit focus on multimodal communication resources (DeThorne et al., 2014; Fisher & Shogren, 2012; King, Hengst, & DeThorne, 2013). Whereas traditional studies have often focused on a single communicative modality, most often speech or a particular AAC system (e.g., Fulwiler & Fouts, 1976; Ganz et al., 2013), the present study focused on communicative offers broadly. The dependent variable was defined by the alignment of any two communicative resources (e.g., eye gaze, use of objects, vocalizations, AAC) and the intervention was designed accordingly.

The focus on exploring instruments and learning to conduct provided a means to highlight nonverbal participation for all the children. In particular, the final stage of AMP, interacting through sounds, explicitly focused on the development of

individualized conducting gestures, thereby encouraging children to think about communication as a flexible and generative process. In addition to the focus on instruments and conducting, AMP incorporated various forms of AAC throughout all phases of the intervention. All children were encouraged to interact with picture boards and individual folders, which contained pictures of the musical instruments and gestures used during the program. Many of the pictures used for visual supports were intentionally the same as those used on Aaron's current AAC systems, which he also had access to. In fact, the "nachos" example offered earlier provides an example of how Aaron's AAC use was taken up as communicative within the musical activities. The explicit multimodality of the intervention was reflected in the comments offered by three of four adult participants in their final interviews, where they mentioned that the intervention helped children to understand communication as a broader concept.

Focus on activity. The third way in which AMP was consistent with a social-ecological framework was the focus on participation within specified activities that aligned with the children's interests (DeThorne et al., 2014; Roth & Lee, 2007). From the beginning, AMP was selected as an intervention based on Aaron's affinity to music, and his peers were specifically selected in part due to their interest in music as well (note the inclusion of peers based on shared interests is also consistent with the principle of communication as distributed across people). Particularly, initial interviews with child participants revealed that they all had interest and abilities in musical activities. Each participant had studied at least one musical instrument and had experience with at least two different musical instruments at the beginning stages of this study. Accordingly, all

child participants reported in their initial interviews excitement about the program, and according to adult interviews, their enthusiasm was maintained throughout the activity.

AMP was designed to meet specific goals, but also it accomplished additional classroom goals and expectations, which were discussed with the head teacher. For example, the children's musical experiences in AMP were focused on developing a shared performance for the classroom's weekly performance time. In addition, the head teacher also considered AMP goals and expectations and adapted some classroom activities accordingly. For instance, the head teacher helped to ensure that the musical instruments used during our program were also available in the classroom during performance time in order to encourage shared exploration of instruments and generalization of peer interactions. This activity-based approach differed from many other interventions for children with autism where the focus has been on the development of individual skills (e.g., Charlop & Walsh, 1986; Dawson & Galpert, 1990) rather than participation in a shared activity (Fisher & Shogren, 2012). The "nachos" example offered earlier provides an illustration of how individual behaviors, such as Aaron selecting "nachos" on his AAC device was taken up within the context of the musical activity at hand by all the participants. Whereas other approaches may have focused on teaching Aaron alternate productions that were deemed more appropriate for the context (c.f., Beilinson & Olswang, 2003; Koegel, Koegel, Hurley, & Frea, 1992). The activity-based focus encouraged the group to acknowledge Aaron's contribution and take them up as relevant to the activity at hand (cf. DeThorne et al., 2014).

Consideration of Null Findings

Even when our intervention showed clear changes in the frequency of communicative offers, there were two specific situations where these effects were not evident. First, there was one dyad, Aaron-Michael, which showed limited effects even during intervention. Second, there was no empirical evidence of generalization across settings. Especially given the limited timeframe of the intervention, it is difficult to know or even speculate on why Michael's data with Aaron appeared different from the other three dyads. The possibilities range from differences in personality to group dynamics. For example, Michael and Phoenix presented as mature and talkative with fairly sophisticated musical experience before the intervention. In her initial interview, Phoenix mentioned that she has "played violin for a really long time" (almost 5 years), and she is learning to play the recorder. Michael also described having experience with the recorder, and he added that he knows "how to play the piano and the drums." Anecdotally, it appeared that Michael enjoyed playing the instruments and interacting with Phoenix, but he was less engaged with the conducting experience. This could have impacted the effectiveness of the intervention. However, it is also possible that with a longer course of intervention, effects would have become more apparent.

