The Use of Music to Increase Task-Oriented Behaviors in Preschool Children with Autism Spectrum Disorders in a Gross Motor Setting

Dissertation

Presented in Partial Fulfillment of the Requirements for the Degree Doctor of Philosophy in the Graduate School of The Ohio State University

By

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Abstract

The purpose of this study is to determine the effect of music and music + instruction on task-oriented behaviors in preschool children with ASD within individual gross motor movement settings. Five preschool children (four boys; one girl) diagnosed with ASD attending a Midwestern private preschool for children with ASD served as participants. The study utilized a multiple-baseline across participants design and task-oriented behaviors during individualized gross motor movement sessions were measured. All sessions were videotaped. Treatment fidelity and inter-observer agreement were established (99% and 93%, respectively). Data were analyzed through visual analysis and descriptive statistics. The results indicate that music + instruction increased task-oriented behaviors when compared to music only for all participants. With the increasing diagnoses of ASD in young children, there is a need for further understanding in how young children with ASD can be successful in movement settings. The results of this study can serve as a foundation to better understand the role of music in preschool programs for young children with ASD.
Dedication

Dedicated to my advisor, to my family and friends, and to those who helped me get to where I am today.
Acknowledgements

This document represents who I have become over the past five years of my doctoral program. The experiences I have gained and the lessons I have learned in creating the following pages are irreplaceable. The superior individuals that I have had the honor to work with over the course of my graduate school career and in completing my doctoral dissertation have been nothing less than supportive and deserve far more than my gratitude. The list of individuals who influenced and supported me throughout this experience is long; however, several individuals need special mention for their contribution to my dissertation and the professional that I have become.

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Publications

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Fields of Study

Major Field: Education – Adapted Physical Education
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Chapter 1: Introduction

In the 1960’s, autism spectrum disorder (ASD) was identified as affecting two in every 10,000 children (Rutter, 2005). Currently, one in every 88 children is affected by ASD (Baio, 2012). ASD can be categorized into five related neurological disorders, which affect development. Included on the spectrum are autistic disorder, Asperger’s disorder, Rett syndrome, pervasive developmental disorder not otherwise specified (PDD-NOS), and childhood degenerative disorder (American Psychiatric Association, 2000). According to the American Psychiatric Association (APA) (2000) Diagnostic and Statistical Manual of Mental Disorders, mild to severe deficits in communication, social interactions, and restricted repetitive and stereotypic behaviors/interests/activities, are characteristics of ASD. In diagnosing ASD one must have at least two deficits in social interaction, at least one deficit in communication, and at least one display of restricted repetitive and stereotypic behaviors/interests/activities, which interferes with cognitive function or the ability to communicate and be understood by others. As such, these symptoms cannot be better explained by other disorders on the autism spectrum (APA, 2000).

With the prevalence of ASD increasing rapidly, the federal mandates in place require free and public education to all children (PL 108-446, 2004) in the least restrictive environment (LRE) is becoming increasingly important. As such, educators need to understand the behaviors of children and youth with ASD in order to better serve
their educational needs.

In order to be successfully included in schools, children with ASD need to exhibit appropriate behaviors that will facilitate learning. These behaviors include task-oriented behaviors, social interaction, and communication, all of which are necessary in order for children to attend to specific learning tasks and engage in typical activities (i.e., group-work) that occur in early elementary classrooms. Specific examples of behavioral deficits that teachers may observe are interactive communication with and between peers, difficulty during transitions and the difficulties making sense of abstract ideas and/or concepts (Department of for Education and Skills, 2004). These deficits in social interaction, communication, and stereotypic behaviors pose unique challenges for educators.

Early intervention programs serving students with disabilities (i.e., ASD) have been shown to increase social and communication skills and improve adaptive behaviors (Lovaas, 1987; Smith, Groen, & Wynn, 2000; Remington, et al., 2007; Kovshoff, Hastings, & Remington, 2011; Fernell, et al., 2011). Specifically, research has shown that children and youth with ASD benefit from early intensive behavioral programs (EIBP) (Lovaas, 1987). Several methods (i.e., parental and school-based programming) have been used in early intervention programs to improve the marked deficits that children with ASD exhibit (Sandall, et al., 2011; Alber-Morgan, Cannella-Malone, & Park, 2011). Most early-intervention programs utilize a direct instruction or teacher directed method to ensure child success. Those children enrolled in early intervention programs in the previous studies sustained educational gains and were more likely to attend schools in which they were integrated with children without disabilities.
In order for children and youth with ASD to reach their maximum potential in educational settings early intervention services are needed (Burrows, 2004). Early intervention programs provide ongoing care and education for young children with disabilities (i.e., ASD) prior to entering kindergarten (National Council, 2001). These programs are particularly important for young children with ASD because they provide realistic learning environments, which promote learning experiences that they may not otherwise have had (Woley & Wilbers, 1994).

In addition to the social and educational deficits, children with ASD often have difficulty with motor and coordination skills (i.e., fine and gross motor) and their motor skill levels are delayed when compared to their same aged peers without disabilities (Green, Charman, Pickles, Chandler, Loucas, Simonoff, & Baird, 2009; Berkeley, Zittel, Pitney, & Nichols, 2001).

The long-term implications, of these characteristics are that they may never obtain the skills (i.e., locomotor) needed to participate with their peers without disabilities in high level games, sports, and leisure activities. In addition, they are likely to be further in jeopardy of acquiring the necessary social skills for interactions later in life. Therefore, it is likely that the lack of these skills may result in inactivity and they may be more likely to be at risk for obesity (Rosser Sandt & Frey, 2005). Additionally, Pan, Tsai, & Heish (2011) suggest the motor skill delays in children and youth with ASD in conjunction with known social and communication deficits could influence their physical activity experiences in adolescence, which in turn could decrease the likelihood they became physically fit/active adults. Stodden et al., (2008) suggest that there is a relationship between children’s experiences in being exposed to and master fundamental motor skills
and their engagement in physical activity later in life. This is of particular importance because of the need for teachers to intervene early with young children with ASD in order to address the motor needs. According to Berkeley, et al., (2001) there is a need for more evidence-based research to support the early intervention educational needs (i.e., physical activity) of children and youth with ASD.

Children with ASD typically exhibit delayed motor skills (Ornitz, Guthrie, & Farley, 1977; Berkley, et al., 2001); therefore, it is important to focus on appropriate behaviors (i.e., mature motor skills) in early intervention gross motor movement activity settings. Berkley et al., (2001) suggest physical educators should be aware of the needs of their students with ASD (i.e., social and communication) to maximize their participation and create an environment that provides children with the opportunity to become successful kinesthetic movers.

One evidence-based practice that has been used successfully in educational settings for children and youth with disabilities (i.e., children and youth with ASD) to enhance their known deficits is music. Music has been shown to increase on-task behaviors (Gunsberg, 1998; Orr, Myles, & Carlson, 1998); increase attention span and non-verbal communication skills (Kim, Wigram, & Gold, 2008); promote independence (Kern, Wolery, & Aldridge, 2007); enhance interpersonal skills (Eidson, 1989); and increase social play (Brownell, 2002; Humpal, 1991). With regard to the Kim, et al., (2008) study it was found that music enhanced appropriate behavior and facilitated eye contact in children with ASD within an educational setting suggesting that music may aid in increasing task-oriented behaviors in physical activity settings.
For young children without disabilities research study results have provided information regarding positive increases in movement performance and rhythmic ability in physical activity and gross motor settings as a result of using music (Zachopoulou, Derri, Chatzopoulos, & Ellinoudis, 2003; Chatzipanteli, Pollatou, Diggelidis, & Kourtesis 2007). To this investigator’s knowledge only a small number of studies have been conducted which have used music within a physical activity setting for children with disabilities. One study was conducted with a ten-year-old boy diagnosed with myotonic dystrophy. Results show that movement skills can be generalized from a music therapy setting to a physical education setting (Kennedy & Kua-Walker, 2006). In a second study, preliminary evidence suggests that preschoolers diagnosed with ASD are able to exhibit increased on-task behavior when participating in music-focused gross motor movement sessions (Titus & Porretta, 2012). While the results of these studies are encouraging additional evidence-based research is needed regarding the utility of music to increase task-oriented behaviors within gross motor movement settings, especially for young children with ASD. Task-oriented behavior is essential in understanding and prompting learning. Conducting studies such as these will help better understand how to promote task-oriented behaviors for children with ASD. The underlying assumption of this work (need to increase task-oriented behaviors) is that if one can increase the amount of successful opportunities to learn (in physical education) by improving task-oriented behaviors, then children will ultimately learn more motor skills and become more successful movers (National Association for Sport and Physical Education (NASPE), 2010; Robinson & Goodway, 2009). Therefore, it is important for researchers to examine the effect of music on task-oriented before evaluating movement concepts and skills.
Physical education is an ideal setting for this research to take place because physical educators already use specific pedagogies (i.e., music) anecdotally to promote success with their students. In order to understand the capacity of music as a teaching tool future studies should focus on children (with ASD) and their ability to attend to tasks in gross motor movement settings when music is present and when it is absent. Furthermore, researchers should investigate music components (i.e., lyrics, rhythm, etc.) is related to changes in behavior (i.e., task-oriented).

Therefore, it is essential to investigate if music alone or in combination with instruction can facilitate task-oriented behaviors in children with ASD. This research will provide foundational information regarding the potential for using music as a teaching tool to increase task-oriented behaviors in order for future studies to examine the effect of music in increasing skill development and physical activity levels of young children with ASD.

This study is rooted in behaviorism (Cooper, Heron & Heward, 2007; Johnson & Pennypacker, 2009). One method of studying behavior is through applied behavior analysis. Study of behavior within an applied setting allows for researchers to better understand the function of participants’ behaviors. In order to determine the function of a behavior it is important to study the behavioral antecedent (or what happens before the onset of the behavior), the behavior itself (what it looks like), and the consequences of the behavior (what happens after the onset of the behavior). The study of these components (i.e., antecedent, behavior, and consequence) allows one to improve the behaviors being studied. Through an empirically designed study a functional relationship
can be determined between socially appropriate task-oriented behaviors and the use of music in gross motor movement settings for preschool children with ASD.

**Purpose of the Study**

The purpose of this study is to determine the effect of music and music + instruction on task-oriented behaviors in preschool children with ASD within individual gross motor movement settings.

**Research Questions**

1. Can preschool children with ASD increase their task-oriented behaviors with the introduction of music (only) within an individualized gross motor movement setting?
2. Can preschool children with ASD increase their task-oriented behaviors with the introduction of music in addition to the visual modeling and verbal prompting of instructions from the investigator, within an individualized gross motor movement setting?

**Delimitations of the Study**

This study is delimitated to:

1. Locomotor skills
2. Overt behaviors exhibited by participants – only behaviors that are physically demonstrated (i.e., running)
3. Gross motor movement sessions – consisting of individualized gross motor movement sessions delivered during the school day by the investigator that occur once a day, four days a week for ten minutes.
4. Task-oriented behaviors during individualized gross motor movement sessions
only, task-oriented behaviors exhibited outside the sessions was not included.

5. The five preschool children diagnosed with ASD.

Limitations of the Study

1. The investigator cannot control the use of music to facilitate learning outside the individualized gross motor setting or outside of school.

2. The investigator cannot control for unplanned attendance of the participants during data collection (i.e., illness and fieldtrips)

3. The investigator could only measure the task-oriented behaviors post-hoc and used ten-second momentary time sampling.

4. The study had to coincide with the school year. Data were collected from March to June but had to be completed by June due to the end of the school year.

Operational Definitions

Autism Spectrum Disorder

An individual who exhibits at least two deficits in social interaction, at least one deficit in communication, and at least one display of restricted repetitive and stereotypic behaviors/interests/activities, which interfere with cognitive function or the ability to communicate and be understood by others (APA, 2000).

Gross Motor Movement Sessions

Any session involving direct interactions between the investigator and participants when locomotor skills and activities are presented. Examples of locomotor skills consist of running, galloping, skipping, and hopping.
General Prompts

Any verbal prompt in the form of a verbal reminder given by the instructor to the participant during the individualized gross motor sessions beyond the music lyrics (verbal instructions) and/or those reiterated by the instructor. This prompting was directed to the participant and may be general or specific to the behavior and skill/task.

Target Behaviors

Any behavior exhibited by the participant that can be categorized as task-oriented (i.e., proper movement skills such as, running during an activity), visual attention (to the investigator) during movement activities, appropriate use of various equipment, transitions between activities, and attention to each of the proposed movement activities.

Non-Task Oriented Behaviors

Behaviors that show non-compliance with instructions/activities presented during the physical activity sessions. These behaviors consist of (a) movement not aligned with the proposed activity, (b) delay in transitioning between activities, (c) inappropriate use of equipment, and (d) refusal to participate in movement activities.

Task-Oriented Behaviors

Behaviors that show compliance with instructions/activities presented during gross motor movement sessions. Task oriented behaviors that can be defined as behaviors consist of (a) proper movement skills (i.e., running during an activity), (b) visual attention (to the investigator) during movement activities, (c) appropriate use of various equipment, (d) transitions between activities and (e) physically attends the task with > 5 second delay.
Chapter 2: Literature Review

Chapter two consists of five sections: (a) behaviorism, (b) educational concerns for children with ASD, (c) early intervention, (d) music, and (e) summary. (a) Behaviorism, (c) early intervention, and (d) music have been divided into sub-sections in order to provide specific information relevant to this study.

**Behaviorism**

One way of studying the characteristics of children with ASD is through the principles of behaviorism. Behaviorism is the science of investigating the behavior of organisms (i.e., human beings) in order to understand the relationship between an organism’s behavior and its environment (Skinner, 1953). This exploration of behavior allows for researchers to examine behaviors that occur both inside (i.e., thinking) and outside (i.e., bathing) the body. Behaviorists believe that all behaviors occur as a result of the interaction between the organism and its environment (Skinner, 1953). Researchers using behavioral methods argue that verbal behavior is not an essential component in the understanding of what is occurring in a particular environment or social setting (Johnston & Pennypacker, 2009). However, the overt or physical behaviors should be examined to better understand the function of the behavior. Therefore, behaviorism can be used to better understand specific behaviors and develop positive interventions for children with ASD. Skinner (1953) suggests that there are six attitudes of science: determinism, empiricism, parsimony, experimentation, replication, and philosophical doubt. Determinism suggests
that the universe (or at least part of it) is a lawful and orderly place in which all phenomena occur as the result of other events. Empiricism supports the practice of objective observation of the target behavior in order to better understand its function. Parsimony encourages the simplest explanation was evaluated (and/or ruled out) first (i.e., the dog scratches at the door → does he need to go outside?). Experimentation ensures that the independent variable(s) (IV) are systematically manipulated and measured in order to interpret the effect that IV has on the targeted behavior or dependent variable (DV). Replication allows for researchers to repeatedly study the IV within an experiment, or repeat entire experiments in order to determine the relationship between the IV and the DV. Finally philosophical doubt encourages investigators to continually question the “truthfulness” of results in order to ensure that the findings are accurate (Johnson & Pennypacker, 2009). These six attitudes act as guidelines for behaviorists to guide their studies.

**Applied Behavior Analysis**

From these attitudes of behavior, several methods of studying behavior have emerged. One method is analysis (ABA) (Johnston & Pennypacker, 2009). This method of studying behavior allows researchers to examine an individual’s behavior in a natural environment (i.e., school). Furthermore, behavioral researchers, utilizing ABA, view the importance of addressing behaviors of practical concern and strive to work to contribute toward changing the current behavior or phenomena (Cooper, Heron, & Heward, 2007).

In addition to utilizing ABA as the study of behavior within a naturalistic setting, Baer, Wolf, & Risley (1987) suggested that there are seven characteristics, which guide studies. The terms used to describe these seven characteristics are: applied, behavioral,
analytical, technological, conceptually systematic, and generality. Research that is applied addresses issues related to directly improving behaviors that enhance the individual(s) quality of life. Behavioral research ensures that the researchers must observe, measure, and attempt to change the “actual” behaviors (Johnson & Pennypacker, 2009). Research, which is analytic, requires the control of occurrences and non-occurrences of a behavior in order for a functional relationship to be established. Research should also be technological which means that the investigator must be able to identify and describe (i.e., measurement tool) the procedures of the experiment. It is also important that the experiment be effective. Effective research ensures that the intervention within an experiment was solely responsible for changes in the target behavior(s) and that the improvements are substantial. Investigators using ABA also strive to conduct research that is conceptually systematic meaning that all procedures should be explicit and easily repeated. Finally ABA research should have generality. This ensures that the changes in the target behavior(s) sustain over time, can be transferred to other settings, and/or generalize to similar behaviors.

These characteristics act as the “gold standard” of ABA research and a study must meet all of the characteristics to be considered an applied behavioral study. For example, a study that is considered applied focuses on behaviors that are considered socially important/valued.

