VISUAL SUPPORTS FOR TGMD-2 TESTING IN YOUTH WITH AUTISM SPECTRUM DISORDER

by

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Submitted in partial fulfillment of the requirements for
Departmental Honors in the Department of Kinesiology
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Fort Worth, Texas

May 3, 2013

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TABLE OF CONTENTS

LIST OF TABLES

INTRODUCTION

The prevalence of Autism Spectrum Disorder (ASD) is increasing rapidly in the United States. When autism was originally identified in 1943, it was estimated that 1 in 10,000 children had the disorder. Today, this figure has increased drastically, and now approximately 1 in 88 children are diagnosed with ASD in the United States (CDC, 2012). The rise in prevalence of ASD has a large impact on the educational system. One area affected is the ability to properly measure and assess the skills of individuals with ASD. Due to communication deficits associated with ASD, standard methods of measurement and assessment might not be appropriate. An emerging area of research is identifying and examining, appropriate measurement, and assessment materials.

One of the most widely used test materials is the Test of Gross Motor Development-2 (TGMD-2) (Ulrich, 2000). The TGMD-2 assesses an individual's fundamental motor skills in two categories: locomotor skills and object control skills. The locomotor skills include running, galloping, hopping, leaping, horizontal jumping, and sliding. Object control skills include striking, dribbling, catching, kicking, overhand throwing, and underhand rolling. The importance of testing these twelve skills is because they act as building blocks of more advanced skills required in many popular games (Burton & Miller, 1998). Mastery of these advanced skills contributes to the overall physical, social, emotional, and psychological development (Kovar, Combs, Campbell, Napper-Owen, & Worrell, 2007).

Past research by Staples and Reid (2010) showed individuals with ASD were performing the motor skills at the same level as typically developing children half their age. One possible reason for these results may be that the TGMD-2 is administered

verbally, and children with ASD are predominantly visual learners (Broun, 2004; Bryan & Gast, 2000; Tissot & Evans, 2003; Welton et al., 2004). Therefore, due to their communication deficits, individuals with ASD may not fully understand what is being asked of them, and this may contribute to poor scores on the TGMD-2. A possible solution to this problem would be to add visual supports to the TGMD-2 testing protocol.

Visual supports have been shown to aid in decreasing confusion, enhancing perception and interaction, and decreasing disruptive behavior in individuals with ASD when incorporated into classroom and testing settings (Gredler, 2005; Rao & Gagie, 2006). Picture task cards are visual supports that depict an action based, goal-oriented task (Dooley et al., 2001; Johnston et al., 2003). The implementation of picture task cards could decrease verbal instruction and increase the focus on visual learning, making them valuable in TGMD-2 testing.

REVIEW OF LITERATURE

Autism Spectrum Disorder (ASD) is an inclusive title used to describe different developmental disorders of the brain, which can cause social and behavioral challenges (Lord & Jones, 2012). The term spectrum is meant to represent the diversity of symptoms seen and the range of level of functioning seen in children diagnosed with the disorder (CDC, 2013). Autism has been previously diagnosed by "at least two deficits or difficulties in social interaction, at least one deficit in communication, and at least one exhibition of repetitive and/or stereotypic behavior, interest, or activity at a level that interferes with cognitive function or the ability to speak and be easily understood by others" (American Psychiatric Association [APA], 2000). Recently, the medical community has moved away from defining ASD in this way, and diagnosis now depends

on a pattern of social-communication deficits and repetitive/restricted behaviors and interests (Lord & Jones, 2012).

The newest diagnostic criteria falls within the two domains previously mentioned: social-communicative deficits and repetitive/restricted behaviors and interests (Ozonoff, 2012). Now, a diagnosis of ASD requires three of three social communication symptoms and two of four repetitive/restricted behavior and interests (Zwaigenbaum, 2012). Symptoms of social-communicative deficits include little to no eye contact, lack of listening and response to people in their environment, failure to engage in group games or sharing with others, and an unusual response to the emotions of others.

Behavior challenges, characterized by repetitive actions or unusual behaviors, range from mild to severe (National Institute of Mental Health, 2011). For example, common repetitive actions for children with ASD are hand flapping, rocking back and forth, and obsessing over a specific topic such as science topics or train schedules (National Institute of Mental Health, 2011; Autism Speaks, 2012). Children with ASD typically enjoy being in a strictly scheduled environment giving them the same routine day after day (Olney, 2000). Sometimes, deviating from this routine can cause an emotional break down where the child lashes out in anger or frustration.

The symptoms most important to this study however are communication and motor coordination deficits seen in children with Autism Spectrum Disorder. While motor deficits are not a core part of an ASD diagnosis, they are commonly found in this population. The mastery of fundamental motor skills leads to the ability to perform more complex motor skills, like sports (Burton & Miller, 1998).

Fundamental Motor Skills

To fully understand why individuals with ASD struggle with motor development, it is important to discuss what a motor skill is. First, the definition of motor is different from that of movement, although sometimes these two terms are used interchangeably. Movement is motion that is observable, while motor refers to the process behind the actual movement (Burton & Miller, 1998). Motor abilities are inferred from performance of skills. Therefore, a motor skill is a goal-oriented movement that develops after the child learns to walk. This occurs in the first one to seven years of life, and is mastered after the age of ten (Burton & Miller, 1998). Most motor skills can be classified as being either locomotor or object control skills. Both locomotor and object control skills are considered to be fundamental motor skills. Mastery of fundamental motor skills should occur at an early age, and is necessary for overall development of a child (Payne & Isaacs, 2008). Testing motor skills gives an idea of an individual's ability to perform a motor ability like balance or hand-eye coordination (Burton & Miller, 1998).

Landa and Garret-Mayer (2006) conducted a prospective study between groups of children with langauge delay, typical development, and children with ASD. Parents of children later diagnosed with ASD noticed delayed motor performances of major milestones, especially walking (Landa & Garret-Mayer, 2006; Chawarska, et al., 2007). These motor milestone delays are noticed in children with autism around six months of age. These deficits progressed and worsened to affect gross motor skills at the ages of 14 and 24 months (Landa & Garrett-Mayer, 2006; Lloyd, et al., in press; Teittelbaum, et al., 1998). This study shows that motor performance deficits are prominent in children with ASD at a young age (Landa & Garrett-Mayer, 2006).

One past research study showed 80% of children with high functioning autism scored in the poor or very poor range for locomotor skills and 53% scored in the poor or very poor range for object control skills (Berkeley et al., 2001). Berkeley and colleagues found children with autism focused on the outcome or product of the skill rather than components that make up the skill. When directed to gallop, for example, the participants simply ran from point A to point B instead of performing the task (Berkeley et al., 2001). Although their research was done with the Test of Gross Motor Development-1, it supports claims that there is a delay in motor function among individuals with autism (Gowen & Hamilton, 2012). Interestingly, they found children with ASD scored better on object control skills than locomotor. Another study with high functioning participants found motor deficits to be common across the ASD spectrum, but not a universal trait for people with autism (Pan et al., 2009). Since both of these studies only look at children higher on the spectrum, arguments can be made that children lower on the spectrum will most likely score worse on the TGMD-2.