In fact, the limited time course of the intervention may also have contributed to the limited evidence of generalization. I believe that a longer implementation period could improve results. For example, "creando a través de señas", the workshop that inspired the present intervention, has a duration of 8 months (Aguirre, 2013). Considering this timing, the one month length with which AMP was developed was most likely not adequate time to glean the full potential of the intervention. In regards to generalization

across settings, the classroom culture could have presented an unanticipated barrier. Although receptive to Aaron, his activities and seating in the classroom were often separate from his peers. For example, at the beginning of the study Aaron often sat apart from his peers during performance time due in part to the concern that he might hit a peer. However, at my suggestion, Aaron began to be seated within the larger group during this time. Consistent with the observation that Aaron was often near but not fully integrated in the overall classroom activities, the head teacher, Violet, reported that her interaction with him "…isn't parallel to the other kinds of contacts I have with the students because I don't instruct him (…) he's in the class, he's doing something parallel. So either an activity or he's doing his classwork while we're doing our classwork." Additionally, Aaron spent a substantial portion of the school day outside of the main classroom, which, according to peers, may have limited the interactions they had with him. In the final interview, when asked about what Aaron likes to play with, Brittany said: "I don't know. I'm not usually around him because (…) because he's normally in the sensory room or somewhere else."

Study Limitations

In addition to the limited timeframe already mentioned, this study has two additional limitations worth noting. First, this study does not meet the design standards proposed by evidence based practice because it has two instead three demonstrations of basic effects (see Horner et al., 2005). While it is true that I measured the communicative offers between Aaron and four peers, the program was implemented in triads (e.g., Aaron, Drago, and Brittany) and therefore only represents one independent replication of the intervention effect (i.e., Aaron-Brittany and Aaron-Drago).

Another source of weakness in this project study was the inter-observer agreement attained (IOA). IOA in this study was 72.16 %, which is below what is suggested in the literature (80-100%). Although it is notoriously difficult to have reliable coding in complex multimodal interactions, it is important to note that these values likely underestimate our reliability given that they were derived on the independent coding of video data prior to the final consensus pass.

Future Directions

Clinically, this promising proof of concept study encourages clinicians and researchers to develop interventions based on key aspects of the social-ecological framework, as there are currently very few available for children with autism given the popularity of behaviorist deficit-based approaches designed to target explicit individual skills. Consequently, based on findings from AMP and other studies that have implemented similar approaches (Wolfberg et al., 2008), I offer three explicit suggestions for designing an intervention study based on a social-ecological framework.

First, I suggest selecting peers based on common interests and natural affinities toward one another when planning intervention programs. Although musical activity might be a common interest based on published profiles of children with autism (Edgerton, 1994; Heaton, 2009; Overy & Molnar-Szakacs, 2009), groups can form around most any interest. Ron Suskind highlights this idea as well in his book "Life Animated," in which his connections with his son Owen often revolved around a shared interest in Disney movies (Suskind, 2014)

The second suggestion would then be to focus intervention on activities that draw upon the children's shared interest and enjoyment. This idea of supporting interaction

through a focus on common interests has been referred to as "affinity therapy" (Suskind, 2014). Within "Life Animated," Ron Suskind reports the success of a group that Owen started in college focused on discussing Disney movies, and how this group supported the development of friendships, including a romantic partner. For school-age children, Wolfberg has highlighted a similar approach of focusing on shared interests with younger children through the Integrated Playgroup Model (Wolfberg & Schuler, 1993), which has been recognized by the by the National Autism Center's National Standards Project (2009) as an example of Peer Training Packages that were considered "established treatments" with evidence of effectiveness.

The final suggestion is to support the interaction, as opposed to focusing solely on individual skills for the child with autism. Wolfberg and Schuler (1999) employ the analogy of "stage director" (p.45) in which the clinician sets the stage for children to explore their common interests, guides and models interactions, facilitates interpretation of less familiar communication attempts, and validates all children as competent communicative partners. For this purpose, clinicians should take advantage of the natural-occurring opportunities to scaffold interactions even when they do not meet specifically with the expected behavior. The reader is referred again to the singing nachos excerpt from my study as an example of what this looks like (see also examples from DeThorne et al. 2014 and DeThorne et al. 2015). Thus, interventions targeting social interaction involving children with autism should focus on the alignment of participants to facilitate successful social exchanges within meaningful activities.

Although the present study represents a single proof of concept intervention, its results were generally promising across both single subject and qualitative findings. In

addition, this study builds on a powerful theoretical framework and some prior intervention studies which focused on children with (Aguirre, 2013; Wolfberg et al., 2008), to support the need for serious clinical consideration and additional research. However, the nature of the social-ecological framework is difficult to pair with traditional concepts of experimental group designs and replication. By nature, the social-ecological framework highlights the importance of context in shaping behavior, and context is never the same across any two interactions, let alone any two studies. However, through use of more flexible research methodologies, such as single subject and qualitative methods, I am optimistic we as a field can develop evidence-based practices surrounding a social-ecological approach to intervention for children with autism that are potentially more powerful than what is currently available.