**Single-Subject Research**

Children with ASD often exhibit behaviors that are different from one another. Therefore, interventions utilizing a group design are difficult to implement because of the variability in behavior both within and across participants. Single-subject research was
developed a little over forty years ago as a method of studying and individual’s behaviors (Sidman, 1960). Since that time single-subject designs have been utilized for studying individual behaviors relevant to education (Horner, et al., 2005). These types of design are particularly important for studying the behaviors of individuals with disabilities because it allows for participants to act as their own controls.

Single-subject research is considered to be a rigorous and scientific method to study human behavior in order to establish evidence based practices (Horner et al., 2005). Therefore, single-subject research designs are ideal in determining the function of specific pedagogies on participants’ behaviors. Often single-subject research is used to “…document or determine causal or functional relationships between independent and dependent variables” (Horner et al., 2005, p.166), which is particularly important when trying to develop or determine successful teaching practices. However, there are concerns about the utility of research findings because of the small participant numbers; therefore, it is important for steps to be taken to improve the internal and external validity of this type of research. Horner et al., (2005) addressed issues of potential threats to internal and external validity by proposing a need to operationally define the participants, settings, independent and dependent variables so that the audience is aware of exactly what is being studied. By operationally defining these components of a study the audience has a better picture of purpose and intentions of the study.

For this study it was decided to use a behavioral perspective to conduct an applied single-subject research study. Behaviorists often utilize single-subject designs in order to examine each child’s behavior at the individual level and establish a function of the targeted behavior. In addition, utilizing behaviorism and ABA allows for the researcher
to better understand and examine the individual behaviors of each participant in the study in a natural setting (i.e., school gymnasium).

For this study a multiple baseline across participants was used. Multiple baseline across participants designs allow for investigators to examine how an intervention (IV) affects multiple participants’ behaviors at the same time. Advantages of this study are that is does not require withdrawing a seemingly effective treatment, it is viewed as a more acceptable method for demonstrating effects of an intervention, it is suited for progressive and sequential changes in behavior (Cooper et al., 2007; Johnson & Pennypacker, 2009). Limitations of this design are that they may not allow for demonstration of experimental control even though functional relation exists, it infers more about the effectiveness than it does the function of a target behavior, and it is timely (Johnson & Pennypacker, 2009). Determining a functional relationship (or the effectiveness of the intervention) is determined by establishing steady state responding. Steady state responding allows for the investigator to make predictions, verify those predications by continuing measurement, and hopefully establishing that other participants in the study replicate that behavior. For this study, prediction is made if the environment held constant, the measurement would reveal similar levels of responding (i.e., behavior). Verification of predicted level of responding for one behavior (or tier) is obtained if little or no change is observed in data paths (i.e., other participants) that are still exposed to the condition, which the previous prediction was made (i.e., previous phase). Replication is established if the same changes in behavior are observed across all phases (as a result of the IV).
This design was chosen for this study because it allows for multiple participants to receive an intervention without removing treatment (Cooper et al., 2007). Because pilot data infers that there is some positive relationship between the use of music and task-oriented behaviors (Titus & Porretta, 2012); a multiple baseline design will allow for the investigator better determine which component of music is the most effective in increasing task-oriented behaviors. The total intervention includes a baseline phase, music only phase, and music + instruction phase.

Prior to the start of the study, baseline data was collected on task-oriented behaviors. The Baseline condition will consist of instructional prompts to participations to perform activities (i.e., locomotor), model the activity and provide general praise (i.e., good job) and re-direction only (i.e., “Child’s name, do this behavior”) as needed. Activities were the same as those presented in two subsequent interventions (music only; music + instruction). Once steady state responding has been established in baseline, the music only intervention phase was introduced. In the music only phase, the instructor will only provide general prompts to start and stop activity (i.e., “listen to the directions and do what they say” and “all finished”). Once maximum task-oriented behaviors have been identified through steady state responding, a second participant was moved to into the music only phase. Subsequent participants was moved into the music only phase once previous participants in that phase have begun to exhibit increases in task-oriented behaviors. Once all participants have reached maximum task-oriented responding they was moved to the music and instruction phase. During the music and instruction phase the same music presented in the music only phase was used. The instructor will provide
prompts and modeling as well as general praise and redirection feedback (used in Baseline condition), as needed.

Educational Concerns for Children with ASD

The known deficits in social interaction, communication, and repetitive and stereotypic behaviors of children diagnosed with ASD pose unique challenges for educators, particularly in regard to promoting inclusion. In addition, children and youth with intellectual and/or behavioral disabilities (i.e., autism spectrum disorders) often struggle with exhibiting appropriate social behaviors, working with peers, engaging in structured activities, and staying motivated and on-task (Fegan, 2011; Reid & Collier, 2002; Samalot-Rivera & Porretta, 2012). Children with ASD often struggle during the school day during unstructured academic time (i.e., individual reading time), transitions (i.e., moving from the classroom to the gymnasium for P.E.), and/or social play (i.e., recess). Therefore, teachers often try to structure tasks and plan for transitions to provide increased opportunities for students to be successful during the school day.

Physical educators teaching students with ASD often encounter disruptive and/or off-task behaviors exhibited by their students with ASD in physical activity settings (Lavay et al., 2006). This can be potentially explained by examining the known deficits in gross and fine motor movements and physical activity levels and lack of attention to a teacher directed tasks (Berkeley et al., 2001; Tales & Reid, 2010).

Berkley et al., (2001) examined the FMSs of fifteen children with ASD using the TGMD-2. The TGMD-2 is a standardized test used to evaluate the FMSs of young children. The study concluded that 73% of all children were in the poor to very poor categories for both locomotor and object control skills. This suggests that children with
ASD have significantly lower fundamental motor skill performance than their same-aged peers without disabilities.

Provost, Lopez, & Heimerl, (2007) compared the motor delays of young children with ASD, developmental delays, and developmental concerns. Participants were recruited from the University Center for Excellence in Developmental Disabilities (UCEDD). The study included fifty-six children (n = 19 - participants diagnosed with ASD, n = 19 – participants who were diagnosed with developmental delays and motor delays, and n = 18 – participants identified with concerns of developmental delay but no motor delay) ranging from 21 to 41 months. The assessment instruments used were the BSID II Motor Scale and the PDMS-2. It was concluded that participants with ASD had significant delays in gross and/or fine motor skills when compared to their same aged peers with developmental delays/concern for developmental delays.

Staples & Reid (2010) conducted a study to examine the FMS levels of 25 young children (ages 9-12) diagnosed with ASD using the TGMD-2. The groups of 25 participants diagnosed with ASD were compared to three other groups: 1) chronological age matched group (n = 25); 2) developmentally matched group (n = 22); and 3) mental age matched group (n = 19). The researchers concluded that the group of participants diagnosed with ASD was more delayed in their FMS when compared to any other group in the study.

In addition, Pan et al., (2011) conducted a study on ninety-five adolescents with and without ASD in a physical education setting. The researchers used accelerometers to measure physical activity levels of students during thirty-eight physical activity lessons. It was determined that students with ASD engaged in significantly less physical activity.
than their peers without disabilities. It was also determined that the amount of physical activity was positively related to the amount of social interaction that the students with ASD engaged in and the amount of vigorous physical activity was related to the content being taught by the physical education teacher.

As a result of these studies it has been suggested that delays in motor skill performance and lack of physical activity in conjunction with the known social and communication deficits of children and youth diagnosed with ASD could influence their physical activity experiences in adolescence, which in turn could prevent them from becoming physically fit/active adults (Pan et al., 2011). Therefore it is direly important to understand why children with ASD are not physically active and develop programming to encourage motor skill development and in turn physical activity to ensure the quality of life for these children.

One way to do this is to introduce physical activity and motor skills to young children with autism during early education experiences (i.e., early intervention programs). Introducing such programing early will provide numerous opportunities for children to learn these skills and master them.

**Early Intervention**

Early intervention programs provide ongoing care and education for young children with disabilities (i.e., ASD) or those children suspected to be at risk for developmental delay prior to entering kindergarten (National Council, 2001). The premise of early intervention programs is that if intervened early, children may be less at risk for poor educational gains later in life. Early intervention programs serving students with disabilities (i.e., ASD) have been shown to increase social and communication skills

**Classroom Settings**

Lovaas (1987) conducted a two-year longitudinal study on fifty-nine young children (under four years old) diagnosed with ASD. The researcher proposed an intensive behavioral modification treatment to improve the known deficits (i.e., communication, social interaction, repetitive behaviors) for the experimental group \((n=19)\). At the conclusion of the study, it was determined that 47% of children in the experimental group exhibited normal intellectual and educational functioning in the first grade when compared to only 2% of the control group (who did not receive the intensive behavioral modification treatment).

Smith et al., (2000) examined the difference between parent training versus intensive treatment on intelligence, visual spatial skills, language, behavioral problems, adaptive functioning, and academics of twenty-eight preschool children with ASD. Two groups were used. The parent directed group focused on training parents to use treatment approaches to help their children acquire skills. Sessions were conducted in the children’s’ home two days a week (total of five hours per week) for three to nine months. The intensive treatment group focused on the child’s adaptive, intellectual, and socio-emotional functioning and consisted thirty hours per week of intervention for 2-3 years. In addition, the primary caregiver of the child was asked to conduct an additional five hours a week of therapy (alongside the student therapist) for the first three months of the study. After parent training (three to nine months) and intensive treatment (one to two years) it was determined that the intensive treatment group outperformed the parent
treatment group on all measures except for behavioral problems and adaptive functioning suggesting that the early intervention intensive treatment program was more successful than the parent training program.

A similar study by Remington et al., (2007) examined parental preference on two programs: (1) early intensive behavioral intervention (n= 23) and (2) typical treatment (n=21). The early intensive behavioral intervention consisted of a home-based behavioral intervention delivered by the parents of the child and a trained tutor for two years (twenty-five hours a week). The program used a discrete trial method to promote and maintain emerging behavioral repertoires in a natural setting. The typical treatment program consisted of the children’s local school’s services for children with ASD for two years. This program consisted of speech therapy and alternative communication training. The program took place over two years with measures of dependent variables taken after year one and two. It was found that the early intensive behavioral intervention produced higher observed measures of intelligence, language, daily living skills, and social behaviors for preschool children with ASD when compared to a control group of children with ASD who were receiving typical treatment.

Fernell et al., (2011) studied 208 children with ASD ages twenty to fifty-four months in a naturalistic (i.e., educational) setting for two years. The children where divided into two groups (1) intensive applied behavioral analysis (ABA) group and (2) non-intensive, targeted intervention based on ABA principles group. The intensive ABA group consisted of a parent and trained professional directed intervention, which took place both at school and at home. The programs consisted of fifteen to thirty hours per week of intense behavioral training (depending on who was directing the intervention).
All sessions took place over a six-month period. The non-intensive intervention of different targeted behaviors (i.e., toilet training) using ABA techniques over the course of a two-year period. The Vineland Adaptive Scale was used to quantify targeted outcomes. At the two-year follow up it was determined that both groups produced increases in Vineland Adaptive Scale composite scores, with no significant differences between groups.

It can be concluded from the research that early intervention programming in classroom settings utilizing intense (i.e., high amount of time in contact with teacher and program) teacher directed programs leads to positive growth toward the child’s educational and adaptive behavior goals that sustain over time. Furthermore, children who do not engage in early intervention programs show no significant growth over time for their educational and adaptive behavior goals when compared to their same aged peers who were involved in the program.

**Movement Settings**

A number of studies have been conducted in movement settings for preschool children with and without disabilities. These studies can be helpful to the understanding of the potential of motor skill programing for young children with ASD. Only studies conducted on preschool children in movement settings with dependent measures of physical activity or motor development and independent variables that included a motor or movement intervention were reviewed in order to determine best practice techniques for preschoolers.

A large-scale study was conducted in Scotland on 542 preschool children (Reilly, et al., 2006). The study examined the influence of a school-based program (comparison)
versus a school-based program plus a home based program (intervention) on the physical activity levels, BMI, and fundamental motor skill proficiencies of the participants. The school-based program focused on FMSs and physical activities to promote increased activity levels. The supplemental home-based program included a structured physical activity packet sent home to the parents. The parents were then required to encourage their children to engage in the activities (presented in the packet). After a twenty-four week intervention, which took place three times a week for thirty minutes each it was concluded that the intervention group exhibited significantly higher scores for fundamental motor skills than the comparison group.

Another study conducted on preschool children examined the effect of verbal feedback on improving the overhand throw for seven preschool children (Oslin, Stroot, & Siedentop, 1997). Five components of the overhand throw were measured using two types of verbal feedback were used. The first type of feedback was based on the force production sequence while the other feedback was based on the participant’s forward chaining sequence. Each type of feedback was pre-scripted and provided after each throw was completed. The study used a single-subject research design; therefore, the sessions varied across participants (fifteen to sixty trials lasting four to fifteen minutes). The results exhibited that there was no difference in the two types of feedback provided to participants for improving the sequencing of their overhand throw.

Children who are developmentally delayed or at-risk for developmental delay. Gross motor movement and physical activity interventions implemented at the preschool level have resulted in increased motor skill performance and movement patterns for preschool children who are developmentally delayed or at-risk for

Goodway & Branta (2003) studied fifty-nine African American preschool students on their perceived competence of fundamental motor skills. Participants were divided into control (n=28) and motor skill intervention (MSI) groups (n=21). This study was conducted to examine fundamental motor skills (FMS) measured by the Test of Gross Motor Development (TGMD). In this study participants were divided into a control group (n=28), and a motor skill intervention (MSI) group (n=21). Fundamental motor skills (FMS) were measured using the TGMD-2. After twelve weeks of two-day per week teacher directed motor skill sessions, which lasted forty-five minutes each it was determined that the MSI group exhibited higher scores for both object control (i.e., throw, catch, kick, strike, roll, and dribble) and locomotor skills (i.e., run, hop, jump, leap, and slide) when compared to the control group.

In addition, Goodway & Rudisill (1996) used the same population as the Goodway & Rudisill study (2003). The MSI group attended twelve weeks of two-day per week teacher directed motor skill sessions which lasted forty-five minutes, while the control group continued receiving typical daily unstructured play (i.e., recess). At the conclusion of the study it was determined that participants in both groups had improved perceived physical and cognitive competence in addition to peer and maternal acceptance when compared to pre-test scores.

Similarly, Goodway et al., (2003) studied the FMS of a group of sixty-nine preschool students from ethnically diverse backgrounds. The students were dived into a
FMS group (i.e., SKIP) and a comparison group. SKIP consisted of structured teacher
directed FMS sessions, which focused on two FMSs per sessions. Each session included
a brief warp-up activity followed by two FMS activities (which promoted multiple trials)
and concluded with a brief wrap-up/cool down. The SKIP group received nine weeks of
two day per week, while the comparison group only received unstructured outdoor play.
At the conclusion of the study it was determined that the SKIP group had significantly
higher object control and locomotor skills when compared to the post-test scores of the
comparison group.

Robinson & Goodway (2009) studied 117 preschool children’s FMS. All
participants were randomly assigned to two FMS groups and one comparison group. The
FMS groups consisted of a high autonomy (MC) activity and a low autonomy (LA)
activity group. The MC group was student-directed and allowing for the participants to
move independently through the movement space and try each activity (i.e., throwing
station). In addition, the participants in the MC group were able to choose the level of
skill they would complete (i.e., throwing to a target close to them) and how long they
would spend at each activity. The LA group was teacher directed and consisted of two
FMS stations, which lasted twelve minutes each. The comparison group did not receive
any formal FMS practice. The study took place over nine weeks and included two
sessions a week for thirty minutes each. The results concluded that both the MC and LA
groups exhibited significantly better object control and locomotor skills at posttest when
compared to the comparison group. However, there was no difference in FMS between
the MC and LA groups.
Robinson, et al., (2009) used the same population as Robinson & Goodway (2009) to study perceived motor competences. The results exhibited a significant increase in perceived motor competence for the MC group from pre-test to post-test while the LA and comparison groups exhibited no increase from pre-test to post-test.

These studies suggest that children with disabilities (i.e., ASD) could also benefit from early intervention gross motor programming. The results of these studies suggest that preschool children, when intervened, improve their movement skills (i.e., FMSs) more than their same aged-peers who did not receive the intervention. The results of these studies suggest that a teacher directed, prolonged (8-12 weeks) interventions are successful at teaching and sustaining FMS performance. Although this study is only investigating the amount of on-task behavior of preschool students during gross motor movement sessions, this body of literature provides an outline of how to implement a “quality” movement intervention. Because there have been few studies conducted on preschooolers with autism in movement settings it is helpful to first examine and understand the impact of FMS and movement interventions on children with disabilities.

**Children with disabilities.** Rimmer & Kelly (1989) conducted a pilot study to determine the effectiveness of three different gross motor programs on the gross motor skill development of twenty-nine preschool students with learning disabilities. The three programs were occupational therapy, adapted physical education, and a non-structured free play. All three programs varied in length and dose and took place during the regular preschool school day over the entire school year (33-35 weeks). At the conclusion of the study the researchers determined that the participants who received the adapted physical
education program made significant gains on the measured variables (i.e., locomotor and manipulative skills).