Another past research study found that children with ASD also scored low on the TGMD-2 due to low performance quality (Staples & Reid, 2010). Unlike the Berkeley study (Berkeley et al., 2001), this study included both high and low functioning children on the autism spectrum. Results found scores were poor for both locomotor and object control skills. The findings suggested children were able to perform the tasks in both categories (locomotor and object control), but their movements were choppy, uncoordinated, and often unrelated to the task. Although there have been adjustments in the TGMD-2, children with ASD are still scoring at the same level as typically developing children half their age (Staples & Reid, 2010). This might be because the

TGMD-2 is administered using verbal commands that children with ASD might not understand (Berkeley et al., 2001; Pan et al., 2009; Staples & Reid, 2010).

Learning Styles of Children with ASD

A characteristic of individuals with ASD is they are better visual learners than auditory learners, meaning they can better understand information if they can see the presented material (Broun, 2004; Bryan & Gast, 2000; Tissot & Evans, 2003; Welton et al., 2004). Speech and other time dependent formats are difficult for individuals with ASD to understand, so it is important to include visual supports when instructing this population (Simpson, 2005; Quill, 1995). Visual supports, like pictures, that illustrate both visual and time based information work best for individuals with ASD's comprehension of tasks (Simpson, 2005). Research shows the figures on visual supports should be simple drawings to minimize distraction while maximizing understanding (Quill, 1997; Welton et al., 2004). Visual supports can be applied during instruction and assessment by using picture task cards or activity schedules.

Individuals with ASD differ from typically developing children in the way they process sensory information (Cohen, 1998). They often have difficulties recognizing and identifying the appropriate stimuli (Broun, 2004). Sometimes instead of identifying and responding to relevant stimuli in their environment, individuals with ASD will focus on or misperceive specific stimuli (e.g., verbal stimuli like instructions). For example, a child with ASD might love a particular sport like indoor soccer, but as soon as the teacher mentions playing outside the child with ASD has a temper tantrum (Breslin, 2009).

The temper tantrum results from the child's eyes' sensitivity to sunlight, so his tantrum is a way to escape after hearing "outdoor soccer." The tantrum has nothing to do

with the child's feelings about soccer. Due to these sensory processing issues, individuals with ASD have trouble understanding time-based activities, which causes confusion during everyday life (Cohen, 1998). Routines provide consistency for individuals with ASD by reducing the confusion caused by not understanding one's environment. Deviating from a schedule could trigger inappropriate behaviors, which may result in the inability to communicate verbally (Cohen, 1998; Grandin, 1995).

Simple modifications to a natural environment will allow individuals with ASD to better process information and complete tasks. One of the best ways to simply modify an environment so an individual with ASD can better understand sensory stimulants is to add visual supports (Tissot & Evans, 2003). According to a study by Gredler (2005), using visual supports will enhance the perception and interpretation of information presented to individuals with ASD. This is because visual supports assist the individual by directing their attention to the appropriate stimuli while concretely showing the abstract components of a task. Also, visual supports help decrease confusion within an environment by organizing the individual with ASD's ability to process information and decreasing outbreaks of inappropriate behaviors (Rao & Gagie, 2006).

Common visual supports used are picture cards and activity schedules (Rao & Gagie, 2006). Both of these types of visual supports have been utilized in different methods of teaching for individuals with ASD because of their usefulness in decreasing off-task behaviors and increasing positive, on-task behaviors (Broun, 2004; Fittipaldi-Wert & Mowling, 2009; Quill, 1995; Rao & Gagie, 2006; Tissot & Evans; 2003). Two of the most used and widely known methods include the Picture Exchange Communication System (PECS) and the Treatment and Education of Autistic and Related

Communication-Handicapped Children (TEACCH). PECS focuses on the exchange of communication between two individuals based on the use of picture cards instead of verbal commands, while TEACCH facilitates better classroom behavior by using activity schedules and picture cards to transition between activities (Autism Speaks, 2012; Pecs-USA, 2012).

Picture cards provide information to an individual using pictorial depictions of a person, place, thing, or action when there is difficulty with verbal communication (Welton et al., 2004; Breslin, 2009). The use of picture cards that depict an action based, goal-oriented task become picture task cards, and they have been successful in decreasing disruptive behaviors and increasing behaviors relevant to the task (Dooley et al., 2001; Johnston et al., 2003). In a study conducted by Johnston et al. (2003), preschool aged children used a picture task card representing the question “Can I play?” to initiate interactions between peers instead of verbal communication. Results of this study showed the frequency of social interactions increased throughout the intervention, and individuals with ASD used the picture task card as a means of communication (Johnston, 2003).

Furthermore, activity schedules are pictures that list the sequence of activities the individual is to partake in for the completion of a specific task (Bryan & Gast, 2000; Welton et al., 2004). Activity schedules can be in paper form or multimedia form on a computer, and may be displayed publically for the teacher and student to see or privately for just the student (Bryan & Gast, 2000; Welton et al., 2004). They describe exactly how a task is supposed to be done, and the order in which the student is supposed to carry out the task. The theory behind activity schedules is they provide individuals with ASD consistency and relieve them of anxiety of what will happen next while decreasing

inappropriate behaviors (Welton et al., 2004). A study done by Bryan & Gast (2000), found activity schedules 90% of the time increased on-task behaviors and 70% of the time decreased off-task, or inappropriate behaviors providing some truth to this theory. Incorporating visual supports into everyday activities may have the ability to increase understanding of simple tasks, like fundamental motor skills.

TGMD-2 and Importance of Testing FMS

Fundamental motor skills act as the building blocks to other activities such as sport, dance, and play (Burton & Miller, 1998). Children are exposed to many opportunities to participate in physical activity, and they will be more likely to engage in these healthy activities if they are confident they can perform the basic motor skills needed for sport (Payne & Isaacs, 2008, Staples et al., 2012). In order to ensure individuals with ASD are developing fundamental motor skills appropriately, testing is advised. Accuracy in testing fundamental motor skills is crucial to a child's development.

The Test of Gross Motor Development (Second Edition [TGMD-2]) is the most widely used assessment of fundamental motor skills in the United States (Ulrich, 2000). It assesses twelve motor skills in children between the ages of three and ten years. The locomotor skills (running, hopping, leaping, sliding, galloping, and horizontal jumping) are fluid and coordinated in nature (Staples et al., 2012). Object control skills (kicking, striking a stationary object, overarm throwing, catching, rolling, and dribbling) determine a child's ability to control a ball (Staples et al., 2012).

While there have been updates to the administration protocol of the TGMD-2, the instructions are still to be given in verbal commands (Ulrich, 2000). Due to the visual learning styles of children with ASD, there may be some confusion of what is being

asked of them during the test administration of the TGMD-2. This confusion could be a factor in the low scores seen on the TGMD-2 by children with ASD (Breslin & Rudisill, 2011). Research shows the addition of visual supports in administering the TGMD-2 could increase gross motor quotient scores on the TGMD-2.

A study done by Breslin and Rudisill (2011) implemented two forms of visual supports in the administration of the TGMD-2: picture activity schedules and picture task cards. There was not a significant increase in gross motor quotient scores after the picture activity schedule protocol. The investigators assumed this was due to an information overload to the child with ASD in an individual testing setting (Breslin & Rudisill, 2011). However, their results did show an approximate six-point increase in gross motor quotient scores in subjects that were administered the picture task card protocol compared to the traditional protocol. The picture task card protocol minimized verbal commands and focused on the visual learning styles of children with ASD to clearly communicate instructions for the skills being tested (Breslin & Rudisill, 2011).