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TABLES AND FIGURES

Table 1

MacArthur-Bates CDI: Words and Gestures Assessment Pre-Intervention.

Part I: Early Words	**Score**
- First Signs of Understanding	3/3
- Phrases	23/28
- Starting Talk	1/2
- Vocabulary	
Produced words	13/396
Understood words	253/396
Part II: Action and Gestures	
- Total Gestures	18/63
- Early Gestures	7/18
- Later Gestures	11/45

Table 2

Summary of participants of the study

Participants	**Names**	**Race**	**Role**
Primary Participant	Aaron	White	Student
Secondary Participants Children	Drago	White/Caucasian	Student/Peer
	Brittany	Caucasian	Student/Peer
	Michael	AA Interracial	Student/Peer
	Phoenix	Asian	Student/Peer
Secondary Participants Adults	Dana	White	Aaron's Mother
	Violet	White	Head Teacher
	Rachel	White	Personal Aid
	Kelly	White/Caucasian	Personal Aid
	Lucia	White	Special Education Coordinator

Table 3

Overview of intervention procedures.

Intervention Phase	Description	Objectives	Sessions
Baseline	1. Free play activity with musical instruments	• Assess initial amount of communicative offers	4 for triad 1 (2 weeks) 5 for triad 2 (4 weeks)
Exploring through Sounds	1. Introduction to an instrument 2. Play the instrument 3. What instruments we like/dislike	• Auditory sensitization • Sound exploration • Own bodies exploration • Learn to pay attention to peers behaviors	2 for triad 1 (1 week) 1 for triad 2 (1 week)
Connecting through Sounds	1. Introduction of role of conductor and musician 2. Introduction of at least 4 conventional gestures associated with sound parameters 3. Perform the role of conductor and musician	• Sound parameters exploration • Gradual understanding of music as means of social interaction	3 for triad 1 (2 weeks) 2 for triad 2 (1 week)
Interacting through Sounds	1. Introduction of activity 2. Develop of at least 1 individual gesture 3. Perform the role of conductor and musician	• Explore individual ways of musical interaction	3 for triad 1 (2 weeks) 1 for triad 2 (1 week)
Maintenance	1. free play activity with musical instruments	• Assess the generalization across time of the intervention effects	4 for triad 1 (2 weeks) 0 for triad 2 (0 week)

Table 4

Percentage of codes by category and participants.

Category	Dana		Violet		Rachel		Kelly		Lucia		Aaron		Drago		Brittany		Michael		Phoenix		Total
	I	F	I	F	I	F	I	F	I	F	I	F	I	F	I	F	I	F	I	F	
Background	12.06	1.26	2.83	1.00	6.61	0.58	9.23	1.42	9.60	-	0.94	0.58	1.94	0.89	1.15	0.68	0.63	-	1.73	-	53.12
Speech-Language skills	4.04	0.37	0.52	0.16	1.26	0.52	1.21	0.10	1.26	-	0.00	0.00	0.00	0.00	0.00	0.16	0.21	-	0.47	-	10.28
Social Interaction	3.72	0.37	1.94	0.63	1.99	1.52	2.36	0.63	2.99	-	0.16	0.21	0.52	0.63	0.47	0.42	0.73	-	1.26	-	20.56
Intervention	0.68	3.04	0.73	1.00	0.52	1.84	0.58	2.57	1.26	-	0.00	0.10	0.42	1.10	0.21	0.89	0.63		0.47	-	16.05
Total	20.50	5.03	6.03	2.78	10.38	4.46	13.37	4.72	15.10		1.10	0.89	2.88	2.62	1.84	2.15	2.20		3.93		100.00

I = initial interviews; F = final interviews.