Another study conducted on FMS performance of four preschool children with disabilities examined the difference in motor skill performances in an inclusive setting compared to a segregated setting (Zittle & McCubbin, 1996). The inclusive setting included regular physical education classes attended by preschoolers with and without disabilities. The segregated setting included the same physical education classes but only included students with disabilities. Similar lessons were taught in both settings. A total of twenty-five, teacher facilitated, student-directed sessions were conducted. At the conclusion of the study the I-CAN measurement system was used to determine the motor skill performance of the children. The results concluded that the children engaged in similar levels of motor skill performance in each setting suggesting that inclusive settings should be utilized to promote socialization and FMS development of children with disabilities.

This literature provides evidence of the value of FMS interventions for preschoolers with disabilities. However, it only focused on the FMS performance of the students and not the children’s behavior (i.e., task-oriented). This body of literature supports the need for more empirically based studies in the preschool setting for young children with disabilities. However, even less information is known about young children with ASD, specifically preschoolers with ASD.

Children with ASD. Finn & Valkova (2007) conducted an individualized motor skill intervention for five preschool children with varying disabilities (i.e., autism, intellectual, and behavior disabilities). The researchers used a single subject research
design and developed a four-month individualized motor skill intervention for each participant. At the conclusion of the intervention, the researchers concluded there were significant improvements from the pre-test in all of the participants motor skill proficiencies (measured by the Movement-ABC). However, no baseline was measured, making results difficult to attribute solely to the motor skill intervention.

As a whole, the motor/movement intervention literature suggests that preschoolers with disabilities benefit from structured, teacher-directed programs. Although the researcher for this particular study is not interested in motor outcomes, it provides support for the need and the potential benefits of gross motor movement interventions.

Although the previous studies were conducted on preschool children with ASD, the following study investigated the effects of different types of prompts on elementary children with ASD. Because of the interest in ASD and instructional-based gross motor interventions this study is useful in the understanding the implications of prompting on the task-oriented behaviors of preschool children with ASD. Reid, Collier, & Cauchon (1991) investigated the effects of using visual, verbal, and physical prompting on the skill acquisition of a bowling skill for four children/adolescents (2 boys-15 years old and 2 girls 11 and 15 years old) with ASD. The intervention took place across 120 trials. At the conclusion of the study it was determined that both the verbal/visual and the verbal/physical prompting packages were successful at increasing skill acquisitions. However, the verbal/physical prompting package was more effective. These implications support the use of prompting for increasing skill acquisitions of young children with ASD.
Music

In order to address issues surrounding physical inactivity and delayed motor skill acquisition of preschool children with ASD, specific pedagogies need to be developed. Educators and therapists typically use a variety of pedagogies (i.e., music) to promote success with their students. However, little empirical evidence exists in regard to specific pedagogical techniques that have been successful in engaging and promoting success for students diagnosed with ASD in gross motor movement settings. Music has been used with children with severe behavioral, social, and communication needs (Thaut, 1988). Therefore, it is important to understand how music can be used as a teaching tool within a gross motor movement setting for children with ASD. Using music can provide a common thread, in which individuals can relate (i.e., interact with each other and develop an understanding of music) (Humpal, 1991). “Music” can be defined as “…vocal, instrumental, or mechanical sounds having rhythm, melody, or harmony” (Music, 2012). Research has been conducted in music therapy, neuroscience, music education, special education, and physical education settings. However, only research in neuroscience and education settings was reported in this review because the music therapy and education literature often are reported together and it is difficult to single out what field the research is derived.

Neuroscience

In order to understand the potential of music in improving gross motor functioning it is important to review work in neuroscience. Music and the central nervous system (CVS) can be associated with one another by examining interactions between the brain’s auditory and motor systems of the brain (Thaut, Kenyon, &
Schoauer, 1999). Research has attempted to examine the effect of music on specific areas of the brain in addition to specific behaviors and populations. However, much of this research has been conducted on adults with and without disabilities rather than on children.

In order to better understand the neuroscience literature pertaining to music, research reviews and summaries are reported. It has been shown that when music is played brain function in both hemispheres, including the motor control systems can be observed (Hodges, 2000). Thaut et al., (1999) also suggest that the brain processes auditory cues faster than visual or physical cues. In addition, Rossignoll & Jones (1976) discovered that simple music tunes could promote repetitive muscle activity (during rhythmic hopping). Even the listening of music has been found to activate several physiological responses such as heart rate (Hodges, 2000). Therefore, music as a behavioral and neurological tool has the potential to influence gross motor movement and behaviors for young children.

**Education and Music**

The education setting is perhaps the most common are in which music has been used to meet specific educational needs (i.e., academic, social, motor, and language) (Presti, 1984). Research has shown the beneficial use of music in a variety of educational settings for several different behaviors (Kern, Wolery, & Aldridge, 2007; Orr, Myles, & Carlson, 1998; Presti, 1984; Humpal, 1991; Gunsberg, 1988; Brownell, 2002; and Kim, Wigram, & Gold, 2008). These behaviors consist of social interaction, on-task behavior; socially appropriate behaviors, attention to classroom tasks, independence, and non-verbal communication. In addition, studies in the area of music therapy have shown a
positive relationship between music and learning (Thaut, 1988). This body of literature provides potential benefits for the use of music as a specific pedagogy that can be used in gross motor movement settings.

A study done by Kern, et al., (2007) addressed the effects of using morning entrance routines set to music to help two preschool children with ASD transition into the classroom each morning independently. A music therapist composed an individualized entrance routine song for both participants, which were then sung each day when they enter the classroom. Modifications were made for one of the participants in order to promote more success. A single-subject research design was used to measure the number of independent responses during the entrance routine. Results exhibited that the implementation of an individualized song into the morning routine was successful in facilitating entrance into the classroom, greeting the teacher and/or peers, and engaging in play (Kern, et al., 2007). For one participant the number of interactions with peers was also measured and compared with when music was played. The results suggested that music increased the number of interactions the participant had with his peers (Kern, et al., 2007).

Research has also shown that rhythmic sound may influence on-task and self-managing behaviors (Orr, et al., 1998; Presti, 1984). A study conducted by Orr et al., (1998) used a single subject study (A-B-A-B reversal design) and rhythmic entrainment (i.e., metronome) to decrease aggressive/disruptive behaviors of a young girl with ASD during the school day. The participant was exhibiting two behaviors: head jerking and screaming that did not reveal a predictable pattern. The study took place over twenty-eight days in the participant’s classroom during structured activities. During the
intervention sessions (B) music was played for twenty-minutes via tape recorder. The results exhibited a decrease in screaming as a result of the intervention. However, there was not a consistent decrease in head jerking as a result of the intervention.

Presti (1984) proposed a music therapy program for children diagnosed as emotionally disturbed. The program took place in a public elementary school in conjunction with the district’s music program. The program goal of the program was to increase the ability to maintain “normal” classroom behavior through a specific music therapy program. The program was derived from the participants’ school positive education program (PEP) and embedded with individualized music therapy techniques. Each program was individualized for the student and the music therapist was responsible for moving each participant’s independently through the prescribed levels. The researcher concluded that the participants involved in the program exhibited increased appropriate behavior during class time.

Humpal (1991) examined the effects of using music to develop social interaction and communication among preschool children with disabilities (n=12) and their typically developing peers (n=15) in an educational setting. The theory proposed was based on the premise that music can be a common ground by which both groups of children can relate. The study took place during weekly music therapy sessions at the participants’ preschool. After the initial pretest and fifteen music therapy sessions the researcher concluded that interactions (measured by a pre-established checklist) between preschool children with disabilities and their typically developing peers increased when music was used.

Gunsberg (1988) conducted a study to examine the effects of using improvised music play to promote social play between twelve preschool children with and without
disabilities. Social play was comprised as social interaction between children with disabilities and their typically developing peers. The study took place over five months in an integrated preschool classroom and involved twelve preschool children with and without disabilities. The improvised music play consisted of teacher directed musical play (i.e., playing the drums or guitar). All sessions were videotaped and analyzed. Social play durations were determined by examining phases of play (i.e., entrance into the classroom) through direct observation techniques and examining the differences in behaviors of the participants between music and non-music conditions. The results of the study suggested that when improvised music was used the duration of social play was three times longer than when music was not played.

Another study compared the effects of changing problem behaviors of four elementary school children with autism, using a social story modified with music (Brownell, 2002). Social stories were written for each of the participants to address current behavioral goals. The researcher used a fifteen-day multiple treatment design. The participants’ behaviors were recorded when social stories were set to music and when social stories were read. The researcher found that when a story was set to music the children’s targeted behavior improved. As a result, it was found that preschool children with autism respond positively to social stories set to music.

Finally, Kim, et al., (2008) conducted a study on preschool children with ASD (n= 10 boys). The researchers of this study were interested in the difference between social interaction and joint attention in improvisational (making music) music therapy versus developmental play sessions. The sessions took place at a clinic once a week for thirty minutes, for twelve weeks. It was concluded that the improvisational music
therapy sessions were more effective at facilitating social interaction and joint attention (i.e., prolonged eye contact and turn-taking) when compared to the developmental play sessions (Kim, et al., 2008).

Overall, this body of literature supports the benefits of using music to facilitate appropriate social behaviors and decrease aggressive or socially inappropriate behaviors. This literature provides the missing link in how to promote interactions and increase activity/skill levels of our young children with ASD. Furthermore, to this researcher’s knowledge, there are no empirically based studies that have examined the effect of music in a movement setting for young children with ASD.

**Music and Movement for Children without Disabilities**

Music used during gross motor movement interventions has been linked to enhancing motor skills and physical activity for young children with and without disabilities. Recent research has shown that eight-week and ten-week gross motor movement interventions combined with music have resulted in improvements in the rhythmic movements and manipulative gross motor skills of young children without disabilities (Brown, Sherril, & Gench, 1981; Zachopoulou, et al., 2003; Derri, et al., 2006; Chatziantzeli, et al., 2007).

Brown et al., (1981) investigated the effect of an integrated physical education/music program on young children’s perceptual-motor performance. The study included thirty children ages 4 to 6 years old (n= 15) in the experimental group and (n= 15) in the control group. Each group received 24, 30-minute sessions, 4 days per week. The experimental group received integrated physical education/music instruction, while the control group received physical education only. The participants were pre- and post-
tested on their motor, visual, auditory, and language functioning. The results of the study reported that the experimental group had significant improvements in motor, auditory, and language functioning when compared to the control group.

Zachopoulou et al., (2003) examined the rhythmic abilities of seventy-two preschool students during a movement program. The participants were divided into two groups: (1) music-movement program and (2) non-music unstructured free-play. The music movement program involved rhythmic instruction developed from the Orff and Dalcroze methods, which are a well-known music concept method in which individuals are taught to learn and experience music concepts through music. Each session lasted thirty to forty minutes and took place twice a week for ten weeks. It was compromised of a warm-up and activity time that utilized an improvisational use of music. At the conclusion of the study the participants’ rhythmic ability was tested again. It was concluded that participants in the music-movement program had significantly higher rhythmic ability at post-test when compared to the participants in the non-music unstructured free-play program.

Derri et al., 2001 examined the effects of a 10-week music and movement program on locomotor skills for young children (4-6 years old). The study included sixty-eight children and used the TGMD to assess locomotor skills pre- and post-test. Thirty-five children participated in a twice/week, 35-40 minute movement/exercise sessions while the other children engage in free play (only). The music sessions consisted of percussion and rhythmic sounds. The results after 10-weeks concluded that the children who attended the music movement session had significantly higher scores than the children who only engaged in free play.
Chatzipanteli et al., (2007) conducted a study on the effects of using a music movement program for the development of overhand throwing for seventy-five young children in physical education. Participants were divided into two groups. Group one consisted of a music-based movement program that took place twice a week for eight weeks and group two consisted of the same movement program without music. The music-based program utilized rhythmic music, which was played during the entire session. At the conclusion of the study it was determined that participants in the music-based program had higher manipulative scores (measured by the TGMD-2) than the participants in attended the movement program without music.

Deli et al., (2006), used a musical movement instructional approach to facilitate locomotor skill development for seventy-five preschoolers. The intervention included a structured movement program that focused on FMSs and a control group that did not receive the intervention. After a ten-week intervention, researchers found increased performance in running, hopping, leaping, jumping, and skipping for both the movement and music movement instructional approach groups when compared to a control group, but no difference was found between groups.

The conceptual framework and results of these studies suggest the potential benefits for using much in gross motor settings. Although these studies focused on manipulative and rhythmic ability activities it shows the music has an influence on the performance of young children in gross motor settings. This information is beneficial to this study because it supports the use of music to increase skills (i.e., task-oriented behaviors) for young children with ASD in gross motor movement settings.
Music and Movement for Children with Disabilities

To this investigator’s knowledge only three studies have been conducted using music in motor settings for children with disabilities. One study dealt directly with motor skills acquisition and the other two dealt with on-task behavior (Kennedy & Kua-Walker, 2006; Edwards-Duke, Boswell, McGhee, & Decker, 2002; and Titus & Porretta, 2012).

Another study was conducted on a ten-year-old boy diagnosed with myotonic dystrophy who exhibited low gross motor skills (Kennedy & Kua-Walker, 2006). A music therapist addressed issues of fine and gross motor skills and worked individually with the student. This study exhibited positive movement skill transfer from music therapy sessions to physical education classes after twelve observations over the course of six months.

Edwards-Duke, et al., (2002) examined the effects of using a twelve-week creative educational dance (CED) program, which incorporated music, musical instruments, and movement into a gross motor activity program. The participants in this study were three elementary students diagnosed with varying behavioral disorders. The researchers found that the CED program decreased levels of off-task behavior and/or changed the types of off-task behaviors the elementary students engaged in during the gross motor activity time.

Finally, Titus & Porretta (2012) studied the on-task behavior of two preschool children with ASD during a gross motor movement program. A single subject reversal design (A-B-A-B) was used and chosen for its ability to compare Baseline (A) and treatment (B) conditions. Two conditions were presented to the participants and then repeated: Baseline (non-music) and intervention (music). Both were similar in content.
(i.e., locomotor skills), differing only in the absence/presence of music. The sessions took place three days a week for twenty to twenty-five minutes for approximately nine-weeks. The results suggested that preschoolers with ASD can exhibit an increase in on-task behaviors during music-focused physical activity sessions. Selected segments of the ALT-PE (Academic Learning Time in Physical Education) were used to assess the frequency of off-task behaviors. Both participants exhibited marked decreases in off-task behaviors during treatment (music). On average, participant one exhibited a 33% decrease (43% Baseline, 11% treatment; 42% Baseline, 9% treatment), and participant two a 18% decrease (23% Baseline, 7% treatment; 28% Baseline, 8% treatment) in off-task behaviors during treatment (music) when compared to Baseline. In addition, treatment fidelity and inter-observer agreement were established (100% and 99%, respectively) on 10% of randomly chosen sessions.

This preliminary information suggests that music has some influence on on-task behaviors for young children with ASD in gross motor movement settings. This study also suggests that the study was completed with integrity and agreeability between observers, which suggests that the results are meaningful. The research as a whole supports the use of music in motor movement settings but does not really suggest what component of music is the most effective at facilitating task-oriented behaviors. The goal of this study is to examine the different components of music and instruction to better understand what component of the intervention is the most effective at facilitating task-oriented behaviors.
Summary

This section provides a summary of the literature related to the study. In the first section described behaviorism, applied behavior analysis and single-subject research pertinent to the study were addressed. Single-subject research is considered to be a rigorous and scientific method to study human behavior in order to establish evidence based practices (Horner et al., 2005). The second session provided information regarding the educational concerns for children with ASD (based on their known deficits). Information was provided regarding the potential educational and lifelong problems (i.e., poor social interaction, inability to attend to tasks, obesity, etc.) that could occur if deficits are not addressed. The third section addressed the importance of early intervention programming in non-movement and movement settings in order to close the educational and movement gap for children with ASD. Many of the studies utilized structured interventions to improve targeted behaviors (i.e., academic, social, and movement). General findings suggest structured and intensive programs promote targeted gains in behavior. The fourth section described the use of music as a specific pedagogy to increase the known deficits of children with ASD as it related to behavioral and movement tasks. As a whole there is a need for specific motor interventions for preschoolers with ASD because of the need to increase their FMS levels which will lead to more active and social lifestyles. This particular study is setting the groundwork for a line of research to investigate how to promote FMSs and physical activity levels of children with ASD through the use of music. This researcher believes that if a specific pedagogy such as music can be used to promote task-oriented behaviors of young
children with ASD, then the opportunity to engage in learning will increase which then can improve FMS and physical activity levels.
Chapter 3: Methodology

This chapter describes the overall methodology for the study. It contains the following sections: (a) pilot study, (b) setting, (c) participants, (d) experimental design, (e) independent variable, (f) dependent variables, (g) general procedures, (h) specific procedures, (i) inter-observer agreement (IOA), (j) treatment fidelity, (k) social validity, and (l) data analysis.

Pilot Study

A pilot study was conducted (Titus & Porretta, 2012). Two participants were recruited, a 4-year-old boy and a 5-year-old boy both with ASD. Participants were enrolled in an all day preschool program in a Midwest urban city and had a history of off-task behavior. Both participants attended a gross motor movement program with their classmates (including children with and without disabilities) twice a week. The intervention included individual gross motor movement sessions implemented three times a week.