While scores with the picture task card protocol increased, the study confirmed past findings that children with ASD have some delays in their fundamental motor skills (Berkeley et al., 2001; Breslin & Rudisill, 2011; Pan et al., 2009; Staples & Reid, 2010). The use of visual supports in administering the TGMD-2 could also increase the validity and reliability of the test, providing more accurate results regarding the abilities of individual with ASD. Therefore, due to findings from past research and our understanding of ASD, we hypothesize that the use of visual supports will increase test scores in youth with autism spectrum disorder on the TGMD-2. The purpose of this study is to assess the performance of individuals with ASD on the TGMD-2 to see if the

implementation of visual supports facilitates better understanding of TGMD-2 instructions.

METHOD

Participants

A total of 8 children with ASD were recruited for this study, and divided into two subgroups for comparison: a) TGMD-2 with standardized procedures and b) TGMD-2 with picture task cards. The children with ASD were ages 8-15 years old all of whom were male (n = 8, Caucasian = 7, African American = 1). All participants had a diagnosis of autism from a trained, licensed school or clinical psychologist. Participants were excluded from the study if they had a physical disability restricting them from physical activity, adverse negative reactions to new situations, or a concomitant diagnosis with ASD as reported by the participants' parents. The age range of the participants ensures the participants would be able to perform the skills on the TGMD-2. The parents of the children determined the severity of the participant's social behaviors completing the Social Responsiveness Scale (SRS). Participants were from the Dallas-Fort Worth area.

The control group was made up of 4 individuals selected at random, ages (8.3 – 13.11 years old). These participants were administered the TGMD-2 with normal standardized procedures. This group provides baseline information regarding the performance of children with ASD on the TGMD-2. The treatment group was comprised of 4 individuals also selected at random, ages (8.4 – 15.2 years old). These participants were administered the TGMD-2 with picture task cards in addition to standardized procedures.

Instruments

Social Responsiveness Scale

The SRS is a 65-item questionnaire that assesses social behaviors among youth with ASD (Constantino & Gruber 2005). The questions on the SRS measure multiple areas of social impairment: a) social information processing, b) social awareness, c) autistic characteristics, d) anxiety or avoidance of social situations, and e) ability for reciprocal social communication. The parents completed the survey upon arriving at the Physical Activities and Developmental Disabilities lab on the campus of Texas Christian University, or as part of a packet sent home by the child's teacher. The child's social impairment is measured on a quantitative scale that ranges from mild to severe. For this study, the total score, which reflects total social impairment, and social communication score were used.

Test of Gross Motor Development – 2 (TGMD-2)

The TGMD-2 examines object-control and locomotor skills to assess the fundamental motor skills of children. The object-control skills include stationary dribbling, overarm throwing, catching, striking a stationary ball, kicking, and underhand roll, and the locomotor skills include running, leaping, galloping, hopping, sliding, and jumping (Ulrich, 2000). Every skill is assessed on three to five performance criteria, and each performance criteria represents a mature movement pattern.

The children in the study performed each skill twice. A binary score of 1 or 0 is given for each criterion demonstrating the child did or did not perform the specific criterion correctly for the given skill. These individual raw scores are summed as directed in the *TGMD-2 Examiner's Manual,* and used to find a standard score for each subtest

(locomotor and object-control) ranging from 1 to 20 adjusted for age and sex. The two subtest values are summed then compared to a table in the *TGMD-2 Examiner's Manual*. This table determines the gross motor quotient score, which ranges from 46 to 160, and is based on normative data previously collected. The child's performance age equivalent can also be found by comparing each subtest value to another table in the *TGMD-2 Examiner's Manual*. The TGMD-2 has reliability coefficients ranging from 0.79 to 0.90 and 0.67 to 0.93 for the locomotor subtest and object control subtest respectively**.**

The primary investigator was trained to evaluate the subjects' test performance on each criterion as directed by the *TGMD-2 Examiner's Manual*. Training consisted of scoring videos of typically developing children performing the TGMD-2, and maintaining 90% accuracy with the scores of the original test administer for these videos. Test scores for this study were determined from videotaped footage of the child's performance of each skill. The profile/examiner record form for the TGMD-2 can be found in Appendix A. The scores used in this study included locomotor standard scores, object control standard scores, age equivalent scores, and the mean scores for each skill.

Procedure

Data was collected during the spring semester in the Physical Activity and Developmental Disability Lab at Texas Christian University (TCU), and at Wedgewood Academy, a local non-profit school for children with learning differences and ADHD. The TGMD-2 was administered to each participant once over a period of one hour in the lab, and at the school. Approval was attained via informed consent by the parents of the participants. Before administration of the TGMD-2, participants read a social story

explaining the study, and gave their oral assent confirming their willingness to participate in this study.

After obtaining consent, upon arrival at the lab or via completion of the home packet, parents of the participants completed the Social Responsiveness Scale. Before testing began, the participant became acclimated to the testing environment. The child with ASD was administered the TGMD-2 under one of two conditions: the traditional protocol or the picture task card protocol. The protocol the participant was given was randomly assigned after initial recruitment and prior to administration of the test. The entire testing session was videotaped.

For the traditional protocol condition, the participant was directed to complete the skills exactly as directed by the *TGMD-2 Examiner's Manual* protocol. The test administrators presented the test to the participant using complete sentenced verbal instruction, and demonstrated the skill up to two times if requested by the participant for clarification. The participants were allowed one practice trial. After the practice trial, the participant was instructed to perform each skill twice for scoring.

For the picture task card protocol, the test administrators continued to give verbal instruction and demonstration, but added the use of picture task cards before the skill was performed. The picture task cards are basic, gender-neutral figures depicting the different tasks required by the TGMD-2. If a second demonstration was requested, the picture task card was also shown to the participant again. The picture task card was shown in between the two trials for each skill on the TGMD-2.

RESULTS

The purpose of this study was to investigate the use of picture task cards on performance of the Test of Gross Motor Development-2 (Ulrich, 2000) in youth with Autism Spectrum Disorder to see if the implementation of the visual supports will enhance the understanding of activities in physical education and therapeutic settings for children with ASD. The hypothesis of this study was that the picture task card group would perform better on the TGMD-2 than the standard testing group because of the implementation of the visual supports. Performance of each group was measured by locomotor and object control standard scores and the age equivalence of each group. It was assumed both groups would be of similar chronological ages and levels of severity, which were determined by parent completion of supplemental information forms and the SRS.

For each component of the TGMD-2, effect size was calculated and for the majority of skills was found to be huge. Effect size determines the estimated magnitude of a relationship without stating the effect size represents the true population. The meaningfulness of the data is calculated by determining effect size. Effect size is particularly important when sample size is not large enough to have statistical significance.

The first assumption of this study was that the two test groups would be similar in chronological age and level of overall severity. The parent of the participant reported chronological age, and determined their child's severity by completion of the SRS. An independent t-test was run to compare the group mean scores for the SRS. The means and standard deviations for the SRS t-score for the standard testing group and the picture task

card group were 57.75 +/- 8.99 and 72.25 +/- 5.56, respectively. The SRS t-scores were statistically different showing the picture task card group had a higher mean (p=0.041). For the social communication domain of the SRS, the means and standard deviations for the standard testing group and the picture task card group were 58.00 +/- 9.20 and 70.75 +/- 6.24, respectively. The social communication domain of the SRS was not statistically different between the two groups (p=0.068).