Table 5

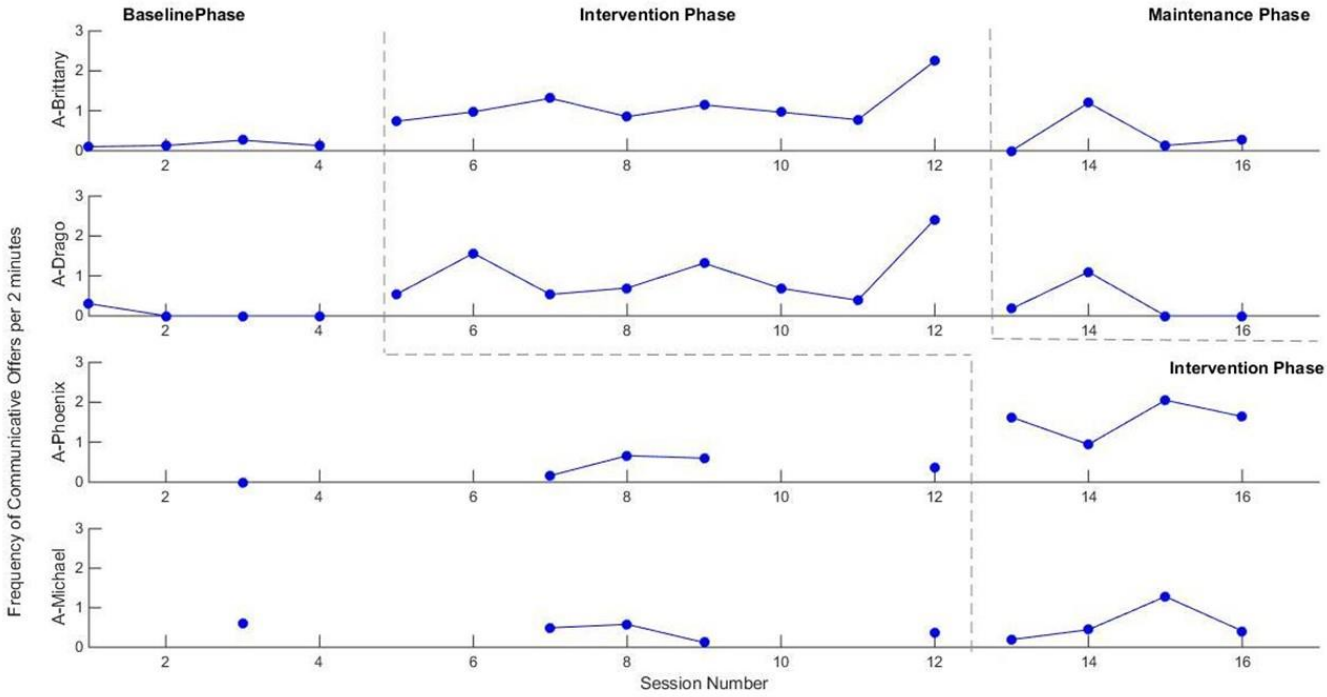
Number of adults and children that reported the emerged themes

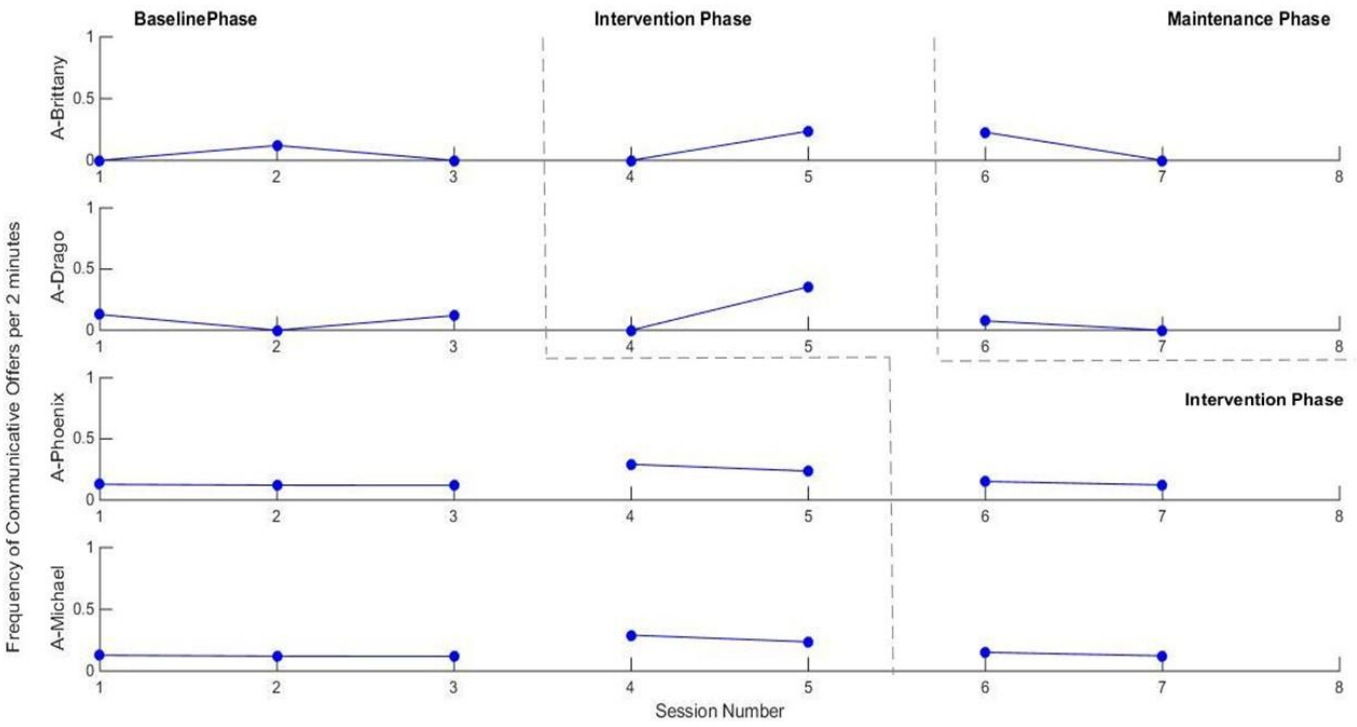
Theme	Adults	Children
Increased Awareness	4/4	2/3
Positive changes in interactions	4/4	2/3
Communication as broader concept	3/4	0/3
Increased familiarity with musical instruments	2/4	2/3