During these sessions the investigator acted as the instructor of the movement activities. All sessions were similar in length (i.e., 21-23 minutes) and took place in the same motor space (large open gymnasium). The initial non-music (Baseline) condition and the music (intervention) conditions involved similar types of movement activities (i.e., putting the beanbag on your head). The only difference between the two conditions was the presence of child-friendly music during the intervention. All sessions were videotaped and analyzed after each session. An ABAB reversal design was used to
examine baseline and intervention conditions. Upon visual analysis of graphed data, it was concluded that both participants exhibited marked decreases in off-task behaviors during intervention. On average, participant one exhibited a 33% decrease and participant two an 18% decrease in off-task behaviors during treatment (music) when compared to Baseline.

It was decided that further investigation of what components of the music intervention were responsible for increasing on-task behavior needed to occur. As a result, the present study was designed to use more stringent techniques to separate the effects of the music versus the effects of the instruction. As such, two phases of intervention were developed for implementation: (a) music only and (b) music + instruction. This allowed the investigator to further examine the effects of music and good instruction to promote task-oriented behaviors in a gross motor setting.

**Setting**

A public preschool in the central Ohio region was chosen as the setting for this study. It was chosen for its convenience and accessibility to a large number of young children with ASD. The preschool program was a part of a private pre-kindergarten through twelfth grade private school. Enrollment was open to all children who have been formally diagnosed on the autism spectrum and peers without disabilities.

The preschool program serves children formally diagnosed on the autism spectrum, and peer buddies without disabilities. The program allows for children diagnosed on the autism spectrum to receive additional educational programming alongside their same-aged peers prior to entering kindergarten. Each classroom has a maximum of sixteen children, 8-9 who have been identified as being on the autism
spectrum and 6-8 who act as typically developing peers. The program consists of four all day (6-hour) sessions and one half day (3-hour) session each week. One licensed pre-k teacher taught each class and alongside three trained teaching assistant. Children received speech/language therapy, occupational therapy, physical therapy, school psychology services, and other supplemental services as needed. The teachers used a variety of teaching techniques throughout the school day. One of techniques used was music. Activities evolving music were present daily in the classroom during entrance and exit routines (i.e., circle time) and during structured educational activities (i.e., table time).

The space used for the study was a school lunchroom, which was also used for indoor recess when necessary. The space was a large triangular shape with two entrances/exits, a door to an office, and a storage closet. The lunch tables and shelving units remained in the space at all times but were moved to the sides of the room during each session.

**Participants**

Five participants were recruited for the study. Participants were purposely chosen. Selection criteria included preschool-age (i.e., 3-6 years old), diagnosed with ASD, and have a history of exhibiting off-task behaviors.

A recruitment letter and parental/guardian permission form (Appendix A) was sent home explaining the nature of the study via regular school procedures (i.e., folder or schoolbag) to all the children in two predetermined classrooms. Parents/guardians who agreed to have their children participate in the study returned the signed and dated forms directly to a locked box located at the front desk of the preschool. After the investigator
received the names of potential participants, the classroom teachers were contacted to identify participants who had a history of off-task behavior during instructional time. Those participants were then included in the study.

Participant 1 (Carter) was a five-year-old African American male diagnosed with autism. He lives with his mother and was an only child. He had very low speech skills compared to his peers, especially in regard to his expressive language. He received physical therapy and occupational therapy for his gross and fine motor skills. He also received speech therapy for his speech and language needs. His off-task behavior consisted of physically moving away from an activity area and defiance in attending to a given task. Defiance consisted of ignoring the verbal and physical prompts given to him by a teacher/instructor, engaging in inappropriate behaviors (i.e., self-stimulating) instead of the task, or running/walking/sitting down instead after being asked to do something.

Participant 2 (Rowan) was a six-year-old Asian American male diagnosed with autism that lives with both parents. He was non-verbal and does not use a communication device or use American Sign Language. He received physical therapy and occupational therapy for his gross and fine motor skills. He also received speech therapy for his speech and language needs. His off-task behavior consisted of physically removing himself (i.e., walks away, stands or sits to the side) during class instruction.

Participant 3 (Garrison) was a six-year-old Caucasian male diagnosed with autism that lives with his parents. He was non-verbal and used a low-tech communication device (i.e., PEC symbol cards with Velcro communication board). He received physical therapy and occupational therapy for his gross and fine motor skills. He also received
speech therapy for his speech and language needs. His off-task behavior consisted of physically removing himself (i.e., stands or sits to the side) during class instruction.

Participant 4 (Logan) was a six-year-old Asian American diagnosed with autism who lives with both parents. He also used a lower-limb prosthetic due to a birth defect. His expressive language was very low but was receptive language was average when compared to his peers without disabilities. He received physical therapy and occupational therapy for his gross and fine motor skills. He also received speech therapy for his speech and language needs. His off-task behavior consisted of frustration, which often leads to screaming or physically removing himself from the instructed activity.

Participant 5 (Ava) was a five-year-old female diagnosed with PDD-NOS. She lives with both parents. Her expressive language was low compared to her peers without disabilities but her receptive language was much better than her expressive language but still low when compared to her peers without disabilities. She received physical therapy and occupational therapy for her gross and fine motor skills. She also received speech therapy for her speech and language needs. Her off-task behavior consisted of delayed responses or repetitive behaviors that inhibit her from engaging in the proposed activity.

Teachers and the parents of the participants completed a social validity questionnaire. A socially validity questionnaire consent form (Appendix B) was placed in the teachers’ school mailboxes and sent home with the participants via their school bag. Teachers and Parents who completed the socially validity questionnaires returned the signed and dated forms directly to a locked box located at the front desk of the preschool.
Design

A multiple baseline across participants design was used. This design was chosen because it allows for multiple participants to receive an intervention without removing treatment (Cooper et al., 2007). This design allows for the investigator to examine the effect of different components of a music intervention (i.e., music only versus music plus instruction) to determine which was more effective in facilitating task-oriented behaviors. In this design each participant was introduced independently (one at a time) to the intervention phases. All sessions included approximately ten minutes of physical activity (i.e., locomotor skills). The total intervention included a baseline phase, music only phase, music + instruction phase, back to music only phase, and a maintenance phase. Throughout the study generalization probes were administered every 3-4 sessions to examine the participants’ task-oriented behaviors to a non-familiar song. The music only phase was reintroduced one week following the end of the music + instruction phase (maintenance). Prior to the start of the study, baseline data was collected on task-oriented behaviors.

Baseline

The baseline condition consisted of instructional prompts to participants to perform activities (i.e., locomotor), physical modeling of the activity, and re-direction only (i.e., “Child’s name, come back over here”) as needed. Activities were the same as those presented in two subsequent intervention phases (music only and music + instruction). The instructor directed all activities with the help of an ear bud (with the music playing) so the activities could be delivered to the participants with the same cadence as the songs. Once steady state responding was established in Baseline, the
music only intervention phase was introduced. The decision to move of participants to the intervention phases was determined by the instructor (primary investigator). The first participant that exhibited steady state responding or a dramatic trend in the undesired direction for at least three sessions was moved to phase “A” first. The same criteria were used for the proceeding participants until they were moved to phase “A”.

**Independent Variable**

The independent variable for this study was “child friendly” music presented in gross motor movement sessions. Each movement session consisted of various gross motor movement activities that incorporated age appropriate activities (i.e., locomotor and manipulative skills). All lyrics and song lengths can be found in (Appendix C).

There two phases of the intervention (music only and music + instruction). The two phases allowed the investigator to better understand what component of the independent variable was responsible for behavior change.

**Music Only Phases**

In the music only phases 1 and 2, the instructor provided general prompts to start and stop activity (i.e., “listen to the directions and do what they say” and “all finished”). The same activities used in the baseline phase was used in this phase, except they were set to music. Once maximum task-oriented behaviors were identified through steady state responding, a second participant was moved to into the music only phase. Subsequent participants were moved into the music only phase once previous participants in that phase have begun to exhibit increases in task-oriented behaviors. Once all participants reached maximum task-oriented responding they were moved to the next phase.
Music only was the first phase presented to the participants. In this phase the instructor began the session by stating, “listen to the music and follow the directions.” No instruction, verbal reciting of lyrics or physical modeling was included in this phase.

**Music + Instruction Phases**

The music + instruction phase was introduced second. The same songs in the music only phase were used in the music + instruction phase; but, the instructor physically modeled (i.e., demonstrated each activity) and verbally recited the activities along with the lyrics of the music (i.e., put the beanbag on your head). However, during this phase the instructor provided prompts (i.e., physical demonstration and verbal reciting of lyrics) and general prompts as needed.

Throughout each phase (i.e., baseline, music only phases 1 and 2, music + instruction phases 1 and 2) the instructor was responsible for moving the participant to the next phase after steady state responding occurs. While there was not a set number of sessions required for the participant to remain in before moving to the next phase, the rule of thumb was that at least three data points (sessions) and steady responding or a trend of behavioral movement in the undesired direction of the study (Cooper et. al., 2007) needed to be observed.

**Dependent Variables**

**Task-Oriented Behaviors**

Task-oriented behaviors were determined by observing participants, during the movement sessions, and using momentary time sampling every 10-second interval to code task-oriented behaviors. This was recorded on a direct-observation recording sheet (Appendix D). Task-oriented behaviors were coded as a “T” if the student was attending
the motor skill task/activity that was presented by the teacher at the onset of the 10-second interval. Task oriented behaviors consist of (a) proper movement skills (i.e., running during a running activity), (b) visual attention (to the investigator) during movement activities, (c) appropriate use of various equipment, (d) transitions between activities (e) physically attends (engages) to the task within 5 seconds of the initiation of the activity.

Task-oriented behaviors were coded as an “N” if the participant modified the task, or was not attending to the motor skill activity/task presented by the instructor. Data were collected during the baseline and intervention phases.

In addition, an activity rubric (Appendix D) was used to code whether or not the participants were engaged in the presented activities/skills of the song. This was marked as an “X” in the appropriate column (i.e., present or absent). The operational definition of targeted behavior can be used to determine if the activity or skill was present. The activity rubric was utilized by the investigator to examine if the task was attempted by the participants.

**General Prompts**

General prompts given by the instructor were also observed to ensure that the similar levels and types of prompts were provided to all the participants across all sessions. Prompts were tallied using a feedback (prompt)-recording sheet (Appendix D). Prompts were tallied under two categories, (1) skill and (2) behavior. Under those categories the type of prompt provided were divided into (1) positive, (2) corrective, (3) negative, (4) praise, (5) desist, and (6) nasty.
Field Notes

Throughout the study the investigator took field notes on the participants’ behaviors that may not have been captured in data coding (e.g., participant 3 laughing during the sessions). The field notes were recorded directly on the data coding sheets for each session.

General Procedures

The structure of each session was held constant across all sessions and participants. The same music was played at the same level of volume during each session. The music was placed on a random shuffle to ensure that the order of the songs varied across each session. Additionally, the same investigator ran each session for all participants. All sessions took place in the same research space. Upon bringing each participant to the study area the investigator would announce, “Participant’s name are you ready? Listen to the music and follow the directions.” At that time, the investigator would turn on the video camera and start the music. During the session the only verbal responses given by the investigator other than reciting the lyrics of the song (when appropriate) were general prompts (i.e., “listen to the music and follow the directions” or “come over here”). At the conclusion of the study the investigator would announce, “All finished.”

Specific Procedures

Prior to the beginning of the study the preschool setting for the study was identified and the appropriate administrators (preschool and academy directors) were contacted. After the both the preschool and academy director agreed to allow the investigator conduct the study at their site, an official approval letter was written granting
permission to conduct research at their school (Appendix F). The Ohio State University Institutional Review Board (IRB) research forms were submitted and approval was obtained prior to the onset of the study (Appendix G).

Following IRB approval, a recruitment letter and parental consent form were sent home to all of the students in two preschool classrooms. Parents and/or guardians interested in having their children involved in the study completed the permission forms and returned them to a locked box at the front desk of the school. Once potential participants were identified, the classroom teachers were consulted to identify the participants who best suited the requirements of the study (i.e., history of off-task behavior and 3-6 years old).

All music was selected prior to the study from a “child friendly” music album (i.e., Greg and Steve – Kids in Motion). The same songs were used each session (i.e., 3 songs per sessions). All songs provided similar numbers of tasks to participants (i.e., 12-14 tasks pre songs) and involved both manipulative and locomotor skills. A block plan was provided (Appendix E) in order to see each explicit task in the song. Each song provided verbal cueing (spoken or sung movement instructions) for the types of activities participants should engage in.

The music chosen for the study was transferred to an Apple I-Phone4®. It was played during intervention sessions using a portable Sony Sound System® (Model number ICF – CS10iP).

The participants individually attended four, ten-minute sessions per week. The investigator created a schedule to ensure that participants attend sessions at the same time each day. All sessions took place inside the lunchroom (Appendix H) and were led by
the investigator (instructor). All the tables, chairs, and shelving units were moved toward the outer walls of the lunchroom in order to control for potential distractions. Only poly spots, beanbags, Sony sound system, video camera, and video camera tripod was in the room.

During all sessions only the participant and the instructor were in the lunchroom. All sessions were videotaped using a Flip Video ultraHD flash memory camcorder® (Model number – U32120W) with 8GB internal storage, placed on a tripod in a far corner of the gymnasium. The instructor verbally described and physically demonstrated the activities during the baseline and music + instruction sessions. No feedback regarding the quality of movements (i.e., step with your opposite foot as your throwing arm) was provided.

Prior to the beginning of each session the video camera was turned on. Upon entering the gymnasium the participants were asked to stand on their spots (designated poly spot placed on the floor). After participants reached their designated “spots” the instructor started the music (during intervention). All songs were incorporated into a music play list so that each song flows from one to the other (with a 2-3 second pause between songs). During baseline, the instructor listened to the songs using an ear bud so the participants could not hear the songs out loud.

During the music only phase of the intervention the instructor did not verbally prompt or model the activities and did not provide feedback to the participants unless there was a safety concern (i.e., if participant playing with a stack of chairs, “participant’s name, come over here…listen to the music and follow the directions”). During the music + instruction phase, the instructor verbally prompted and modeled the
activities to the participant in addition to the sung instructions in the songs. After the first music + instruction phase was completed the instructor reintroduced the music only phase to check for changes in behavior (verify and replicate). Then, the investigator returned to the music + instruction phase one last time to ensure that the change in behavior was not the result of a learning effect. This was determined by showing differences in levels of behavior across all phases (baseline, music only, and music + instruction).

After the playlist ended, the investigator announced that the session was over. At the conclusion of the each session the instructor asked participants to help clean up the gross motor activity space (i.e., move poly spots back to the center of the lunchroom). This took about 30-40 seconds. After clean up the instructor turned off the video camera and lead the participant out of the lunchroom to meet his/her teacher. Each session took ten to twelve minutes depending on how long it took to start the music at the beginning of the session.

**Inter Observer Agreement**

A graduate student and the investigator coded task-oriented behaviors via a two-hour training session prior to the beginning of the study. During the training session both the graduate student and investigator reviewed the operational definitions for task-oriented and non-task oriented behaviors and practiced coding video previous recordings of preschoolers engaging in physical activity sessions.

**IOA for Task-Oriented Behaviors**

Exact inter-observer agreement (IOA) was used. When using exact IOA, agreement was obtained when graduate student and investigator agreed on all target behavior frequencies within each interval (i.e., number of instances of non-task oriented
behaviors observed by observer one in the first two minutes of the session was the same as observer two) (Cooper, et al., 2007). The formula used for determining exact (frequency within intervals) agreement is:

\[ \text{Intervals Agreed}/(\text{Intervals Agreed} + \text{Intervals Disagreed}) \times 100 = \text{Exact IOA} \]

Both the investigator and the observer utilized the same coding sheet (Appendix D) to ensure an objective method to measure behavior was used to code each activity as present or absent. Both the investigator and the observer coded each session using the ALT-PE coding sheet for momentary time sampling of 10-second intervals.

**IOA for General Prompts**

For general prompts the investigator and the observer tallied the type of general prompts provided by the teachers. Then, the general prompts recorded on the tally sheet were utilized to measure total IOA. The total IOA equation is:

\[ \text{Small}/\text{Large} \times 100 = \text{Total IOA} \]

IOA was conducted for at least 25% of randomly selected sessions. For the momentary sample rubric the observers used a stopwatch to time the sessions. At the onset of each 10-second interval, the observer determined if the participant was engaged in: T- task-oriented behaviors, N- non-task oriented behaviors and recorded the designated letter on the interval. For the activity rubric frequency count the observers used the criteria listed in the operational definition to code the activity/skill as present or absent.

**Treatment Fidelity**

Treatment fidelity was obtained to ensure that the intervention was consistently applied treatment condition was consistent across all participants and sessions. A
treatment fidelity checklist can be found in Appendix I. As such treatment fidelity checklists control for possible treatment drift and ensures that the proposed intervention is being carried out correctly (Cooper, et al., 2007). All of the baseline and treatment sessions were observed post-session by the primary investigator. The treatment fidelity checklist results (all participants over 95%) suggest that the fidelity of the treatment presented with integrity.