Table 1

Means, standard deviations, and p-values for group chronological age, SRS t-score, and social communication domain of the SRS.

Group	Chronological Age	p-value	SRS T-score	p-value	Social Communication	p-value
Standard testing	10.88 +/- 2.02	0.587	57.75 +/- 8.99	0.034	58.00 +/- 9.20	0.062
Picture task card	11.88 +/- 2.84	0.589	72.25 +/- 5.56	0.041	70.75 +/- 6.24	0.068

Next, an independent t-test was conducted to determine if there was a significant difference between the means on the TGMD-2. The hypothesis of this study was the picture task card group would have higher mean scores on the TMGD-2. The means and standard deviations for the standard testing and picture task card groups were 3.25 +/- 0.96 and 7.50 +/- 2.08 on the locomotor skills, respectively. The locomotor skills were statistically different showing the picture task card group performed better (p= 0.019). The means and standard deviations for the standard testing and picture task card groups were 2.00 +/- 1.16 and 4.50 +/- 2.52 on the object control skills, respectively. While the picture task card group had a higher mean, the data was not significantly different (p=0.142).

Table 2

Means, standard deviations and p-values for locomotor and object control standard scores by each group.

Group	Locomotor	p-value	Object Control	p-value
Standard testing	3.25 +/- 0.96	0.010	2.00 +/- 1.16	0.121
Picture task card	7.50 +/- 2.08	0.019	4.50 +/- 2.52	0.142

Since there was significance between the locomotor standard score means, another independent t-test as run to determine which skill was responsible for the significance. The results indicate that the difference between means in the horizontal jump were responsible for the significance in the locomotor standard scores. The means and standard deviations for horizontal jump were 1.75 +/- 0.957 for the standard testing group and 6.00 +/- 2.160 for the picture task card group (p=0.022). Mean differences for each individual skill on the TGMD-2 is presented in Appendix G.

The performance on the TGMD-2 was also measured by comparing age equivalents between the two groups. The mean chronological ages were 10.88 +/- 2.02 and 11.88 +/- 2.84 for the standard testing and picture task card group, respectively. The results indicate that for the locomotor skills the picture task card group performed at an age equivalent of (insert #) and the standard testing group performed at an age equivalent of (insert#). For object control skills, the results indicate the picture task card group performed at an age equivalent of (insert #) and the standard testing group performed at an age equivalent of (insert #). The age equivalents are presented in Appendix F.

Lastly, the effect size scores were determined for each TGMD-2 skill as well as the overall locomotor and object control standard scores. The scale for effect size is as follows: negligible effect (≥ -0.15 and <0.15), small effect (≥0.15 and <0.40), medium effect (≥0.40 and <0.75), large effect (≥0.75 and <1.10), very large effect (≥1.10 and <1.45), and huge effect (>1.45). The locomotor and object control effect size scores were 3.03 and 1.47, respectively. Since both scores were greater than 1.45, the effect size for locomotor and object control skills was considered huge. The majority of the individual skills also had effect sizes of at least large. These results can be seen in Table 3 below.

Table 3

Effect size scores for the locomotor, object control, and individual skills on the TGMD-2.

Skill	Effect Size score	Percent Change
Locomotor standard	3.03	135
Object Control standard	1.47	131
Run	0.96	26
Gallop	0.89	29
Hop	1.51	35
Leap	1.59	50
Horizontal Jump	2.94	243
Slide	0.60	-7
Strike	0.57	21
Dribble	1.55	35
Catch	0.20	5
Kick	0	0
Overhand Throw	2.16	92
Underhand Roll	0.80	36

DISCUSSION

The purpose of this study was to investigate the use of picture task cards on performance of the Test of Gross Motor Development-2 (Ulrich, 2000) in youth with Autism Spectrum Disorder to see if such use will enhance the understanding of activities in physical education and therapeutic settings for children with ASD. The results partially supported the hypothesis that the treatment group would have higher scores on the TGMD-2. The picture task card group performed better on the locomotor and object control skills compared to the standard testing group. While the difference between the two means for the locomotor standard scores were statistically significant, the difference between the object control standard scores was not. This was also true for the locomotor and object control age equivalent scores. The picture task card group performed at a higher age equivalent in both locomotor and object control skills than the standard testing group, but only the locomotor age equivalent was statistically significant.

In the picture task card protocol, the test administrator used short verbal commands to minimize the auditory information, and showed the visual support prior to the physical demonstration of the skill to maximize visual learning, which are children with ASD's strength (Grandin, 1995; Simpson 2005). Implementing the visual supports into the testing protocol yielded almost a four and a half point difference in the mean locomotor standard scores between the two testing groups. The picture task card group also scored two points higher than the standard testing group on the mean object control standard scores. The effect sizes for both locomotor and object control standard scores were considered to be huge (locomotor effect size = 3.03, object control effect size = 1.47) showing the data to be quite meaningful.

It is important to note that individuals with ASD have different levels of functioning. The severity level of each participant's ASD was determined by the completion of the SRS by the individual's parent. The mean SRS t-scores from each group show there is a statistical difference in overall severity between the two test groups. The picture task card group had a statistically higher SRS t-score than the traditional protocol group. This means the picture task card group was more severe overall. In regards to the social communication domain of the SRS, however, there was no statistical difference between the two groups. The social communication domain was most important to this study because it analyzes the individual's ability to communicate with others. The results show that even though the picture task card group was more impaired, they performed at a higher age equivalent than the standard testing group. This is evidence that the visual supports had a positive effect on the outcome of the TGMD-2.

This study supports past findings that regardless of the testing protocol group, individuals with ASD are delayed in their execution of the fundamental motor skills on the TGMD-2. This can be seen by the locomotor and object control standard scores for each group. While the picture task card group scored better than the standard testing group, both groups performed at an age lower than the groups' mean chronological age. These results also support past findings by Staples and Reid (2010) that show children with ASD in the standard testing group performed the skills of the TGMD-2 at a level half their chronological age. Overall, the results of this study confirmed past findings that individuals with ASD are impaired in their fundamental motor skill development as measured by the TGMD-2 (Berkeley et al., 2001; Pan et al., 2009; Staples & Reid, 2010;

Breslin & Rudisill, 2011). The results, however, also show the picture task card group performed at a higher level on the TGMD-2 even though they were more impaired.

Although the results of this study partially supported the hypothesis, there were limitations that need to be addressed. The main limitation of this study is the lack of recruitment leading to a small sample size in this study. This lack of recruitment was not from lack of effort, but mainly attributed to a lack of parent understanding. The packet sent home by the individual's teachers consisted of reading materials explaining the study to parents, but investigators were unable to further explain the testing procedures. Another reason for the small sample size could be because recruitment took place over the school's spring break. Some of the parents may have forgotten to read and complete the send home packet. The small sample size led to a lack of significance in the data even though the picture task card group performed at a higher mean in most skills on the TGMD-2. A cross over design might have been appropriate due to the small sample size, but would potentially create a learning effect. A learning effect could artificially inflate test scores on the TGMD-2 and hinder results.