Figure Caption

Figure 1. This figure shows the frequency of communicative offers evidenced in intervention setting. The number of communicative offers per 2 minutes are displaying across phases (baseline, intervention and maintenance) and dyads (Aaron-Brittany, Aaron Drago, Aaron Phoenix, and Aaron Michael. The two first dyads (Aaron-Brittany and Aaron –Drago) composed the first triad, for which the program was implemented. The two last dyads (Aaron-Phoenix and Aaron-Michael) composed the second triad.

Figure 2. This figure shows the generalization of intervention to performance time activity. The number of communicative offers per 2 minutes are displaying across phases (baseline, intervention and maintenance) and dyads (Aaron-Brittany, Aaron Drago, Aaron Phoenix, and Aaron Michael. The two first dyads (Aaron-Brittany and Aaron –Drago) composed the first triad, which program was implemented. The two last dyads (Aaron-Phoenix and Aaron-Michael) composed the second triad. This data was collected in performance time setting.


BaselinePhase
Intervention Phase
Maintenance Phase
Intervention Phase
A-Brittany
A-Drago
A-Phoenix
A-Michael
Frequency of Communicative Offers per 2 minutes
Session Number


BaselinePhase
Intervention Phase
Maintenance Phase
A-Brittany
A-Drago
A-Phoenix
A-Michael
Intervention Phase
Frequency of Communicative Offers per 2 minutes
Session Number

APPENDICES

Appendix A

Speech and language assessment conducted within a year prior to the initiation of our study.

Test	Scores
VMPAC	
- General motor Control	< 5th Percentile
- Oromotor control	< 5th Percentile
Sensory Profile	
- Auditory Processing	< 2nd Percentile
- Multisensory Processing	< 2nd Percentile
- Oral Sensory Processing	< 2nd Percentile
- Visual Processing	> 16th Percentile
- Vestibular Processing	2nd - 16th Percentile
- Touch Processing	2nd – 16th Percentile
Mullen Scales of Early Learning (MSEL)	
- Fine Motor Skills	< 1st Percentile
- Visual Reception	< 1st Percentile
Vineland Adaptive Behavior Scale II	
- Receptive language	4 (age equivalent: 13 months)
- Expressive Language	1 (age equivalent: 15 months)
Mc Arthur Bates Inventory CDI	
Part I: Early Words:	
- Phrases Understood	23/28
- Words Understood	178/396
- Words Produced	10/396
Part II: Actions and Gestures	
- Total Gestures	19/63
- Early Gestures	7/18
- Later Gestures	12/45

Appendix B

Semi-structured interviews

Primary participant.

Initial semi-structured interview primary participant.

Social Dimension.
Goal: To obtain knowledge of social dimension in the peer context.

- Do you like the school?
- What do you prefer between this three activities?
    - Math
    - Literacy
    - Play a musical instruments
- Do you have friends?
- Who do you like to play with?

(Provide pictures of classmates and tutors)

- What do you like to play?

Music
Goal: To obtain awareness of musical background, musical interests and musical preferences.

- Do you like music?
- Do you play some instrument? Could you show me what instrument?
- Do you like some specific song?
- Do you dislike some sounds?

Expectancies about Intervention
Goal: To gain knowledge about expectancies that peers have of intervention.

- Do you want to participate in a musical activity?
- What feelings do you have about this new performance practice?

(Provide options)

Final semi-structured interview primary participant.

Social Dimension.
Goal: To obtain knowledge of social dimension in the peer context.