**Social Validity**

Social validity was determined through the development and completion of a written questionnaire. At the completion of the study, a questionnaire (Appendix I) was given to the parents of the participants via the regular school procedures (i.e., folder or schoolbag). In addition, classroom teachers were also asked to complete the same questionnaire. The questionnaires were placed in the teachers’ mailboxes and returned to the investigator upon completion. This questionnaire was important in order to ensure that the study was applied, or socially important (Cooper, et al., 2007). The questionnaire asked four questions to evaluate the interpreted value of the intervention using a Likert-type scale. The questions asked included: (1) My child/student looked forward to attending music and physical activity sessions, (2) Learning motor skills and being physically active are important for my child/student to live a healthy lifestyle, (3) As a result of participating in the study my child/student exhibits greater task-oriented behaviors when music is presented, and (4) My child/student enjoys listening to music and being active with his/her friends.
**Data Analysis**

Visual analysis of graphed data was used. For this study both within- and between-phase analyses were conducted. Within-phase analyses allowed the investigator to determine the frequency and variability (of the target behaviors) within each phase. A between-phase analysis allowed for the investigator to determine changes in levels of responding, variability, and trends. In addition trend lines were used to determine phase changes. Data were reported using frequencies and percentages.
Chapter 4: Results

Chapter four presents the results of the effect of music on task-oriented behaviors in preschool children with ASD within individual gross motor movement settings. Five major sections are included in this chapter. In the first section interobserver agreement (IOA) results are reported, while treatment fidelity results are reported in the second section. The third section includes data for all five participants. Section four provides a summary of overall results. Finally, social validity results are presented in the fifth section.

Interobserver Agreement

The IOA percentage for task-oriented behaviors of participants during individualized gross motor movement sessions with and without music was taken for all five participants for a randomly selected twenty-five percent of sessions. Session-by-session IOA of task-oriented behaviors was also taken randomly for all participants. Random selection was used in order to ensure that all phases of the study were included. In addition, session-by-session IOA of general prompts was taken randomly for all participants. The same randomly selected sessions for task-oriented behaviors were used to determine IOA for general prompts. Twenty-five percent of all sessions was considered to be appropriate by Cooper, Heron, and Heward (2002). It should be noted that all results were rounded to the nearest whole number. The mean IOA for task-oriented behaviors by trial (10-second interval) for all participants was 93% across all five participants. The mean IOA for bouts of general prompts across session was 94%. For the purpose of this study a “bout” of feedback is considered to be an entire phrase or
sentence reminding the participant to perform the required behaviors (e.g., “Remember listen to the music and follow the directions.”)

IOA percentages for task-oriented behaviors across sessions ranged from 86% to 98%. Acceptable IOA is considered to be 85% or higher; therefore, IOA was considered acceptable for all participants. Table 4.1 contains the mean IOA percentages for task-oriented behaviors for all five participants.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Mean Percent IOA for Task-Oriented Behaviors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (Carter)</td>
<td>93%</td>
</tr>
<tr>
<td>2 (Rowan)</td>
<td>97%</td>
</tr>
<tr>
<td>3 (Garrison)</td>
<td>98%</td>
</tr>
<tr>
<td>4 (Logan)</td>
<td>91%</td>
</tr>
<tr>
<td>5 (Ava)</td>
<td>86%</td>
</tr>
<tr>
<td>Overall Mean</td>
<td>93%</td>
</tr>
</tbody>
</table>

Table 4.1. Mean IOA (Percent Agreement) for Task-Oriented Behaviors per Session (Based on 10-Second Intervals)

IOA for amount (bout) of general prompts (reminders) given to each participant per session was also calculated to attempt to hold feedback constant across all sessions. IOA for percentage of agreement for bouts of general prompts across sessions ranged from 88% to 98%. Table 4.2 contains the IOA percentages for bouts of general prompts for all five participants.
<table>
<thead>
<tr>
<th>Participant</th>
<th>Mean Percent IOA for General Prompts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (Carter)</td>
<td>97%</td>
</tr>
<tr>
<td>2 (Rowan)</td>
<td>95%</td>
</tr>
<tr>
<td>3 (Garrison)</td>
<td>98%</td>
</tr>
<tr>
<td>4 (Logan)</td>
<td>91%</td>
</tr>
<tr>
<td>5 (Ava)</td>
<td>88%</td>
</tr>
<tr>
<td><strong>Overall Mean</strong></td>
<td><strong>94%</strong></td>
</tr>
</tbody>
</table>

Table 4.2. Mean IOA (Percent Agreement) for Bouts of General Prompts Per Session

**Treatment Fidelity**

Treatment fidelity for this study was established by using a treatment fidelity checklist (Appendix J), which consisted of seven questions related to the interactions between participants and instructor. Treatment fidelity was obtained for each session (total = 166 sessions). Across all sessions and participants treatment fidelity was calculated at 99% (range = 97% to 100%). Table 4.3 contains the mean percentages of general prompts bouts (reminders) for all participants.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Mean Treatment Fidelity Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (Carter)</td>
<td>97%</td>
</tr>
<tr>
<td>2 (Rowan)</td>
<td>100%</td>
</tr>
<tr>
<td>3 (Garrison)</td>
<td>100%</td>
</tr>
<tr>
<td>4 (Logan)</td>
<td>98%</td>
</tr>
<tr>
<td>5 (Ava)</td>
<td>100%</td>
</tr>
<tr>
<td><strong>Overall Mean</strong></td>
<td><strong>99%</strong></td>
</tr>
</tbody>
</table>

Table 4.3. Treatment Fidelity Percentages Across all Participants.
Participant Results

This section includes the results for all five participants’ task-oriented behaviors as well as general prompts bouts (reminders). Participant results are presented individually.

Participant 1 (Carter)

Carter participated in all phases of the study: baseline, music only, and music + instruction phases, for a total of thirty-one sessions. The mean percent of task-oriented behaviors across all sessions by phase were as follows (53% - baseline, 15% - music only phase 1, 54% - music + instruction phase 1, 9% - music only phase 2, 53% - music + instruction phase 2). Figure 4.1 is a graphic display of the mean percent of task-oriented behaviors exhibited by Carter.

**Baseline.** Task-oriented behaviors ranged from 26% to 81% (mean = 53%). Carter exhibited a decrease (55%) in task-oriented behaviors over the first three baseline sessions. This decrease is considered undesirable. Therefore, Carter was moved to the first music only phase.

**Music only phase 1.** Task-oriented behaviors ranged from 5% to 10% (mean = 15%). During the first music only phase Carter engaged in a lower percentage of task-oriented behaviors. At that time, the he was moved to the first music + instruction phase.

**Music + instruction phase 1.** Task-oriented behaviors ranged from 35% to 75% (mean = 54%). During this phase (10 sessions) Carter exhibited higher percentages of task-oriented behaviors than during the previous music only phase. However, his
behavior was variable. After six sessions he exhibited steady state responding and was moved again to the music only phase (phase 2).

**Music only phase 2.** Task-oriented behaviors ranged from 5% to 12% (mean = 9%). During the second music only phase Carter engaged in similar levels of responding as in the first music only phase. It should be noted that his task-oriented behaviors were lower than the previous music + instruction phase. Because steady state responding was obtained quickly at similar levels as the first music only phase the he was moved to the second music + instruction phase.

**Music + instruction phase 2.** Task-oriented behaviors ranged from 32% to 76% (mean = 53%). During this phase Carter engaged in higher levels of task-oriented behaviors as the first music only phase. This level of responding was considered to be at a steady state.

**General prompts.** Across all sessions the range of general prompts bouts was 9 to 19 (mean =13 bouts). Across all phases the range of general prompts bouts was 11 to 16 (mean = 14). General prompts were also measured across all thirty-one sessions of the study. Table 4.4 shows the range and mean of general prompts bouts given during each phase of the study, for participant 1 (Carter).

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Music Only Phase 1</th>
<th>Music + Instruction Phase 1</th>
<th>Music Only Phase 2</th>
<th>Music + Instruction Phase 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>12-16</td>
<td>11-17</td>
<td>11-18</td>
<td>14-18</td>
<td>9-19</td>
</tr>
<tr>
<td>Mean</td>
<td>14</td>
<td>13</td>
<td>15</td>
<td>15</td>
<td>12</td>
</tr>
</tbody>
</table>

Table 4.4. Range and Mean Bouts of General prompts Given During Each Phase of the Study for Participant #1 (Carter).
Figure 4.1. Mean Percent of Task-Oriented Behaviors by Session (Participant #1 - Carter)
Summary. The mean percentages of task-oriented behaviors across the first and second music + instruction phases were 54% and 53% respectively (mean across both phases = 54%). During both music only phases he exhibited a decrease in task-oriented behaviors (means = 15% and 9%, respectively) when compared to the music + instruction phases. Additionally, the range in mean number of general prompts bouts given to Carter across all phases was 11 to 16 (mean =14). Carter attended 31 sessions during the study. As a result of the music + instruction phases, Carter’s task-oriented behaviors increased.

Participant 2 (Rowan)

Rowan participated in all phases of the study: baseline, music only, and music + instruction, for a total of thirty-four sessions. The mean percent of task-oriented behaviors over all sessions by phase were as follows (2% - baseline, 0% - music only phase 1, 9% - music + instruction phase 1, 0% - music only phase 2, 17% - music + instruction phase 2). Figure 4.2 is a graphic display of the mean percent of task-oriented behaviors exhibited by Rowan.

Baseline. Task-oriented behaviors ranged from 0% to 3% (mean = 2%). After ensuring that steady state responding had been obtained, and it had been verified that Rowan’s behavior was not a result of changing the condition of participant 1 (Carter), he was moved to intervention.

Music only phase 1. Task-oriented behaviors ranged from 0% to 1% (mean = 0%). Rowan exhibited little change in behavior from baseline to the music only phase. However, he was engaged in behavior that was considered “steady state responding” so he was moved to the first music + instruction phase.
Music + instruction phase 1. Task-oriented behaviors ranged from 1% to 10% (mean = 9%). During the music + instruction phase (10 sessions) Rowan engaged in a higher mean percent of task-oriented behaviors than the previous music only phase. Although Rowan demonstrated steady state responding, he was kept in the first music + instruction phase with the intent of increasing task-oriented behaviors.

Music only phase 2. There was not a range in task-oriented behaviors, the mean was 0% demonstrating that Rowan’s task-oriented behaviors were lower than the previous music + instruction phase. During the second music only phase he exhibited the same mean percent of task-oriented behavior as the first music only phase. Because steady state responding was obtained quickly and at similar levels as the first music only phase he was moved to the second music + instruction phase.

Music + instruction phase 2. Task-oriented behaviors ranged from 11% to 22% (mean = 17%). During the second music + instruction phase Rowan engaged in a higher mean percent of task-oriented behaviors than in previous phases. After six sessions it was determined that steady state responding had occurred. Maintenance sessions began one week following the end of the intervention sessions.

General prompts. The range of general prompts bouts given during a session was 7 to 14 (mean = 10 bouts). Across all phases the range of general prompts bouts was 8 to 13 (mean = 11). General prompts were also measured across all thirty-four sessions of the study. Table 4.5 shows the range and mean of general prompts bouts given during each phase of the study for participant 2 (Rowan).
Figure 4.2. Mean Percent of Task-Oriented Behaviors by Session (Participant #2 - Rowan)
<table>
<thead>
<tr>
<th>Range</th>
<th>Baseline</th>
<th>Music Only Phase 1</th>
<th>Music + Instruction Phase 1</th>
<th>Music Only Phase 2</th>
<th>Music + Instruction Phase 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>7-11</td>
<td>7-10</td>
<td>8-14</td>
<td>10-14</td>
<td>8-14</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>8</td>
<td>11</td>
<td>13</td>
<td>11</td>
</tr>
</tbody>
</table>

Table 4.5. Range and Mean Bouts of General prompts Given During Each Phase of the Study for Participant #2 (Rowan).

**Summary.** The mean percentages of task-oriented behaviors across the first and second music + instruction phases were 9% and 17% respectively (mean across both phases = 13%). During both music only phases he exhibited a decrease in task-oriented behaviors (means = 0% and 0%, respectively) when compared to the music + instruction phases. Additionally, the range in mean number of general prompts bouts given to Rowan across all phases was 8 to 13 (mean = 11). Rowan attended 34 sessions during the study. As a result of the music + instruction phases, Rowan’s task-oriented behaviors increased.

**Participant 3 (Garrison)**

Garrison participated in all phases of the study: baseline, music only, and music + instruction, for a total of thirty-one sessions. The mean percent of task-oriented behaviors over all sessions were as follows (8% - baseline, 0% - music only phase 1, 23% - music + instruction phase 1, 0% - music only phase 2, 29% - music + instruction phase 2). Figure 4.3 is a graphic display of the mean percent of task-oriented behaviors exhibited by Garrison.
**Baseline.** Task-oriented behaviors ranged from 5% to 12% (mean = 81%). Garrison engaged in a low mean percent of task-oriented behaviors during the baseline condition (7 sessions). Because of the nature of the design used and the other participants’ behavior Garrison was kept in the baseline phase until he and the other participants in intervention phases exhibited steady state responding. After ensuring that steady state responding had been obtained, and it was verified that Garrison’s behavior was not a result of changing the condition of the other participants; Garrison was moved to the next phase of the intervention.

**Music only phase 1.** Task-oriented behaviors were steady all sessions of the phase (mean = 0%). Garrison engaged in a lower mean percent of task-oriented behaviors when exposed to the music only phase when compared to baseline. After six sessions steady state responding was established. At that time, he was moved him to the first music + instruction phase to promote an increase in mean percent of task-oriented behaviors.

**Music + instruction phase 1.** Task-oriented behaviors ranged from 14% to 29% (mean = 23%). During the music + instruction phase (10 sessions) Garrison engaged in more task-oriented behaviors than previous phases. After seven sessions it was determined that Garrison had demonstrated steady state responding; therefore, Garrison was moved to the next phase.
Figure 4.3. Mean Percent of Task-Oriented Behaviors by Session (Participant #3 - Logan)
**Music only phase 2.** Task-oriented behaviors were steady for all sessions (mean = 0%). During the second music only phase Garrison exhibited the same mean percent of responding as the first music only phase. Because steady state responding was obtained quickly and at the same level as the first music only phase he was moved him to the second music + instruction phase.

**Music + instruction phase 2.** Task-oriented behaviors ranged from 21% to 35% (mean = 29%). During the second music + instruction phase Garrison engaged in a higher mean percent of task-oriented behaviors than the previous music only phase, which was similar to the level of responding in the first music + instruction phase. After four sessions it was determined that steady state responding was present. At that point in time the intervention was concluded. Maintenance sessions began a week following the end of the intervention.

**General prompts.** The range of general prompts bouts given during a session was 6 to 17 (mean = 10 bouts). The range of general prompts bouts given across all phases was 9 to 13 (mean = 10 bouts). General prompts were also measured across all thirty-six sessions of the study. Table 4.6 shows the range and mean of general prompts bouts given during each phase of the study for participant 3 (Garrison).

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Music Only Phase 1</th>
<th>Music + Instruction Phase 1</th>
<th>Music Only Phase 2</th>
<th>Music + Instruction Phase 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>9-17</td>
<td>6-14</td>
<td>6-15</td>
<td>11-16</td>
<td>8-13</td>
</tr>
<tr>
<td>Mean</td>
<td>12</td>
<td>9</td>
<td>10</td>
<td>13</td>
<td>9</td>
</tr>
</tbody>
</table>

Table 4.6. Range and Mean General prompts Bouts Given During Each Phase of the Study for Participant #3 (Garrison).
**Summary.** The mean percentages of task-oriented behaviors across the first and second music + instruction phases were 23% and 29% respectively (mean across both phases = 26%). During both music only phases he exhibited a decrease in task-oriented behaviors (means = 0%) when compared to the music + instruction phases. Additionally, the range in mean number general prompts bouts given to Garrison across all phases was 9 to 13 (mean = 10). Garrison attended 36 sessions during the study. As a result of the music + instruction phases, Garrison’s task-oriented behaviors increased.

**Participant 4 (Logan)**

Logan participated in: baseline, music only, and music + instruction phases of the study for a total of twenty-eight sessions. The mean percent of task-oriented behaviors over all sessions by phase were as follows (40% - baseline, 0% - music only phase 1, 57% - music + instruction phase 1, 0% - music only phase 2, 53% - music + instruction phase 2). See Figure 4.4 for a graphic display of the percent of task-oriented behaviors exhibited by Logan.

**Baseline.** Task-oriented behaviors ranged from 12% to 54% (mean = 40%). Logan’s task-oriented behaviors were variable during baseline (14 sessions). After eleven sessions Logan’s task-oriented behaviors made a successive decline over three sessions. Because of the decrease in behavior in opposite direction Logan was moved to the first phase of the study (music only).