Positive aspects of this study include the similarity between the two test groups. The difference in mean age of the two test groups was only a year apart, 10.88 for the standard test group and 11.88 for the picture task card group. Also, the social communication scores on the SRS were not statistically different showing the groups were at similar levels of functioning in that domain. Another positive of this study was the large effect size scores throughout the majority of the data. Even though the sample size was small, the higher means for locomotor and object control standard scores demonstrated huge effect size scores suggesting the difference between the means was, in

fact, meaningful. Also, each skill in the TGMD-2 with the exception of slide, kick, and catch had at least an effect size score of large (Cohen's $d \geq 0.75$). The skills that were the most significantly different between the two groups were the horizontal jump (locomotor) and the overhand throw (object control). This may be due to the complicated nature of these particular skills. Both tasks require a detailed preparation phase, and fluid motion throughout the entirety of the skill. Future studies should replicate this research design with more participants in a smaller age range to determine if the data in this study was meaningful.

In summary, the results from this study confirm past findings that children with ASD are delayed in their motor skill development. The findings also show that incorporation of picture task cards into the instructions of the TGMD-2 may facilitate better communication between the test administrator and the individual with ASD resulting in more valid test scores. In spite of the small sample size, the effect size scores indicate there is a large relationship between the mean differences of the two testing groups for the locomotor and object control standard scores. This data combined with the performance at an increased age equivalent shown by the picture task card group suggest implementing visual supports into test settings would be beneficial to children with ASD.

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APPENDICES

Appendix A. Informed Consent

Texas Christian University
Fort Worth, Texas

CONSENT TO PARTICIPATE IN RESEARCH

Title of Research: Visual Supports for TGMD-2 Testing in Youth with Autism Spectrum Disorder

Funding Agency/Sponsor: TCU Kinesiology Department

Study Investigators:
Olivia Ulett, Student Member of TCU John V. Roach Honors College,
Philip Esposito, Ph.D., Assistant Professor of Kinesiology

What is the purpose of the research?
The purpose of this study is to examine the use of picture task cards on the results of the Test of Gross Motor Development-2 for individuals with Autism Spectrum Disorder.

How many people will participate in this study?
30 individuals with Autism Spectrum Disorder will be invited to participate in this study.

What is my involvement for participating in this study?
Your child will perform the TGMD-2 once in our Physical Activities and Disabilities lab in the TCU Kinesiology Department. We will have your child run, leap, gallop, horizontal jump, hop, slide, catch, throw, dribble, strike a stationary ball, and roll a ball. These are the components of the locomotor and object control portions of the TGMD-2.

How long am I expected to be in this study for and how much of my time is required?
You and your child will visit our lab once for one hour.

What are the risks of participating in this study and how will they be minimized?
Any physical activity has risk for minor injury. With the object control portion of the test, there is minimal risk because the objects could injure the child if mishandled. We will take the required precautions to help minimize this risk of injury by having trained investigators present during the test. There are no psychological, social, or privacy risks. With any study, there is unforeseen risk.

What are the benefits for participating in this study?
You will receive the results of your child's performance on the TGMD-2. These results will be standardized which means you will see your child's results compared to those of other children in their same age and gender groups.

Will I be compensated for participating in this study?
Participants will not be compensated.

What is an alternate procedure(s) that I can choose instead of participating in this study?
You may choose to NOT participate.

How will my confidentiality be protected?
All information regarding participation in the study, SRS form, and lab results obtained during the study will be kept confidential. Also, confidentiality will be kept after enrollment by changing your child's name to an alpha-numeric code which will become their participant identification number for research presentation purposes. Any results from the study that are made public via research presentations or publications will be expressed as group averages.

With your permission, photographic images might be taken of your child during their participation in the research. These images are for:

- Showing participants in other research studies.
- Scientific or scholarly publications
- Scholarly conferences, meeting, or workshops.
- Educational purposes used in classrooms
- Public presentations (community, Special Olympics, etc.).

You may consent to some of these uses or none of these uses.

Is my participation voluntary?
Yes, participation in this study is completely voluntary.

Can I stop taking part in this research?
Yes, your child may withdraw from the study at any point in time without penalty or repercussions.

What are the procedures for withdrawal?
Tell us your child is no longer able/wish to participate in the study. You may do this by phone, e-mail, or in person.
Olivia Ulett, Telephone: 817-257-6859 , email: o.ulett@tcu.edu
Phil Esposito, Telephone: 817-257-6866, email: p.esposito@tcu.edu

Will I be given a copy of the consent document to keep?
Yes, you will get a copy of this form to keep.

Who should I contact if I have questions regarding the study?
Olivia Ulett, Telephone: 817-257-6859 , email: o.ulett@tcu.edu

Who should I contact if I have concerns regarding my rights as a study participant?
Dr. Gloria Solomon, TCU Kinesiology Review Committee Chair, Telephone 817-257-6868.
Dr. Debbie Rhea, Associate Dean of Research, HCNHS, Telephone 817-257-5263.

Your signature below indicates that you have been read the information provided above, you have received answers to all of your questions and have been told who to call if you have any more questions, you have freely decided to participate in this research, and you understand that you are not giving up any of your legal rights.

Participant's Name (please print): _____

Participant's Signature: _____ Date:_____

Investigator's Signature: _____ Date:_____

Appendix B. Media Release Form

TEXAS CHRISTIAN UNIVERSITY
Media Recording Release Form

Title of Research: Visual Supports during TGMD-2 Testing in Youth with Autism Spectrum Disorder
Study Investigators: Olivia Ulett
Record types: As part of this study, the following types of media records will be made of you during your participation in the research:

Photographic Image
Video Recording

Record uses. Please indicate what uses of the media records listed above you are willing to permit by initialing below and signing the form at the end. Your media records will only be used in ways that you agree to.

The media record(s) can be shown/played to participants in other research studies.

Please initial: _____

The media records(s) can be used for scientific or scholarly publications.

Please initial: _____

The media records(s) can be used at scholarly conferences, meeting, or workshops.

Please initial: _____

The media records(s) can be used in classrooms (TCU classes).

Please initial: _____

The media record(s) can be shown/played in public presentations (community, Special Olympics, etc.).

Please initial: _____

The media record(s) can be shown/played on the Internet/World Wide Web (i.e. TCU research page).

Please initial: _____

I have read the above descriptions and give my consent for the use of the media recordings as indicated by my initials above.

Name: _____

Signature: _____ Date: _____

If you have concerns regarding your rights as a study participant, contact Dr. David Jenkins, Chair, TCU Institutional Review Board, Telephone 817-257-6157 & David Cross, Co-Chair, TCU Institutional Review Board, Telephone, 817-257-6416

Appendix C. Picture Task Cards


DRIBBLE
OVERARM THROW
RUN
HOP
HORIZONTAL JUMP
KICK

Appendix D. TGMD-2 Recording Sheet

TGMD–2

Test of Gross Motor Development–Second Edition

Profile/Examiner Record Form

Section I. Identifying Information

Name _____ School _____

Male ☐ Female ☐ Grade _____ Referred by _____

Date of Testing _____ _____ _____ Reason for Referral _____

Date of Birth _____ _____ _____ Examiner _____

Age _____ _____ _____ Examiner's Title _____

Section II. Record of Scores

First Testing

	Raw Score	Standard Score	Percentile	Age Equivalent
Locomotor	____	____	____	____
Object Control	____	____	____	____
Sum of Standard Scores		____		
Gross Motor Quotient		____	____	