- Do you like the school?
- Do you have friends?
- Who do you like to play with?

(Provide pictures of classmates and personal aids)

- What do you like to play?

Music

Goal: To obtain awareness of musical background, musical interests and musical preferences.

- Do you like music?
- Do you play some instrument? Could you show me what instrument?
- Do you like some specific song?
- Do you dislike some sounds?

Intervention effects

Goal: To gain knowledge about peers' perceptions of intervention.

- Did you like the music lessons with me?

Secondary participants.

Initial semi-structured interview (caregiver)

Social Dimension.

Goal: To obtain knowledge of social dimension in the family context.

- Who are the members in your household?
- Tell me about a typical day for your family.
    - What are the roles of the family members regarding to Aaron?
    - Who is the caregiver?
    - Who is the most play partner of Aaron? Please, give an example of a common play between them.
- How would you describe Aaron?
- Tell me about Aaron's developmental history
    - What specific medical diagnoses has Aaron received and when?
- What kind of activities does Aaron enjoy?
- What treatment/interventions is Aaron currently receiving? (Medication, some specific toy, etc.)?
- When did Aaron begin attending CECC?
- What has your impression been of the school?
- What are looking for in a school environment for Aaron?
- What are your hopes/dreams for Aaron?

Communication

Goal: To obtain information about the use of communication in family context.

- Who does Aaron interact with most frequently?

- Describe a recent interaction you have had with Aaron.
- Tell me about Aaron's talker and the role it plays in communication.
- If Aaron were interacting with peers, what might it look like?
- Can you provide an example when you felt like you couldn't understand what Aaron was trying to communicate?

Music

Goal: To obtain awareness of musical background, musical interests and musical preferences of Aaron.

- Please, tell me about the experience Aaron has had with music and instruments.
- What kind of music does Aaron enjoy?
- How do you know that Aaron is enjoying something like music?
- Is there any music or sounds you can think that Aaron dislikes?
- How would I recognize if Aaron did not like particular sounds?

Expectancies about Intervention

Goal: To gain knowledge about expectancies that caregiver have of intervention.

- What goals do you have for this intervention?
- What do you expect to see after the intervention?
- What feelings do you have about this intervention?

Note: Caregiver was informed about the nature of the intervention

Initial semi-structured interview (teacher and personal aids)

Social Dimension

Goal: To obtain knowledge social dimension in school context.

- Please, tell me about a typical day for Aaron in your class.
    - Describe a typical morning choice time
    - Describe a typical performance time
- Who are the people that interact with Aaron regularly in the school?
- Please describe a recent interaction you had with Aaron.
- How would you describe Aaron's interactions with peers?
- What would you expect Aaron's interactions with his classmates to look like?
- What activities do see Aaron enjoy?
- What situations seem difficult with Aaron at school?
- What supports/services does Aaron currently receive at school?
- What goals do you have for Aaron this year?
- How do you think Aaron feels about school?

Communication

Goal: To obtain information about the use of communication in school context.

- Who does Aaron interact with most frequently?
- Describe a recent interaction you have had with Aaron.
- Tell me about Aaron's talker and the role it plays in communication.
- If Aaron were interacting with peers, what might it look like?
- Can you provide an example when you felt like you couldn't understand what Aaron was trying to communicate?

Music

Goal: To obtain awareness of musical background, musical interests and musical preferences of Aaron.

- Please, tell me about the experience that Aaron have with music in the school.
- What have you observed in terms of Aaron's response to music?
- Kind of music Aaron enjoys?
- How do you know that Aaron is enjoying some piece music?
- What kind of music/sound does not Aaron like?
- How do you know that Aaron is enjoying some piece music?
- What kind of musical instruments have Aaron experienced?

Expectancies about Intervention

Goal: To gain knowledge about expectancies that teacher have of intervention.

- What goals do you have for this intervention?
- What do you expect to see after the intervention?
- What feelings do you have about this intervention?

Note: Head teacher and personal aids were informed about the nature of the intervention

Initial semi-structured interview (children)

Social Dimension.

Goal: To obtain knowledge of social dimension in the peer context.

- Tell me about a typical day in the school.
- Who do you like to play with?
- Please, tell me about Aaron.
    - Who does Aaron like to play with?
    - What does Aaron like to play?
    - If you play with Aaron, what does it look like?

  - How can you tell what Aaron likes and doesn't like?

Music

Goal: To obtain awareness of musical background, musical interests and musical preferences of peers.

- Please, tell me about your music experience.
- What kind of music do you enjoy?
- What kind of music do not you like?
- What kind of musical instruments have you played?

Expectancies about Intervention

Goal: To gain knowledge about expectancies that peers have of intervention.