**Music only phase 1.** The mean task-oriented behaviors during all three music only (phase one) sessions was 0% (mean = 0%). As such, Logan engaged in a considerably lower mean percent of task-oriented behaviors during the music only phase than in baseline. After three sessions and no variability or change in behavior due to
phase changes of other participants steady state responding was established. At that time Logan was moved to the first music + instruction phase with the intent of increasing task-oriented behaviors.

**Music + instruction phase 1.** Task-oriented behaviors ranged from 52% to 66 % (mean = 57%). However, during three of the four sessions Logan’s task-oriented behaviors was in the 50% range. During the music + instruction phase (4 sessions) Logan engaged in a higher mean percent of task-oriented behaviors than previous phases. After four sessions it was determined that Logan had demonstrated steady state responding; therefore, he was moved to the next phase.

**Music only phase 2.** During the second music only phase Logan exhibited the same mean percent of task-oriented behavior as the first music only phase (no range; mean = 0%) over three consecutive sessions. This demonstrated that the mean percent of task-oriented behaviors was lower than the previous music + instruction phase. Because steady state responding was obtained quickly and at the same level as the first music only phase Logan was moved to the next phase.

**Music + instruction phase 2.** Task-oriented behaviors ranged from 52% to 54 % (mean = 53%). During the second music + instruction phase Logan engaged in a higher mean percent of task-oriented behaviors than the previous music only phase which was similar to the level of responding in the first music + instruction phase.

**General prompts.** The range of general prompts bouts given during a session was 7 to 16 (mean = 11 bouts). The range of general prompts bouts given across all phases was 8 to 14 (mean = 11 bouts). General prompts were also measured across all
twenty-eight sessions of the study. Table 4.7 shows the range and mean of general prompts bouts given during each phase of the study for participant 4 (Logan).

**Summary.** The mean percentages of task-oriented behaviors across the first and second music + instruction phases were 57% and 53% respectively (mean across both phases = 55%). During both music only phases he exhibited a decrease in task-oriented behaviors (means = 0%) when compared to the music + instruction phases. The range of general prompts bouts given across all phases was 8 to 14 (mean = 11 bouts). Logan participated in 28 sessions. As a result of the music + instruction phases, Logan’s task-oriented behaviors increased.

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Music Only Phase 1</th>
<th>Music + Instruction Phase 1</th>
<th>Music Only Phase 2</th>
<th>Music + Instruction Phase 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>9-16</td>
<td>12-17</td>
<td>9-16</td>
<td>9-11</td>
<td>7-9</td>
</tr>
<tr>
<td>Mean</td>
<td>11</td>
<td>14</td>
<td>13</td>
<td>11</td>
<td>8</td>
</tr>
</tbody>
</table>

Table 4.7. Range and Mean of General prompts Bouts Given During Each Phase of the Study for Participant #4 (Logan).
Figure 4.4. Mean Percent of Task-oriented behaviors, by Session (Participant #4 - Logan)
Participant 5 (Ava)

Ava participated in: baseline, music only, and music + instruction phases of the study for a total of twenty-eight sessions. The mean percent of task-oriented behaviors over all sessions by phase were as follows (75% - baseline, 68% - music only phase 1, 93% - music + instruction phase 1, 65% - music only phase 1, 92% - music + instruction phase 2). Figure 4.6 is a graphic display of the percent of task-oriented behaviors exhibited by Ava.

**Baseline.** Task-oriented behaviors ranged from 50% to 92% (mean = 75%). Ava’s task-oriented behaviors were variable during baseline (22 sessions). Beginning at session twenty Ava’s task-oriented behaviors began to decrease (70% to 53% to 50%). Because of the decrease in behavior Ava was moved to the first phase (music only).

**Music only phase 1.** Task-oriented behaviors ranged from 61% to 80% (mean = 68%). Ava engaged in a lower mean percent of task-oriented behaviors during the music only phase when compared to baseline. After five sessions, steady state responding was established. Because Ava engaged in a lower mean percent of task-oriented behaviors in this phase and the steady state responding was apparent she was moved to the first music + instruction phase.

**Music + instruction phase 1.** Task-oriented behaviors ranged from 92% to 94% (mean = 93%). During the music + instruction phase (3 sessions) Ava engaged in a higher mean percent of task-oriented behaviors than previous phases. During the three sessions of the music + instruction phase, Ava’s task-oriented behaviors were stable; therefore, after steady state responding was obtained by the participant in the proceeding phase (Logan) Ava was moved to the second music only phase.
**Music only phase 2.** Task-oriented behaviors ranged from 63% to 69% (mean = 65%). During the second music only phase Ava similar levels of responding as the first music only phase (only a 3% difference). After steady state responding was exhibited (4 sessions) she was moved to the next phase of intervention.

**Music + instruction phase 2.** Task-oriented behaviors ranged from 89% to 96% (mean = 92%). During the second music + instruction phase Ava engaged in a higher mean percent of task-oriented behaviors than the music only phase, which was similar to the level of responding in the first music + instruction phase. After three sessions it was determined that steady state responding had been established. At that point in time the investigator concluded the intervention.

**General Prompts.** The range of general prompts bouts given during a session was 2 to 13 (mean = 6 bouts). The range of general prompts bouts given across all phases was 5 to 7 (mean = 6 bouts). General prompts were also measured across all twenty-eight sessions of the study. Table 4.8 shows the range and mean of general prompts bouts given during each phase of the study for participant 5 (Ava).
Figure 4.5. Mean Percent of Task-oriented behaviors, by Session (Participant #5 - Ava)
Table 4.8. Range and Mean of General prompts Bouts Given During Each Phase of the Study for Participant #5 (Ava).

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Music Only Phase 1</th>
<th>Music + Instruction Phase 1</th>
<th>Music Only Phase 2</th>
<th>Music + Instruction Phase 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>2-13</td>
<td>3-7</td>
<td>4-5</td>
<td>5-8</td>
<td>4-8</td>
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<tr>
<td>Mean</td>
<td>6</td>
<td>5</td>
<td>5</td>
<td>7</td>
<td>6</td>
</tr>
</tbody>
</table>

**Summary.** The mean percentages of task-oriented behaviors across the first and second music + instruction phases were 93% and 92% respectively (mean across both phases = 55%). During both music only phases she exhibited a decrease in task-oriented behaviors (means = 68% and 65%, respectively) when compared to the music + instruction phases. The range of general prompts bouts given across all phases was 5 to 7 (mean = 6 bouts). Ava attended 37 sessions during the study. As a result of the music + instruction phases, Ava’s task-oriented behaviors increased.

**Summary Across all Participants**

Two of the five participants (participants 1 and 5) engaged in some task-oriented behaviors during the music only phases (15% and 9%; 68% and 65%, respectively). Three of the five participants (participants 2, 3, and 4) engaged in a mean of 0% of task-oriented behaviors in the music only phases. All participants engaged in a higher mean percent of task-oriented behavior during music + instruction phases when compared to music only phases (Figure 4.6 and Table 4.9). None of the participants engaged in a
higher mean percent of task-oriented behaviors during music only phased when compared to baseline.

Overall, general prompts varied from 2 to 19 across all sessions and participants. The mean general prompts given per session were 10. Within participants, there was a range of 6 to 13 (bouts of general prompts per phase). Additionally, between participants there was range of 6 to 14 (bouts of general prompts per phase).
Figure 4.6. Multiple Baseline Graphs of Task-Oriented Behaviors for all Five Participants.
Table 4.6 Continued
| Participant | # of Sessions | Mean Number of General Prompts Given/Session | % of Task-Oriented Behavior During Baseline | % of Task-Oriented Behavior During Music Only Phase 1 | % of Task-Oriented Behavior During Music + Instruction Phase 1 | % of Task-Oriented Behavior During Music Only Phase 2 | % of Task-Oriented Behavior During Music + Instruction Phase 2 |
|-------------|---------------|---------------------------------------------|-------------------------------------------|-------------------------------------------------|-------------------------------------------------|------------------------------------------------|------------------------------------------------|------------------------------------------------|
| 1 (Carter)  | 31            | 13                                         | 53                                        | 15                                             | 54                                             | 9                                             | 53                                             |
| 2 (Rowan)   | 34            | 10                                         | 2                                         | 0                                              | 9                                              | 0                                             | 17                                             |
| 3 (Garrison)| 36            | 10                                         | 8                                         | 0                                              | 23                                             | 0                                             | 29                                             |
| 4 (Logan)   | 28            | 11                                         | 40                                        | 0                                              | 57                                             | 0                                             | 53                                             |
| 5 (Ava)     | 37            | 6                                          | 76                                        | 68                                             | 93                                             | 65                                            | 92                                             |

Table 4.9. Summary of Results (Percentages) Including Information Regarding Participant Trials, General Prompts, and Percent of Task-Oriented Behaviors per Session.
Social Validity

A four-point Likert scale questionnaire (Appendix I) consisting of four questions was developed. Five responses categories were provided (1 = Strongly Agree, 2 = Agree, 3 = Disagree, 4 = Strongly Disagree, and NA = Not Applicable). This questionnaire was developed in order to obtain the opinions regarding the value of using music in physical activity/gross motor settings. The questionnaire was distributed to a total of eleven individuals (five parents, one staff member, four teachers and one preschool director). Of the eleven individuals who received the questionnaire seven completed it (63%). The respondents included the preschool director, four preschool teachers, the school secretary, and one participant’s mother completed the questionnaire.

All seven (100%) respondents strongly agreed to two of the four statements. The two statements were: 1) My child/student looked forward to attending music and physical activity sessions and 2) Learning motor skill and being physical active are important for my child/student to live a healthy lifestyle. Four of the seven respondents (57%) strongly agreed, two of the seven respondents (28%) agreed, and one of the seven (14%) respondents replied “Not Applicable” with the statement: As a result of participating in the study my child/student exhibits greater task-oriented behaviors when music is presented. It should be noted that the Preschool Director and the school secretary submitted the “Not Applicable” answers. Six of seven respondents (85%) strongly agreed and one of the seven (14%) agreed with the statement: My child/student enjoys listening to music and being active with his/her friends.

These responses and written comments provide support for music-based instruction as a socially valid instructional activity. Furthermore, there was majority
support (four of the seven) for the transferring of task-oriented behaviors into other environments (as answered in question three of the survey – “As a result of participating in the study my child/student exhibits greater task-oriented behaviors when music is presented”). Additionally, unprompted written comments by one respondent suggest that all of the children enjoyed participating in the individualized gross motor movement sessions. In summary, the results of the social validity questionnaire suggest support for and value placed on physical activity and music for young children.
Chapter 5: Discussion

Chapter five provides a discussion of the results of using music to facilitate task-oriented behaviors for preschool children with ASD within individual gross motor sessions. The chapter is composed of a discussion of the results relative to the two research questions, perceived limitations of the study, implications for preschool and other educational settings, suggestions for future research, and a summary.

Research Questions

Research Question 1: Can preschool children with ASD increase their task-oriented behaviors with the introduction of music (only) within an individualized gross motor movement setting?

It was hypothesized that music only as an addition to individualized gross motor movement sessions would facilitate an increase in task-oriented behaviors for preschool children with ASD. Although there was some variability in the mean percent difference between participants, when compared to baseline data, all five participants engaged in lower mean percentages of task-oriented behaviors during both music only phases when compared to baseline and music only phases. Therefore, it was concluded that the introduction of music (only) within an individualized gross motor movement setting did not increase the task-oriented behaviors of preschool children with ASD.

Once moved from baseline to the music only phase, all of the participants engaged in lower mean percentages of task-oriented behaviors than during the baseline
phase. Similar levels of task-oriented behaviors were observed during the second music only phase as the first. These results suggest that participants did not increase their task-oriented behaviors with the introduction of music only. As such, this could be explained by referring to the field notes taken during the music only phases. During the music only phases all of the participants had to be reminded to stay in the research area and not walk to the exit door. Other behaviors exhibited by the participants when they were not engaging in task-oriented behaviors were pacing back and forth, free-choice dance, and engaging in self-stimulating behavior. The prompt given to participants when they began engaging in non-task oriented behaviors was “Listen to the music and follow the directions.”

Results of this study contradict previous research (Presti, 1984; Kim et al., 2008), which support the use of music (only) in promoting appropriate behaviors for individuals with disabilities in a variety of educational settings. Both the Presti (1984) and Kim et al., (2008) studies utilized music as a single stimulus (without instruction) added to an educational environment to increase targeted behaviors.

Presti’s (1984) research study examined a variety of music therapy techniques to increase “normal” behavior in the classroom. The methods of this study were vague and eluded to the use of music in an improvisational (unplanned/unstructured) in increasing “normal” behaviors of the participants so that they could remain in the classroom. The music therapist was responsible for moving the participant through the music therapy steps but no instruction was reported.

The Kim et al., (2008) study utilized music and music instruments placed in a “play area” to enhance peer interaction between preschool children with ASD and their
same aged peers without disabilities. Again no instruction was used and the methods were reported with little detail. Both studies reported an increase in adapted behaviors and prolonged social interaction as a result of music “only” (Presti, 1984; Kim et al., 2008). This could be explained by the lack of rigor in the design and procedures as well as the inability to capture what was responsible for the changes in behaviors (i.e., change in the environment, quality of instruction, etc.). Without more description of the design and procedures it is difficult to make a comparison of the results of this study compared to the Presti (1984) and Kim et al. (2008) studies.

While all five participants exhibited lower mean percentages during the music–only phase, participants 2, 3, and 4 exhibited the lowest mean percentages (0%) of task-oriented behaviors during music only phases when compared to participants 1 and 5. This may be explained by the severity of the participants’ (2, 3, and 4) ASD and their ability to attend to a task with limited visual and verbal prompting (music only phase). The three participants who engaged in 0% of task-oriented behaviors were non-verbal and had lower levels of receptive and expressive language when compared to the two other participants (1 and 5).

On the other hand, participants 1 and 5 may have engaged in higher levels of task-oriented behaviors than their fellow participants because they had more advanced expressive and receptive language skills and were able to respond more appropriately to prompting (i.e., verbal and visual) using verbal responses. It is not clear what role receptive and expressive language skills play in the level of task-oriented behaviors of preschool children with ASD during the music only individualized gross motor sessions. Further investigation is warranted.
Additionally, it should be noted that participants 2, 3, and 4 who exhibited 0% task-oriented behaviors during music only, engaged in some component of the tasks/skills being asked of them to perform by the music al lyrics but never at the correct time. For example, participant 3 (Garrison) would begin jumping once the Animal Actions song began playing. Jumping was a component of “move like a bunny” but the participant rarely jumped when that portion of the song started playing. This may be explained by the repetitiveness and familiarity of songs.

It should also be noted that participant 1 (Carter) was moved from baseline to music only phase 1 after three sessions due to the dramatic decrease in behavior from baseline session 1 to session 3. During baseline participant 1 (Carter) decreased the percent of task-oriented behaviors over the course of three sessions. This magnitude of change did not occur any other time during the study. Furthermore, the task-oriented behaviors participant 1 (Carter) engaged in during the third session of the baseline phase was the lowest percent of task-oriented behaviors observed across baseline, both music + instruction phases, and maintenance phases.

Another interesting finding was that participant 5 (Ava) would sing along during the music only phases but would not engage in all of the tasks/skills; instead, she would spin or dance around while singing. This may be due to the sensory and processing difficulties commonly seen in individuals with ASD to identify (Minshew & Goldstein, 1998). These difficulties (i.e., sensory and processing difficulties) are typically present during unstructured or free choice activities when the child does not understand what is being asked. The music only phase acted as an unstructured or seemingly free choice activity when compared to the music + instruction sessions making it difficult for
children with ASD to understand what they should do during the session. As such, Breslin & Rudisill (2011) suggested that there is a need for teachers to visually and physically model tasks in order to increase success for children with ASD in movement settings. Therefore, the lower mean percentages of task-oriented behavior during the music only phase can potentially be explained by the need for multiple stimuli (i.e., music + instruction) to help prompt the participant to engage in the appropriate task-oriented behaviors for the duration of each proposed task.

As a whole, music by itself was not effective in facilitating higher levels of task-oriented behaviors for preschool children with ASD in individualized gross motor sessions. Children with ASD, especially preschool children with ASD likely need more structure and guidance to be successful in a new and relatively abstract environment (i.e., only music was playing and no instruction was provided).

Research Question 2: Can preschool children with ASD increase their task-oriented behaviors with the introduction of music in addition to the visual modeling and verbal prompting of instructions from the investigator, within an individualized gross motor movement setting?

It was hypothesized that music in addition to visual modeling and verbal prompting of instructions from the investigator within an individualized gross motor movement session would also facilitate an increase in task-oriented behaviors for preschool children with ASD. It was concluded that the introduction of music in addition to visual and verbal prompting of instructions from the investigator (music + instruction) within an individualized gross motor movement setting can increase the task-oriented behaviors of preschool children with ASD.
When compared to baseline and both music only phases, all five participants engaged in higher mean percentages of task-oriented behaviors during both music + instruction phases when compared to the music only phases. Participants 1, 4 and 5 exhibited variability during the baseline phase (i.e., outliers higher than the mean percentage of task-oriented behaviors during music + instruction phases). If one were to add a trend line to the baseline phase it could be determined that there was a decrease in task-oriented behaviors for participant 1, and a steady yet lower mean percentage decrease of task-oriented behaviors for participants 4 and 5.