Second Testing

	Raw Score	Standard Score	Percentile	Age Equivalent
Locomotor	____	____	____	____
Object Control	____	____	____	____
Sum of Standard Scores		____		
Gross Motor Quotient		____	____	

Section III. Testing Conditions

A. Place Tested _____

	Interfering				Not Interfering
B. Noise Level	1	2	3	4	5
C. Interruptions	1	2	3	4	5
D. Distractions	1	2	3	4	5
E. Light	1	2	3	4	5
F. Temperature	1	2	3	4	5

G. Notes and other considerations _____

Section IV. Other Test Data

Name of Test	Date	Standard Score	TGMD–2 Equivalent

Section V. Profile of Standard Scores

Standard Scores	Locomotor	Object Control	Standard Scores	Quotients	Gross Motor Quotient	Quotients
20	. .	. .	20	150	. .	150
19	. .	. .	19	145	. .	145
18	. .	. .	18	140	. .	140
17	. .	. .	17	135	. .	135
16	. .	. .	16	130	. .	130
15	. .	. .	15	125	. .	125
14	. .	. .	14	120	. .	120
13	. .	. .	13	115	. .	115
12	. .	. .	12	110	. .	110
11	. .	. .	11	105	. .	105
10	— —	— —	10	100	— —	100
9	. .	. .	9	95	. .	95
8	. .	. .	8	90	. .	90
7	. .	. .	7	85	. .	85
6	. .	. .	6	80	. .	80
5	. .	. .	5	75	. .	75
4	. .	. .	4	70	. .	70
3	. .	. .	3	65	. .	65
2	. .	. .	2	60	. .	60
1	. .	. .	1	55	. .	55

Additional copies of this form (#9262) may be purchased from
PRO-ED, 8700 Shoal Creek Blvd., Austin, TX 78757-6897
800/897-3202 Fax 800/397-7633

Section VI. Subtest Performance Record

Preferred Hand: Right ☐ Left ☐ Not Established ☐
Preferred Foot: Right ☐ Left ☐ Not Established ☐

Locomotor Subtest

Skill	Materials	Directions	Performance Criteria	Trial 1	Trial 2	Score
1. Run	60 feet of clear space, and two cones	Place two cones 50 feet apart. Make sure there is at least 8 to 10 feet of space beyond the second cone for a safe stopping distance. Tell the child to run as fast as he or she can from one cone to the other when you say "Go." Repeat a second trial.	1. Arms move in opposition to legs, elbows bent			
			2. Brief period where both feet are off the ground			
			3. Narrow foot placement landing on heel or toe (i.e., not flat footed)			
			4. Nonsupport leg bent approximately 90 degrees (i.e., close to buttocks)			
					Skill Score	
2. Gallop	25 feet of clear space, and tape or two cones	Mark off a distance of 25 feet with two cones or tape. Tell the child to gallop from one cone to the other. Repeat a second trial by galloping back to the original cone.	1. Arms bent and lifted to waist level at takeoff			
			2. A step forward with the lead foot followed by a step with the trailing foot to a position adjacent to or behind the lead foot			
			3. Brief period when both feet are off the floor			
			4. Maintains a rhythmic pattern for four consecutive gallops			
					Skill Score	
3. Hop	A minimum of 15 feet of clear space	Tell the child to hop three times on his or her preferred foot (established before testing) and then three times on the other foot. Repeat a second trial.	1. Nonsupport leg swings forward in pendular fashion to produce force			
			2. Foot of nonsupport leg remains behind body			
			3. Arms flexed and swing forward to produce force			
			4. Takes off and lands three consecutive times on preferred foot			
			5. Takes off and lands three consecutive times on nonpreferred foot			
					Skill Score	
4. Leap	A minimum of 20 feet of clear space, a beanbag, and tape	Place a beanbag on the floor. Attach a piece of tape on the floor so it is parallel to and 10 feet away from the beanbag. Have the child stand on the tape and run up and leap over the beanbag. Repeat a second trial.	1. Take off on one foot and land on the opposite foot			
			2. A period where both feet are off the ground longer than running			
			3. Forward reach with the arm opposite the lead foot			
					Skill Score	

Skill	Materials	Directions	Performance Criteria	Trial 1	Trial 2	Score
5. Horizontal Jump	A minimum of 10 feet of clear space and tape	Mark off a starting line on the floor. Have the child start behind the line. Tell the child to jump as far as he or she can. Repeat a second trial.	1. Preparatory movement includes flexion of both knees with arms extended behind body			
			2. Arms extend forcefully forward and upward reaching full extension above the head			
			3. Take off and land on both feet simultaneously			
			4. Arms are thrust downward during landing			
					Skill Score	
6. Slide	A minimum of 25 feet of clear space, a straight line, and two cones	Place the cones 25 feet apart on top of a line on the floor. Tell the child to slide from one cone to the other and back. Repeat a second trial.	1. Body turned sideways so shoulders are aligned with the line on the floor			
			2. A step sideways with lead foot followed by a slide of the trailing foot to a point next to the lead foot			
			3. A minimum of four continuous step–slide cycles to the right			
			4. A minimum of four continuous step–slide cycles to the left			
					Skill Score	
			Locomotor Subtest Raw Score (sum of the 6 skill scores)			

Object Control Subtest

Skill	Materials	Directions	Performance Criteria	Trial 1	Trial 2	Score
1. Striking a Stationary Ball	A 4-inch lightweight ball, a plastic bat, and a batting tee	Place the ball on the batting tee at the child's belt level. Tell the child to hit the ball hard. Repeat a second trial.	1. Dominant hand grips bat above nondominant hand			
			2. Nonpreferred side of body faces the imaginary tosser with feet parallel			
			3. Hip and shoulder rotation during swing			
			4. Transfers body weight to front foot			
			5. Bat contacts ball			
					Skill Score	
2. Stationary Dribble	An 8- to 10-inch playground ball for children ages 3 to 5; a basketball for children ages 6 to 10; and a flat, hard surface	Tell the child to dribble the ball four times without moving his or her feet, using one hand, and then stop by catching the ball. Repeat a second trial.	1. Contacts ball with one hand at about belt level			
			2. Pushes ball with fingertips (not a slap)			
			3. Ball contacts surface in front of or to the outside of foot on the preferred side			
			4. Maintains control of ball for four consecutive bounces without having to move the feet to retrieve it			
					Skill Score	