- What do you expect of this new performance practice?
- What feelings do you have about this new performance practice?
- What do you want to learn with this activity?

Note: Children were not informed about the nature of the intervention. They just knew that would participate in a music activity with some classmates.

Final semi-structured interview (adult participants)

Intervention effects

Goal: To gain knowledge about adults' perceptions of intervention.

- What have you noticed about the intervention?
- What, if any effects, have you observed?
- Have you noticed any changes in Aaron's interaction with peers, the 4 participating peers in particular? If so, please describe an observed interaction.
- How would you describe the children's feelings about the intervention?
- What might you consider changing about the intervention?

Final semi-structured interview (children)

Social Dimension.

Goal: To obtain knowledge of social dimension in the peer context.

- Tell me about a typical day in the school.
- Who do you like to play with?
- Please, tell me about Aaron.
  - Who does Aaron like to play with?
  - What does Aaron like to play?

- If you play with Aaron, what does it look like?
- How can you tell what Aaron likes and doesn't like?

Music

Goal: To obtain awareness of musical background, musical interests and musical preferences of peers.

- Please, tell me about your music experience.
- What kind of music do you enjoy?
- What kind of music do not you like?
- What kind of musical instruments have you played?

Intervention effects

Goal: To gain knowledge about peers' perceptions of intervention.

- What did you think of music lessons with me?
- Do you have some suggestions to improve this activity

Appendix C

Fidelity checklist
Phase 1: Exploring through sounds

	Inst. 1	Inst. 2	Inst. 3	Inst. 4	Inst. 5
The researcher introduces at least 3 instruments/session by					
- labeling the instrument name					
- noting the musical family into the visual board					
- modeling how the instrument is played					
- providing variation along one of the following parameters: pitch, intensity, tempo					
The researcher provides each child at least one opportunity per session to play the musical instrument introduced (with/without prompting).					

	Child 1	Child 2	Child 3
The researcher will identify and interpret at least one behavioral response to the musical instruments per child each session (e.g., "Aaron is covering his ears; I don't think he likes it." Or "Brittany is swaying; I think she likes the beat."			
The researcher will ask and assist (as needed) individual children to categorize each new instrument introduced that sessions as liked/disliked/mixed.			
The researcher provides each child a low-tech AAC Folder with relevant instruments and behaviors that assist in the activity (e.g., yes/no, wait, I want)			

Date: _____ Triad: _____

Phase 2: Connecting through sounds

The researcher will introduce/review the roles of conductor and musician by using the terms "conductor" and "musician" at least once/session and providing reference to associated pictorial/gesture support.	
A board is available with musical instruments and their families.	
A board is available with conventional gestures.	

	gest. 1	gest. 2	gest. 3	gest. 4
The researcher introduces at least 2 conventional conducting gestures/session related to pitch, intensity, or duration				
- labeling each gesture introduced				
- demonstrating each gesture introduced				
- referencing a photographic support for each gesture				
The researcher provides <u>child 1</u> at least one opportunity to try conducting with each gesture introduced within the session (with/without prompting as needed).				
The researcher provides <u>child 2</u> at least one opportunity to try conducting with each gesture introduced within the session (with/without prompting as needed).				
The researcher provides <u>child 3</u> at least one opportunity to try conducting with each gesture introduced within the session (with/without prompting as needed).				

	child 1	child 2	child 3
The researcher will give each child at least one opportunity to select an instrument of their choice and serve in the role of musician (with/without prompting).			
The researcher provides each child a low-tech AAC Folder with gestures, relevant instruments, and behaviors that assist to the development of the activity (e.g., yes/no, wait, I want).			

Date: _____ Triad: _____

Phase 3: Interacting through sounds

The researcher will introduce/review the roles of musical narration and performance with individual accents.	
A board is available with musical instruments and their families.	
A board is available with conventional and individual gestures.	

	child 1	child 2	child 3
The researcher attributes musical meaning to individual gesture/movement related to pitch, intensity, or duration (gesture 1).			
- labeling each gesture introduced			
- demonstrating each gesture introduced			
- referencing a photographic support for each gesture			
The researcher attributes musical meaning to individual gesture/movement related to pitch, intensity, or duration (gesture 2).			
- labeling each gesture introduced			
- demonstrating each gesture introduced			
- referencing a photographic support for each gesture			
The researcher provides each child at least one opportunity to try conducting with each gesture introduced within the session (with/without prompting as needed).			
The researcher will give each child at least one opportunity to select an instrument of their choice and serve in the role of musician (with/without prompting).			
The researcher provides each child a low-tech AAC Folder with gestures, relevant instruments, and behaviors that assist to the development of the activity (e.g., yes/no, wait, I want).			