Furthermore, four of the five participants (2, 3, 4, and 5) engaged in higher mean percentages of task-oriented behavior during both music + instruction phases when compared to baseline. Participant 1 engaged in higher mean percentages of task-oriented behaviors during the first music + instruction phase when compared to baseline and music only; but, the same as baseline in music + instruction 2.

Although there are some differences in levels of task-oriented behaviors across the participants, when comparing baseline to music only, music only to music + instruction, and baseline to music + instruction, there are clear behavior changes. All participants engaged in higher mean percentages of task-oriented behaviors during both music + instruction phases when compared to baseline and music only phases. There was an increase in the mean percentages of task-oriented behaviors for all participants from baseline to music + instruction phase 1. There was also a greater increase in the mean percentages of task-oriented behaviors from music only phases to music + instruction phases. This suggests that music in addition to the visual modeling and verbal prompting can increase the task-oriented behaviors of preschool children.
It should be noted that prior to the study classroom teachers stated that participant 2 (Rowan) enjoyed music but was rarely engaged in any structured activity during “table-time” or “circle-time.” During baseline and music only phases, Rowan engaged in little to no task-oriented behaviors. When exposed to the music + instruction phases (1 and 2) he engaged in higher mean percentages of task-oriented behaviors. The preschool director and classroom teachers responded to the increase in mean percentage of task-oriented behaviors positively, as they had not seen that level of task-oriented behaviors from Rowan prior to the intervention. He engaged in the activities with no physical prompting and seemed to enjoy them (i.e., laughing and smiling throughout the sessions). The increase in task-oriented behaviors from music + instruction phase 1 to phase 2 could be a result of feeling more familiar with the environment and the instructor. However, it should be noted that the increase in behavior did not result in a learning effect because there was a little behavior change in both music only phases. This was because his task-oriented behaviors during both music only phases were less than the mean task-oriented behaviors exhibited during the music + instruction.

During the music + instruction phases, the investigator physically demonstrated (visual model) and spoke the instructions (lyrics being sung) to the music. Because there was no visible increase in task-oriented behaviors for the participants in the study during the music only phase, it can be concluded that the change in behavior may be the result of visual modeling and verbal prompting provided. During both music + instruction phases the same tasks were presented to participants as in baseline and music only phases. Therefore, visual modeling and verbal prompts given by the instructor in addition to the music may have been a key to increasing task-oriented behaviors (Collier & Reid, 1987).
Furthermore, Rink and Hall (2008) suggest that effective teachers should be organized, engaged, explicit and consistent with their teaching. The investigator utilized a number of effective teaching qualities provided by Rink and Hall (2008) during the baseline and music + instruction sessions. Therefore, the environment was less abstract making it more likely for participants to be successful at completing the tasks (i.e., activities presented to them in the songs).

The results of this study are similar to those of Kern et al., (2007). Those investigators used music to supplement the entrance and exit routines of two preschool children with ASD. They found that when the classroom teachers sang (instead of spoke) the structured entrance/exit routines, participants engaged in fewer problem behaviors (i.e., crying) when entering and exiting the classroom.

Prompting has been a teaching method used by educators to improve task-oriented behaviors and learning for young children. Previous research suggests that multiple instructional prompts (i.e., visual, verbal, and physical) promote FMS acquisition in young children with ASD (Collier & Reid, 1987). The Collier and Reid (1987) study examined the effects of different types of prompting (i.e., within-stimulus vs. extra-stimulus prompting) on young children (ages 7-10) with ASD. It was discovered that prompting, especially extra-stimulus (i.e., physical) was effective in promoting specific motor tasks (i.e., bowling). Furthermore, Reid et al., (1991), extended their previous study (Collier & Reid, 1987) and suggested that verbal and physical prompting is slightly more beneficial than verbal and visual prompting. Results support the findings of Collier & Reid (1987) and Reid et al., (1991).
Anecdotally, the idea of supplementing music with instructional prompting (i.e., visual modeling and verbal prompting) to increase targeted behaviors for young children is not new. Teachers have been utilizing music to supplement their instructional techniques for over thirty years in order to make practice more effective (Brown, et al., 1981). The Brown et al., (1981) study concluded that music has been used and should continue to be utilized in physical education to help increase motor skills for young children. This study examined the difference in the perceptual motor performance of 15 participants after completing six weeks of a physical education/music instruction program and compared them to 15 participants who received only a physical education program. The results indicate that perceptual motor skills were higher for the participants who attended the physical education/music instruction program. Additionally, the results of the current study align with previous research that used music in addition to other instructional techniques to promote FMS children with various disabilities (i.e., Kennedy & Kua-Walker, 2006; Deli et al., 2006; Edwards-Duke et al., 2002). For example, the Kennedy & Kua-Walker (2006) study reported that a movement intervention supplemented by music was successful at aiding in the transfer of movement skills into an inclusive physical education setting for an 11-year-old boy with myotonic dystrophy. The literature also supports the use of music to promote increases of target behavior for individuals with and without disabilities (Thaut, 1988; Bruscia, 1998; Daveson & Edwards, 1998; Thaut et al., 1999).

Therefore, preliminary evidence suggests that music in addition to visual and verbal prompting is an appropriate intervention to promote increased task-oriented behaviors for preschool children with ASD. These findings are aligned with previous
research and help advance future research in the field of physical education and motor development.

This study is one of the first of its kind. To this investigator’s knowledge little research has been done as to why music may be effective in promoting positive gains in targeted behaviors. The results of this study provide foundational information regarding the utility of music in early intervention physical education and activity settings and promote the need for quality instruction from teachers. Music along with quality instruction (supported by empirical evidence) is the key to promoting task-oriented behaviors and enhancing instructional programs for young children with ASD.

**Limitations**

There were four limitations to the study. First, the investigator could not control the use of music outside of the data collection setting. Although it would have been ideal if the investigator could have controlled for all instances where music was played it would have been difficult to ensure that music was not played outside of the data collection setting.

Second, the investigator could not ensure the attendance of participants during data collection (e.g., illness and fieldtrips). During the months that data were collected there was a school-wide stomach virus that halted data collection for two days. In addition, there were two field trips and two school holidays that were planned prior to the study. Therefore, the investigator could not collect data on those days. In an ideal situation, all of the participants would attend all of the sessions. However, in a naturalistic setting problems arise that cannot be controlled. For example, participant 4 (Logan) had a number of personal issues and illnesses (e.g., death in the family, stomach
virus, etc.,) toward the end of the study and was absent for several days. Therefore, even though participant 5 (Ava) was showing steady state responding she could not be moved to the next phase of the study because the design required the participant in the tier above her (participant 4) to show steady state responding before she could be moved (Cooper et al., 2007; Johnson & Pennypacker, 2009). Therefore, the investigator had to wait for participant 4 (Logan) to return to school and show steady state responding before she could move participant 5 (Ava) to the next phase of the study. Due to the number of absences and the end of the school year, the investigator could not conduct maintenance conditions on either participant (4 or 5).

Third, the study had to coincide with the school year in order to recruit participants and have a designated research space to conduct the study. Data were collected from March to June and had to be completed by the end of the school year. This was a substantial amount of time to collect data but due to unplanned absences of some participants it was not possible to complete all phases of the study within the regular school year.

Fourth, there was not a generalization component to this study. Providing a generalization phase or probe would allow for the investigator and her audience to better understand the utility of using music in physical education settings.

**Implications for Preschool and Other Educational Settings**

Research studies report the use of early intervention programs to improve socialization and adaptive behaviors for preschool children diagnosed with disabilities (e.g., ASD) (Lovaas, 1987; Smith et al., 2000; Remington et al., 2007; Kovshoff et al., 2011; Fernell et al., 2011). Additionally, Stodden et al., (2008) proposed that a
relationship exists between children’s experiences in being exposed to and master fundamental motor skills and their engagement in physical activity later in life. Therefore, there is a need for FMS and physical activity interventions in early education experiences (i.e., preschool).

Previous research conducted on preschoolers in physical activity and FMS settings suggest that structured interventions are effective in increasing physical activity and FMS levels when compared to their same aged peers who did not receive a structured intervention (Reilly et al., 2006 and Oslin et al., 1997). Additionally, similar interventions conducted on preschool children from disadvantaged environments also suggest that FMS and perceived motor confidence increases as a result of structured interventions (Goodway & Rudisill, 1996; Goodway & Branta, 2003; Robinson & Goodway, 2009; and Robinson et al., 2009). Rimmer and Kelly (1989), Zittle and McCubbin (1996), and Finn and Valkova (2007) conducted physical activity and FMS interventions on preschool children with disabilities, including children with ASD and found that motor skills were improved when compared to their same aged peers who did not receive interventions. As a result, investigators have shown the importance of structured and unstructured physical activity in addition to FMS acquisition in order for preschoolers to become healthy and active individuals later in life (NASPE, 2009).

The results of this study suggest that task-oriented behaviors of young children with ASD are increased with the presence of music and quality instruction. By increasing the amount of task-oriented behaviors it is more likely that children will engage in more quality (structured) activity. Therefore, quality physical activity and FMS programs enhanced with music may help ensure that children are meeting some of the guidelines
(i.e., 60 minutes or more of structured physical activity daily) reported by NASPE (2009).

To this investigator’s knowledge little research has been conducted on creating instructional program to increase physical activity, more specifically FMS in preschool children with ASD. It is important to implement programming that supports the needs of preschool children with ASD in developing FMS and increasing physical activity levels. This is important because the physical activity levels of adolescents with ASD are significantly lower than their peers without disabilities (Pan, 2008, 2009; and Pan et al., 2011). All of the research conducted by Pan et al., reported lower physical activity levels for adolescents with ASD during physical education and unstructured physical activity (i.e., recess) when compared to their same aged peers without disabilities.

This study investigated task-oriented behaviors of preschool children with ASD in an individualized gross motor setting, and results support the use of music + instruction. Based on the findings of this study, music + instruction can be implemented into preschool programs to enhance the task-oriented behaviors, and potentially the successful participation in physical activity and FMS based activities which will in turn promote higher levels of physical activity later in life (Stodden et al., 2008).

The results of this study suggest that music by itself is not enough. Instead, there is a need for physical activity and FMS instructional musical packages to be developed. Not only is it necessary for an instructional package to be developed, there is a need for a quality instructor to deliver that package. One way of ensuring that this is happens is to create professional development workshops so that instructors will know how to deliver similar content to their students. This research is the initial step in promoting successful
music-based instructional packages in physical activity settings.

**Future Research**

This study provides preliminary evidence that an individualized gross motor session supplemented with music and instruction (e.g., verbal and visual prompting) increases task-oriented behaviors of preschool children with ASD. Future studies should:

1. Examine the ability for young children with ASD to generalize and maintain their task-oriented behaviors during music + instruction sessions.

2. Examine the role of music + instruction based interventions on facilitating additional appropriate behaviors of preschool children with ASD (e.g., self-stimulating, social interaction, eye contact, etc.)

3. Examine the role of language skills (i.e., receptive and expressive) on the level of task-oriented behaviors participants engage in during music + instruction interventions for preschool children with ASD.

4. Examine the role of music + instruction based interventions on facilitating additional appropriate behaviors of preschool children with ASD from the instructor’s perspective (e.g., positive feedback, opportunities to respond, etc.).

5. Examine the role of music + instruction based interventions on facilitating task-oriented behaviors in group/inclusive gross motor movement sessions.

6. Examine the role of music + instruction based interventions on the amount of social interactions that occur between peers.

7. Examine the role of music + instruction based interventions on increasing FMS and physical activity levels of preschool children with ASD. These interventions should be conducted in both individualized and group settings to
investigate the generalization of these skills into inclusive settings. Are similar findings apparent in preschool children without disabilities?

8. Develop specific interventions that would be successfully administered to a group of preschool children with and without ASD to promote positive growth in physical activity levels, FMS acquisition, and positive social interaction.

Summary

The purpose of this study was to examine the effect of using music to facilitate task-oriented behaviors during an individualized gross motor movement session. To this investigators knowledge, this was the first study to examine music (music only; music + instruction) for facilitating task-oriented behaviors in preschool children with ASD. Participants included five preschool children (4 boys and 1 girl) diagnosed with ASD who attended a Midwestern private preschool for children and adolescents diagnosed with ASD and their peers without disabilities (typically siblings and family friends). The study utilized a multiple-baseline across participant design in which several different phases (baseline – non-music, music only – phase 1 and 2, and music + instruction – phase 1 and 2) were used.

Study results suggest that music + instruction produces higher mean percentages (by session) of task-oriented behaviors than non-music and music-only. All five participants exhibited in higher mean percentages of task-oriented behaviors during music + instruction phases when compared to the other phases (baseline, music only). Collectively, this study sets the groundwork for a line of research on the role of music in increasing physical activity levels and FMS acquisition for preschool children with and without disabilities.
Reference List


Appendix A: Recruitment Letter/Parental Permission Form
Using Music to Enhance Task-Oriented Physical Activity Behavior in Preschool Children With ASD

Music has been shown to increase positive behaviors and social interaction skills in children with ASD. As such, we would like to invite you to be part of a study in which we will be using music in your child’s physical activity program to increase task-oriented behaviors.

Physical activity sessions will occur 4 days a week during your child’s normally scheduled school day and will last for 20 minutes. During this time the activities that will be conducted as part of this study will be typical of those in which your child would participate as part of his/her regular physical education program. There will be a licensed physical education teacher to provide instruction to your child at all times. Upon completion of each session your child will be returned to class. It is expected that the study will last 8-10 weeks. Upon the completion of the study information regarding the results will be available upon the parents/guardians request. For further information or questions concerning this request, please contact either Dr. Porretta or Ms. Shannon Titus. Their contact information appears on the attached Parental Permission Form.

If your child has been diagnosed with ASD and you are interested in having him/her participate in the study please sign, date, and return this flyer to allow for the investigator to access your child’s school records to obtain official diagnoses.

I, __________________________, give permission to Shannon M. Titus or Dr. David Porretta to have access to my child’s school records and recruit my child for this study.

Name of Child: __________________________

Parent/Guardian Signature: __________________________ Date: __________

Sincerely,

David Porretta, Ph.D.
Professor and Principal Investigator

Shannon Titus, M.A.
Co-investigator
The Ohio State University Parental Permission For Child’s Participation in Research

The Use of Music on the Acquisition, Maintenance, and Generalization of Task-oriented behaviors in Preschool Children With Autism Spectrum Disorder in Gross Motor Settings

Investigator: Shannon Titus

This is a parental permission form for research participation. It contains important information about this study and what to expect if you permit your child to participate.

Your child’s participation is voluntary.

Please consider the information carefully. Feel free to discuss the study with your friends and family and to ask questions before making your decision whether or not to permit your child to participate. If you permit your child to participate, you will be asked to sign this form and will receive a copy of the form.

Purpose:
Children with autism spectrum disorders (ASD) often have documented deficits in social interactions and on-task behaviors which are directly related to deficits in developmental play (MacDonald, Clark, Garrigan, and Vangala, 2005). Music has been used to increase positive behavior changes such as social interaction and independent living skills (Gunsberg, 1988 and Humpal, 1991) of children with ASD. Therefore, the purpose of this study is to determine if the use of music increases on-task behavior for children with autism spectrum disorder (ASD) in a physical activity setting. Increasing on-task behaviors may then lead to further development of social skills (i.e., peer interactions, inclusion, social relationships).

Procedures/Tasks:
Data will be collected during a regularly scheduled physical activity program during Winter/Spring Quarter. All students in each class will be videotaped. Videotaping will take place so that behaviors can be analyzed at a later time. Data will be collected using modified sections of the validated Academic Learning Time in Physical Education (ALT-PE) measurement tool during regularly scheduled physical activity sessions. Each physical activity session will involve highly motivating child friendly activities. Theses activities will include dancing, moving through space, playing with child-friendly physical education equipment (i.e., play ground balls, yarn balls, beanbags, etc). Child-friendly music will be used to increase on-task behavior (i.e., Greg and Steve’s Kid’s in
Motion). During non-music sessions similar lessons will be presented to the participants that will attempt to match the motivational level of the other lessons.

In addition, you will be asked to complete a brief questionnaire at the competition of the intervention about your opinion of the program. This questionnaire will be sent home via your child’s school bag and returned once you have completed the questionnaire to a locked box located at the front desk of the school.

Duration:
Your child may leave the study at any time. If you or your child decides to stop participation in the study, there will be no penalty and neither you nor your child will lose any benefits to which you are otherwise entitled. Your decision will not affect your future relationship with The Ohio State University.

Risks and Benefits:
Aside from participating in regularly scheduled physical activities appropriate for your child there is no increased risk when participating in this study. Your child will be removed from his/her class, along with several other peers who have been selected for the study, 4 times a week for 10 minutes to participate in the physical activity sessions. He/she will participate in all activities with a small group of peers and will not be singled out or asked to individually participate in activities. This study is designed to be confidential and complimentary to the already established physical activity program. The benefits are threefold: 1) the children typically enjoy the attention and activity they get as part of this experience, 2) parents will be provided with the information on the results of the study so they can better understand the effects of music on their child’s on-task behavior during physical activity sessions, and 3) school administrators and teachers will be provided with information collected from the study to help inform them about future physical activity instruction and programming.