Skill	Materials	Directions	Performance Criteria	Trial 1	Trial 2	Score
3. Catch	A 4-inch plastic ball, 15 feet of clear space, and tape	Mark off two lines 15 feet apart. The child stands on one line and the tosser on the other. Toss the ball underhand directly to the child with a slight arc aiming for his or her chest. Tell the child to catch the ball with both hands. Only count those tosses that are between the child's shoulders and belt. Repeat a second trial.	1. Preparation phase where hands are in front of the body and elbows are flexed			
			2. Arms extend while reaching for the ball as it arrives			
			3. Ball is caught by hands only			
					Skill Score	
4. Kick	An 8- to 10-inch plastic, playground, or soccer ball; a beanbag; 30 feet of clear space; and tape	Mark off one line 30 feet away from a wall and another line 20 feet from the wall. Place the ball on top of the beanbag on the line nearest the wall. Tell the child to stand on the other line. Tell the child to run up and kick the ball hard toward the wall. Repeat a second trial.	1. Rapid continuous approach to the ball			
			2. An elongated stride or leap immediately prior to ball contact			
			3. Nonkicking foot placed even with or slightly in back of the ball			
			4. Kicks ball with instep of preferred foot (shoelaces) or toe			
					Skill Score	
5. Overhand Throw	A tennis ball, a wall, tape, and 20 feet of clear space	Attach a piece of tape on the floor 20 feet from a wall. Have the child stand behind the 20-foot line facing the wall. Tell the child to throw the ball hard at the wall. Repeat a second trial.	1. Windup is initiated with downward movement of hand/arm			
			2. Rotates hip and shoulders to a point where the nonthrowing side faces the wall			
			3. Weight is transferred by stepping with the foot opposite the throwing hand			
			4. Follow-through beyond ball release diagonally across the body toward the nonpreferred side			
					Skill Score	
6. Underhand Roll	A tennis ball for children ages 3 to 6; a softball for children ages 7 to 10; two cones; tape; and 25 feet of clear space	Place the two cones against a wall so they are 4 feet apart. Attach a piece of tape on the floor 20 feet from the wall. Tell the child to roll the ball hard so that it goes between the cones. Repeat a second trial.	1. Preferred hand swings down and back, reaching behind the trunk while chest faces cones			
			2. Strides forward with foot opposite the preferred hand toward the cones			
			3. Bends knees to lower body			
			4. Releases ball close to the floor so ball does not bounce more than 4 inches high			
					Skill Score	
			Object Control Subtest Raw Score (sum of the 6 skill scores)			

Appendix E. SRS Questionnaire

Social Responsiveness Scale (SRS) PC Answer Sheet

by John N. Constantino, M.D.

Published by
WESTERN PSYCHOLOGICAL SERVICES
wps. 12031 Wilshire Boulevard
Los Angeles, CA 90025-1251
Publishers and Distributors

Child's Name: _____ Child's ID: _____

Chronological Age: _____ Gender *(required)*: ☐ Female ☐ Male

Race/Ethnicity: ☐ American Indian/Alaska Native ☐ Asian ☐ Black/African American ☐ Hispanic/Latino
☐ Native Hawaiian/Pacific Islander ☐ White ☐ Other

Respondent's Name: _____

Relationship to Child *(required)*: ☐ Mother ☐ Father ☐ Other Custodial Adult ☐ Teacher ☐ Other Specialist

Examiner's Name: _____ Administration Date: _____

DIRECTIONS

For each question, circle the number that best describes the child's behavior *over the past 6 months*.

1 = NOT TRUE 2 = SOMETIMES TRUE 3 = OFTEN TRUE 4 = ALMOST ALWAYS TRUE

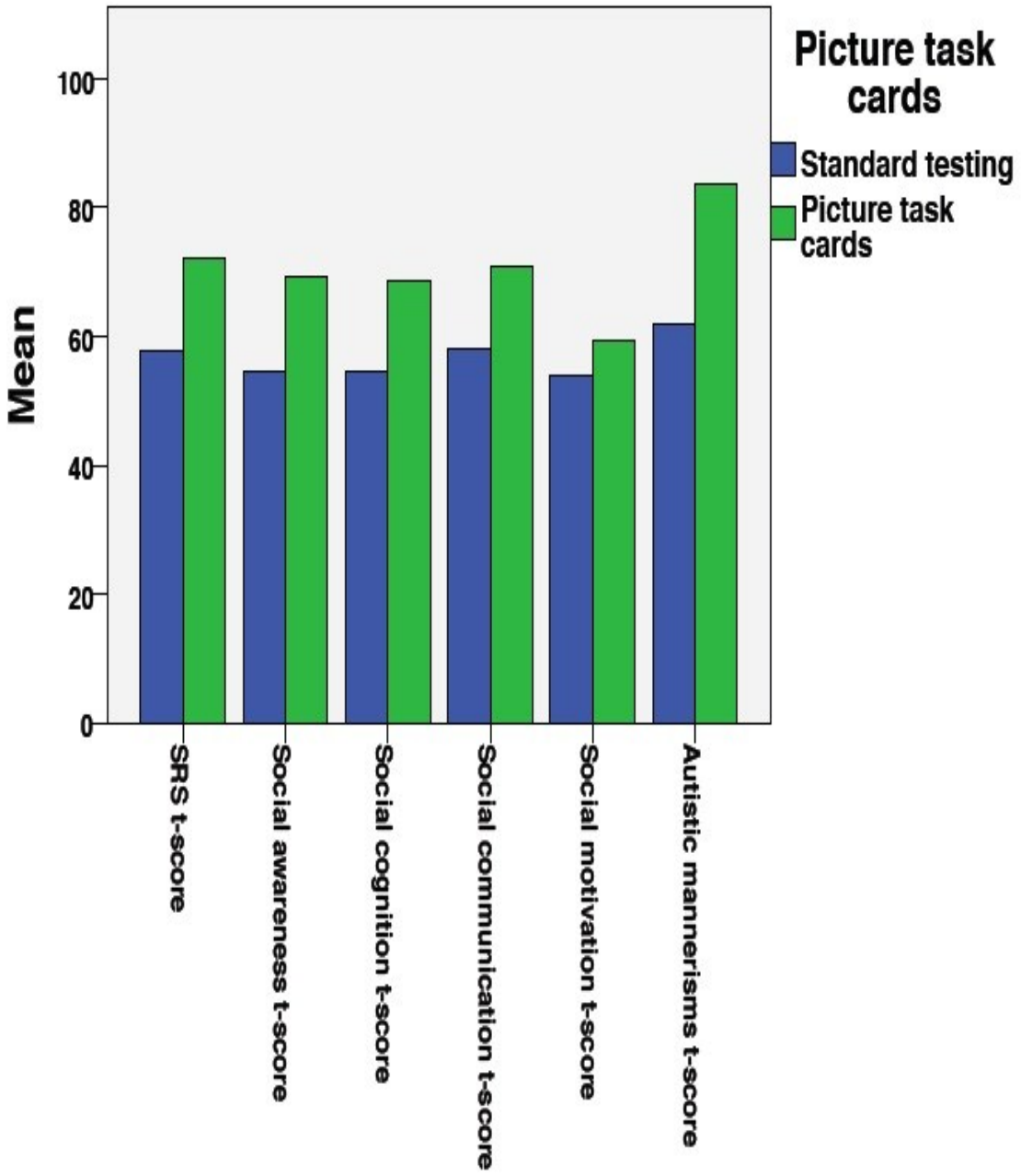
1. Seems much more fidgety in social situations than when alone.	1	2	3	4
2. Expressions on his or her face don't match what he or she is saying.	1	2	3	4
3. Seems self-confident when interacting with others.	1	2	3	4
4. When under stress, he or she shows rigid or inflexible patterns of behavior that seem odd.	1	2	3	4
5. Doesn't recognize when others are trying to take advantage of him or her.	1	2	3	4
6. Would rather be alone than with others.	1	2	3	4
7. Is aware of what others are thinking or feeling.	1	2	3	4
8. Behaves in ways that seem strange or bizarre.	1	2	3	4
9. Clings to adults, seems too dependent on them.	1	2	3	4
10. Takes things too literally and doesn't get the real meaning of a conversation.	1	2	3	4
11. Has good self-confidence.	1	2	3	4
12. Is able to communicate his or her feelings to others.	1	2	3	4
13. Is awkward in turn-taking interactions with peers (e.g., doesn't seem to understand the give-and-take of conversations).	1	2	3	4
14. Is not well coordinated.	1	2	3	4
15. Is able to understand the meaning of other people's tone of voice and facial expressions.	1	2	3	4
16. Avoids eye contact or has unusual eye contact.	1	2	3	4
17. Recognizes when something is unfair.	1	2	3	4
18. Has difficulty making friends, even when trying his or her best.	1	2	3	4
19. Gets frustrated trying to get ideas across in conversations.	1	2	3	4
20. Shows unusual sensory interests (e.g., mouthing or spinning objects) or strange ways of playing with toys.	1	2	3	4

Continue on back page...