Date: _____ Triad: _____

Appendix D

Operational Definitions of Clinician Strategies

Interpretation (I)

Verbally provided meaning for a child behavior (not limited to interaction behaviors) with the consequence to inform other children (e.g., Aaron is plugging his ears, maybe the sound is too loud for him). In addition, verbal meaning needs to have adult eye gaze or some other means of interacting with the other peers.

Direct Prompts for peer Interactions (DP)

Verbal or non-verbal direct or suggestive request (including indirect request) for one child to interact (verbal or non-verbal) with another child (e.g., Brittany, can you give the harmonica to Drago?). In the case of sequenced direct prompts, three seconds must elapse before a new episode of the same strategy can be counted (e.g., higher, higher, higher…(3 seconds)…lower, lower, lower). Direct prompts for other behaviors that do not involve a peer interaction (e.g., Phoenix, can you order the materials?) are not considered. Social interactions directed toward adults are not considered, neither.

Positive Reinforcement for peer Interactions (R)

Immediate verbal or non-verbal praise for a child who interacted with one or more peers. It includes praise after conductor role (e.g., Brittany was asked to give the harmonica to Drago. After she completed the action, the clinician said "good job." "Good job" would be the positive reinforcement in this case. Positive reinforcement for other behaviors different from peer interaction are not considered. Positive reinforcement for interactions between a child and an adult are not considered, neither.

Scaffolding peer Interactions (S)

Therapist (or another adult) intervenes in an ongoing peer interaction verbally or non-verbally to shape it when the interaction has already started. Therapist (or another adult) intervenes to suggest or show another way to interact (e.g., Drago, you can show

the visual board to Aaron, and so, ask him what musical instrument he wants to play). In some opportunities, therapist (or another adult) can use another operationalized clinician strategy to scaffold peer interactions. In these cases, we just count scaffolding strategy.

Environmental Arrangement (E)

Clinician (or another adult) uses non-verbal communication intentionally to re-organize the physical space with the objective of increasing physical proximity between child participants and/or to change children positions with the objective of getting facial/body orientation toward other peers. It could include, but not limited to rearranging objects, such as AAC devices, instruments, and chairs, or directly asking the children to change their positions in the room.

Appendix E

Coding sheet of frequency of communicative offers

Date: _____

Activity Observed: _____

Child Observed: _____

Coding:

Time	Is it a communicative offer (Y/N)?	M	P	D	B	Brief description of behavior/ general notes

**M: Michael; P: Phoenix; D: Drago; B: Britany.

# Total					

Name of Coder: _____

Script notes:

Aaron's Initiation	→
Peer's Initiation	←
Multiparty	∴
Unclear	**?**
behavior w/ prompting	**pr**

Appendix F

Operational definitions of coding categories

Background information. Background information was operationally defined as information related to case history (e.g., medical history, family history, and communicative development), previous interventions and musical experiences, and interests/hobbies. Information related to the relevance (e.g., I think it is a powerful tool) and technical issues (e.g., cost of the device, weight, etc.) of the use of AAC devices is included in this category. Information about goals for Aaron's development is also considered in this category.

Speech-language skills. Speech-language skills were defined as information related to an individual's communication profile, which may relate to a linguistic domain (i.e. phonology, morphosyntax, semantics, and pragmatic skills) or to specified modalities (e.g, gestures, AAC). Also included would be message interpretation, for example "I think he meant 'down' because he has a keyboard in the basement at home." Information about the relevance (e.g., I think it is a powerful tool) and technical issues not related to speech and language skills (e.g., cost of the device, weight, etc.) of the use of AAC devices is not included in this category.

Social interaction. Social interaction category was defined as information related to any real or desired interaction/alignment/engagement between two or more individuals, including information on who the participants are interacting with (e.g., my mom is helping me with my homework), where they are interacting (e.g., I would like to interact with Aaron. However, he is always in the sensory room), or the nature of their

interactions (e.g., he pushes me every time that I go close to him). Interactions can be verbal or nonverbal in nature. Information about friendship is also included, but it does not include naming friends. For example, “I like to play with my friend John” is considered a social interaction. However, the phrase “my friend is John” is not considered because it is the same as “my mom is Kate.” This category also includes social interaction profile of Aaron. For instance, expressions such as “Aaron can play with someone else” or “people can be hit by Aaron” are considered part of the profile of social interaction that Aaron has.

Intervention. Intervention was defined as any information related to the goals, expectations, perceptions, and feelings of the intervention. Hopes for the future related to intervention (projection).