In addition at the completion of the study you (as the parent/guardian) will be asked to complete a brief social validity questionnaire.

Confidentiality:
Efforts will be made to keep your child’s study-related information confidential. However, there may be circumstances where this information must be released. For example, personal information regarding your child’s participation in this study may be disclosed if required by state law. Also, your child’s records may be reviewed by the following groups (as applicable to the research):
- Office for Human Research Protections or other federal, state, or international regulatory agencies;
- The Ohio State University Institutional Review Board or Office of Responsible Research Practices;
- The sponsor, if any, or agency (including the Food and Drug Administration for FDregulated research) supporting the study.

**Participant Rights:**

You or your child may refuse to participate in this study without penalty or loss of benefits to which you are otherwise entitled. If you or your child is a student or employee at Ohio State, your decision will not affect your grades or employment status. If you and your child choose to participate in the study, you may discontinue participation at any time without penalty or loss of benefits. By signing this form, you do not give up any personal legal rights your child may have as a participant in this study. An Institutional Review Board responsible for human subjects research at The Ohio State University reviewed this research project and found it to be acceptable, according to applicable state and federal regulations and University policies designed to protect the rights and welfare of participants in research.

**Contacts and Questions:**

For questions, concerns, or complaints about the study you may contact

Dr. Davide Porretta             Shannon M. Titus
A244 PAES Building             A216 PAES Building
305 W.17th Ave                 305 W.17th Ave
Columbus, OH. 43210            Columbus, OH 43210
porretta.1@osu.edu             titus.49@buckeyemail.osu.edu
614-292-0849                   937-248-8166

For questions about your child’s rights as a participant in this study or to discuss other study-related concerns or complaints with someone who is not part of the research team, you may contact Ms. Sandra Meadows in the Office of Responsible Research Practices at 1-800-678-6251.

If your child is harmed as a result of participating in this study or for questions about a study-related harm, you may contact

Dr. Davide Porretta             Shannon M. Titus
A244 PAES Building             A216 PAES Building
305 W.17th Ave                 305 W.17th Ave
Columbus, OH. 43210            Columbus, OH 43210
porretta.1@osu.edu             titus.49@buckeyemail.osu.edu
614-292-0849                   937-248-8166
Signing the parental permission form
I have read (or someone has read to me) this form and I am aware that I am being asked to provide permission for my child to participate in a research study. I have had the opportunity to ask questions and have had them answered to my satisfaction. I voluntarily agree to permit my child to participate in this study. I am not giving up any legal rights by signing this form. I will be given a copy of this form.

Printed name of subject

Printed name of person authorized to provide permission for subject  Signature of person authorized to provide permission for subject

Relationship to the subject  Date and time

Investigator/Research Staff
I have explained the research to the participant or his/her representative before requesting the signature(s) above. There are no blanks in this document. A copy of this form has been given to the participant or his/her representative.

Printed name of person obtaining consent  Signature of person obtaining consent

Date and time
Appendix B: Teacher Consent Form
The Ohio State University Consent to Participate in Research

Study Title: The Use of Music on the Acquisition, Maintenance, and Generalization of Task-oriented behaviors in Preschool Children With Autism Spectrum Disorder in Gross Motor Settings

Investigator: Shannon Titus

Sponsor:

This is a consent form for research participation. It contains important information about this study and what to expect if you decide to participate.

Your participation is voluntary.

Please consider the information carefully. Feel free to ask questions before making your decision whether or not to participate. If you decide to participate, you will be asked to sign this form and will receive a copy of the form.

Purpose:
To evaluate your opinion on the intervention conducted on your students with ASD who were involved in the gross motor movement intervention.

Procedures/Tasks:
At the completion of the intervention you will be asked to complete a brief questionnaire at the competition of the intervention.

Duration:
You may leave the study at any time. If you decide to stop participating in the study, there will be no penalty to you, and you will not lose any benefits to which you are otherwise entitled. Your decision will not affect your future relationship with The Ohio State University.

Risks and Benefits:
There are no risks or benefits associated with this questionnaire. The questionnaire will be anonymous.
Confidentiality:

Efforts will be made to keep your study-related information confidential. However, there may be circumstances where this information must be released. For example, personal information regarding your participation in this study may be disclosed if required by state law. Also, your records may be reviewed by the following groups (as applicable to the research):

- Office for Human Research Protections or other federal, state, or international regulatory agencies;
- The Ohio State University Institutional Review Board or Office of Responsible Research Practices;
- The sponsor, if any, or agency (including the Food and Drug Administration for FDA-regulated research) supporting the study.

Incentives:

N/A

Participant Rights:

You may refuse to participate in this study without penalty or loss of benefits to which you are otherwise entitled. If you are a student or employee at Ohio State, your decision will not affect your grades or employment status.

If you choose to participate in the study, you may discontinue participation at any time without penalty or loss of benefits. By signing this form, you do not give up any personal legal rights you may have as a participant in this study.

An Institutional Review Board responsible for human subjects research at The Ohio State University reviewed this research project and found it to be acceptable, according to applicable state and federal regulations and University policies designed to protect the rights and welfare of participants in research.

Contacts and Questions:

For questions, concerns, or complaints about the study you may contact:

Dr. Davide Porretta
A244 PAES Building
305 W.17th Ave
Columbus, OH 43210

Shannon M. Titus
A216 PAES Building
305 W.17th Ave
Columbus, OH 43210
For questions about your rights as a participant in this study or to discuss other study-related concerns or complaints with someone who is not part of the research team, you may contact Ms. Sandra Meadows in the Office of Responsible Research Practices at 1-800-678-6251.

If you are injured as a result of participating in this study or for questions about a study-related injury, you may contact:

Dr. Davide Porretta
A244 PAES Building
305 W.17th Ave
Columbus, OH. 43210
porretta.1@osu.edu
614-292-0849

Shannon M. Titus
A216 PAES Building
305 W.17th Ave
Columbus, OH 43210
titus.49@buckeyemail.osu.edu
937-248-8166

## Signing the consent form

I have read (or someone has read to me) this form and I am aware that I am being asked to participate in a research study. I have had the opportunity to ask questions and have had them answered to my satisfaction. I voluntarily agree to participate in this study.

I am not giving up any legal rights by signing this form. I will be given a copy of this form.

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**Investigator/Research Staff**
I have explained the research to the participant or his/her representative before requesting the signature(s) above. There are no blanks in this document. A copy of this form has been given to the participant or his/her representative.

Printed name of person obtaining consent

Signature of person obtaining consent

AM/PM

Date and time
Appendix C: Song Lyrics
1.) Animal Action II: (3:05)

Come on everybody,
Come down to the zoo.
We’re going to do a dance like the animals do.
Animal Actions
It’s so much fun,
Animal actions
Move like a horse
Repeat Verse
...Move like a spider
...Move like a bunny
...Move like a lion
...Move like a bee
...Move like a duck
Animal Action,
Oo, oo, oo
Animal Action.

2.) Beanbag Boogie (3:58)

Put your beanbag on your arm.
While you move your body to the sound.
Now put your beanbag on your nose,
Don’t let your beanbag touch the ground.
Now put your beanbag on your wrist,
And move your body to the sound
Yay, Yeah!
Now hold the beanbag in your hand
And boogie while you can.
Chorus:
Come on and rock to the Beanbag Boogie
Come on and rock to the Beanbag Boogie
Everybody rock to the Beanbag Boogie
Come on and rock to the Beanbag Boogie
Put your beanbag on your foot,
While you move any way you choose.
Now put your beanbag on your leg,
And get your whole self in the groove.
Now put your beanbag in your chest
And boogie while you can.
Chorus...Twist to the Beanbag Boogie
Put that beanbag under your chin,
Lean back, boogie to the sound.
Now put your beanbag under your arm,
Remember, don’t let it touch the ground.
Now put your beanbag between your knee.
Can you boogie, boogie all around?
Now hold that beanbag in your hand
And boogie while you can.
Chorus...Dance to the Beanbag Boogie

3.) The Balancing Act (2:47)

Now put your arms down low
And stretch your neck up high,
Like a tall giraffe with his head in the sky.
Then bend your body down
And put your arms back flat,
Just like a cuckoo bird or a super jet, yeah.
Now spread your legs out wide.
Pointing your hands up high.
Make a mountain like that
In the Balancing Act.
Now grab one leg behind your and stretch it so;
You do your best rendition of an archer’s bow.
Now put your hands up skinny top,
Legs in tight.
Stand on your tippy toes, and you’re an arrow in flight.
Now sit like an easy chair,
Even though nothing’s there
Put your hands in your lap
IN the Balancing Act.
Now lay face down,
Grab your feet, don’t let go,
And you’ll soon be ding the banana boat.
Now sit up,
Make yourself real small,
and you’ll wind up lookin’ like a circus ball. Yeah.
Put your arms and your legs out straight..
Wave goodbye ‘cause we’re running late.
It’s been fun, hurry back
To the Balancing Act.
‘cause we all got the knack
For the Balancing Act.

4.) The Freeze (2:14) –Used during generalization probes

Now here's a game that's kinda neat
Just get your body in the beat
But when you hear the music quit
Don't want to see you move a bit
Now you can dance any way you please
But listen closely for the freeze
(instrumental)
Freeze
Now you can hop and you can bop
And you can flip and you can flop
And you can rock and roll with style and ease
And you can bump and you can hustle
But don't ever move a muscle
When you hear the music come into the freeze.
(instrumental)
Freeze
Now here's a game that's kinda neat
Just get your body in the beat
But when you hear the music quit
Don't want to see you move a bit
Now you can dance any way you please
But listen closely for the freeze
(instrumental)
Freeze
Now you can hop and you can bop
And you can flip and you can flop
And you can rock and roll with style and ease
And you can bump and you can hustle
But don't ever move a muscle
When you hear the music come into the freeze.
(instrumental)
Appendix D: Academic Learning Time in Physical Education (ALT-PE)/Activity Rubric/General Prompts Recording Sheet
Participant Name ___________________________________________ Session _____ Phase ______

**10-Second Momentary Time Sampling** (T=task-oriented behavior; N= non-task oriented behavior; W= wait)

<table>
<thead>
<tr>
<th>Animal Action</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>TASK</td>
<td>Y</td>
<td>N</td>
<td>TASK</td>
</tr>
<tr>
<td>Clap hands</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Move like a horse (gallop)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Clap hands</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
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<tr>
<td>Clap hands</td>
<td></td>
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<tr>
<td>Move like a bee (walk and flap arms fast)</td>
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<td>Clap hands</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Move like a duck (walk with legs out wide and flap arms)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clap Hands</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Song Lyrics/Tasks** (Circle 1, 2, or 3 to designate song order and mark “X” in appropriate “Y” or “N” column to designate whether participants engaged in activity)

<table>
<thead>
<tr>
<th>Animal Action</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>TASK</td>
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<td>N</td>
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<td></td>
</tr>
<tr>
<td>Clap Hands</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Teacher Feedback** (Tally amount and type of feedback given by the instructor)

<table>
<thead>
<tr>
<th>Skill Feedback</th>
<th>Behavior Feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>General</td>
</tr>
<tr>
<td>Specific</td>
<td>Specific</td>
</tr>
<tr>
<td>General</td>
<td>General</td>
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<td>Specific</td>
<td>Specific</td>
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<tr>
<td>General</td>
<td>General</td>
</tr>
<tr>
<td>Specific</td>
<td>Specific</td>
</tr>
</tbody>
</table>

122
Appendix E: Song Lyric Block Plan/Rubric
## Animal Action II

<table>
<thead>
<tr>
<th>Activity/Skills</th>
<th>Present</th>
<th>Not Present</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clap hands</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Move like a horse (gallop)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clap hands</td>
<td></td>
<td></td>
</tr>
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<td></td>
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<tr>
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<td></td>
</tr>
<tr>
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<td></td>
<td></td>
</tr>
<tr>
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<td></td>
<td></td>
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<tr>
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<tr>
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<td></td>
<td></td>
</tr>
<tr>
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<td></td>
</tr>
<tr>
<td>Clap hands</td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>Clap Hands</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Bean Bag Boogie II

<table>
<thead>
<tr>
<th>Activity/Skill</th>
<th>Present</th>
<th>Not Present</th>
</tr>
</thead>
<tbody>
<tr>
<td>Put your bean bag on your arm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Move your body to the sound (standing and moving)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Put your bean bag on your nose</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Put your bean bag on your wrist</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Move your body to the sound (move standing up)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hold your beanbag in your hand</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rock to the beanbag boogie (stand and rock back and forth)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Put your bean bag on your foot</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Move any way you choose (move around)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Put your bean bag on your leg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Put your bean bag on your chest</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Move your body all around (move around)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hold your beanbag in your hand</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Twist to the beanbag boogie (twist torso while standing)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Put your bean bag under your chin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rock and boogie to the sound</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Put your bean bag under your arm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Put your bean bag between your knees</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boogie to the sound (move around)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Put your beanbag in your hand</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dance to the beanbag boogie</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activity/Skill</td>
<td>Present</td>
<td>Not present</td>
</tr>
<tr>
<td>--------------------------------------------------------</td>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>Put your arms down low</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Put your head up high</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bend your body down</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Put your arms back flat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spread your legs out wide</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Point your hands up high</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grab one leg behind you</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Put your arms together up top</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Put your legs together</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stand on your tippie toes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sit down in a chair (bend knees and sit your hips down)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Put your hands in your lap</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lay face down on the ground</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grab your feet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sit up in a small ball (crouch or kneel down in a small ball)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sit with your arms and legs out straight</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wave goodbye</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix F: Preschool Approval Letter
February 28, 2012

To Whom It May Concern:

Shannon Titus has been approved to conduct research here at Oakstone Academy Preschool. Please feel free to contact me with any questions or concerns.

Thank you,

Sean Hanrahan
Preschool Director
Oakstone Academy
Phone: 614-890-7854
E-mail: Shanrahan@ccde.org
Appendix G: Behavioral and Social Sciences Human Subjects Institutional Review Board (IRB)
March 12, 2012

Protocol Number: 2012B0057
Protocol Title: THE USE OF MUSIC TO INCREASE TASK-ORIENTED BEHAVIORS IN PRESCHOOL CHILDREN WITH AUTISM SPECTRUM DISORDERS IN A GROSS MOTOR SETTING, David L. Porretta, Shannon M. Titus, School of Physical Activity & Educational Services

Request to amend the protocol dated 02/28/12--Add Oakstone Academy Preschool as research site.

Type of Review: Amendment—Expedited
Approval Date: March 8, 2012
IRB Staff Contact: Carolyn Hagopian
(614) 292-0569
Hagopian.5@rf.osu.edu

Dear Dr. Porretta,

The Behavioral and Social Sciences IRB APPROVED the above referenced research.

Note that if applicable, informed consent (and HIPAA research authorization) must be obtained from subjects or their legally authorized representatives and documented prior to research involvement. The IRB-approved consent form and process must be used. Changes in the research (e.g., recruitment procedures, advertisements, enrollment numbers, etc.) or informed consent process must be approved by the IRB before they are implemented (except where necessary to eliminate apparent immediate hazards to subjects).

It is the responsibility of all investigators and research staff to promptly report to the IRB any serious, unexpected and related adverse events and potential unanticipated problems involving risks to subjects or others.

This approval is issued under The Ohio State University’s OHRP Federalwide Assurance #00006378. All forms and procedures can be found on the ORRP website – www.orrp.osu.edu. Please feel free to contact the IRB staff contact listed above with any questions or concerns.

Michael Edwards, PhD, Chair
Behavioral and Social Sciences Institutional Review Board
Appendix H: Diagram of Study Space
Appendix I: Social Validity Questionnaire
Social Validity Questionnaire

Circle the number that best corresponds to the following statements
1 = Strongly Agree
2 = Agree
3 = Disagree
4 = Strongly Disagree
NA = Not Applicable

<table>
<thead>
<tr>
<th></th>
<th>SA</th>
<th>A</th>
<th>D</th>
<th>SD</th>
<th>NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>My child/student looked forward to attending music and physical activity sessions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Learning motor skills and being physically active are important for my child/student to live a healthy lifestyle</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>As a result of participating in the study my child/student exhibits greater task-oriented behaviors when music is presented.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>My child/student enjoys listening to music and being active with his/her friends</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
Appendix J: Treatment Fidelity Checklist
<table>
<thead>
<tr>
<th>Present</th>
<th>Absent</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Investigator gives explicit gross motor instructions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Investigator encourages participant to stay on task (when needed) but does not stop lesson</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Investigator positively interacts with participant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Investigator models gross motor skills but relies on the participant to carry them out independently</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Session last between 9-13 minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Investigator positively reinforces task-oriented behaviors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Research redirects child but continues lesson when child is off task</td>
</tr>
</tbody>
</table>