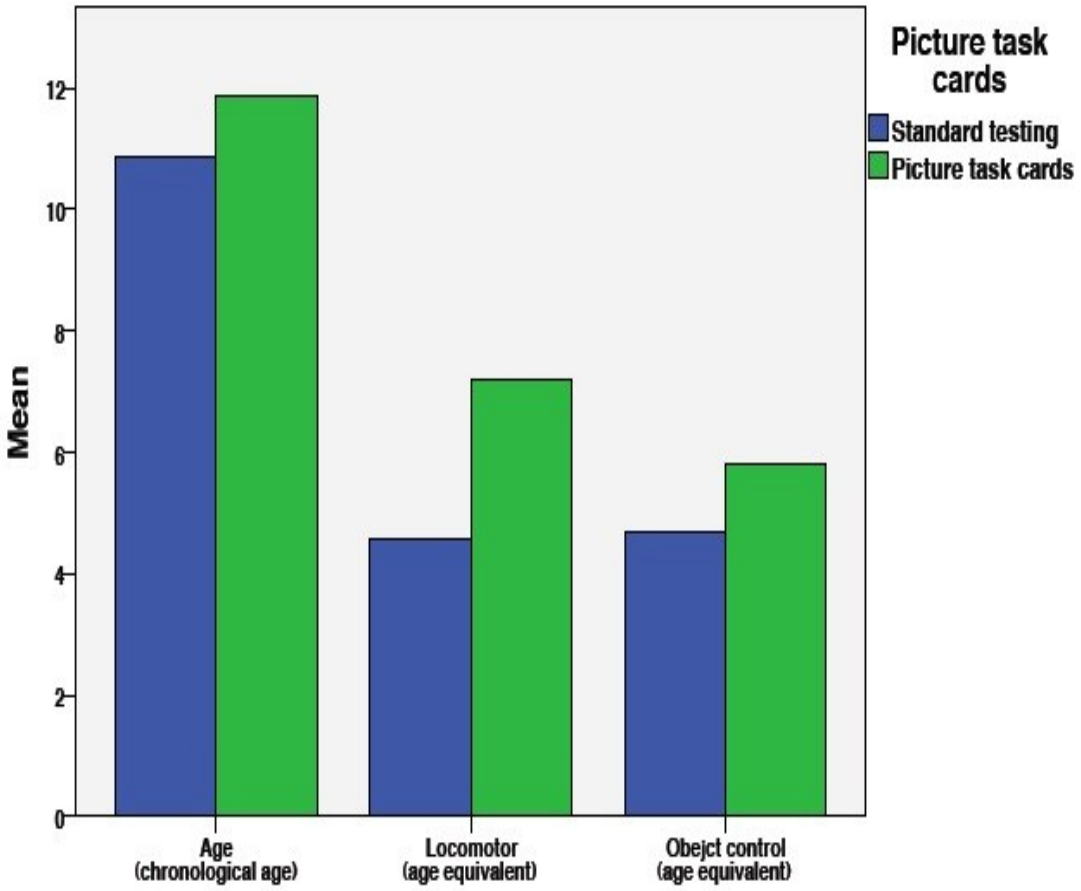
1 = NOT TRUE	2 = SOMETIMES TRUE	3 = OFTEN TRUE	4 = ALMOST ALWAYS TRUE

21. Is able to imitate others' actions.	1	2	3	4
22. Plays appropriately with children his or her age.	1	2	3	4
23. Does not join group activities unless told to do so.	1	2	3	4
24. Has more difficulty than other children with changes in his or her routine.	1	2	3	4
25. Doesn't seem to mind being out of step with or "not on the same wavelength" as others.	1	2	3	4
26. Offers comfort to others when they are sad.	1	2	3	4
27. Avoids starting social interactions with peers or adults.	1	2	3	4
28. Thinks or talks about the same thing over and over.	1	2	3	4
29. Is regarded by other children as odd or weird.	1	2	3	4
30. Becomes upset in a situation with lots of things going on.	1	2	3	4
31. Can't get his or her mind off something once he or she starts thinking about it.	1	2	3	4
32. Has good personal hygiene.	1	2	3	4
33. Is socially awkward, even when he or she is trying to be polite.	1	2	3	4
34. Avoids people who want to be emotionally close to him or her.	1	2	3	4
35. Has trouble keeping up with the flow of a normal conversation.	1	2	3	4
36. Has difficulty relating to adults.	1	2	3	4
37. Has difficulty relating to peers.	1	2	3	4
38. Responds appropriately to mood changes in others (e.g., when a friend's or playmate's mood changes from happy to sad).	1	2	3	4
39. Has an unusually narrow range of interests.	1	2	3	4
40. Is imaginative, good at pretending (without losing touch with reality).	1	2	3	4
41. Wanders aimlessly from one activity to another.	1	2	3	4
42. Seems overly sensitive to sounds, textures, or smells.	1	2	3	4
43. Separates easily from caregivers.	1	2	3	4
44. Doesn't understand how events relate to one another (cause and effect) the way other children his or her age do.	1	2	3	4
45. Focuses his or her attention to where others are looking or listening.	1	2	3	4
46. Has overly serious facial expressions.	1	2	3	4
47. Is too silly or laughs inappropriately.	1	2	3	4
48. Has a sense of humor, understands jokes.	1	2	3	4
49. Does extremely well at a few tasks, but does not do as well at most other tasks.	1	2	3	4
50. Has repetitive, odd behaviors such as hand flapping or rocking.	1	2	3	4
51. Has difficulty answering questions directly and ends up talking around the subject.	1	2	3	4
52. Knows when he or she is talking too loud or making too much noise.	1	2	3	4
53. Talks to people with an unusual tone of voice (e.g., talks like a robot or like he or she is giving a lecture).	1	2	3	4
54. Seems to react to people as if they are objects.	1	2	3	4
55. Knows when he or she is too close to someone or is invading someone's space.	1	2	3	4
56. Walks in between two people who are talking.	1	2	3	4
57. Gets teased a lot.	1	2	3	4
58. Concentrates too much on parts of things rather than seeing the whole picture. For example, if asked to describe what happened in a story, he or she may talk only about the kind of clothes the characters were wearing.	1	2	3	4
59. Is overly suspicious.	1	2	3	4
60. Is emotionally distant, doesn't show his or her feelings.	1	2	3	4
61. Is inflexible, has a hard time changing his or her mind.	1	2	3	4
62. Gives unusual or illogical reasons for doing things.	1	2	3	4
63. Touches others in an unusual way (e.g., he or she may touch someone just to make contact and then walk away without saying anything).	1	2	3	4
64. Is too tense in social settings.	1	2	3	4
65. Stares or gazes off into space.	1	2	3	4

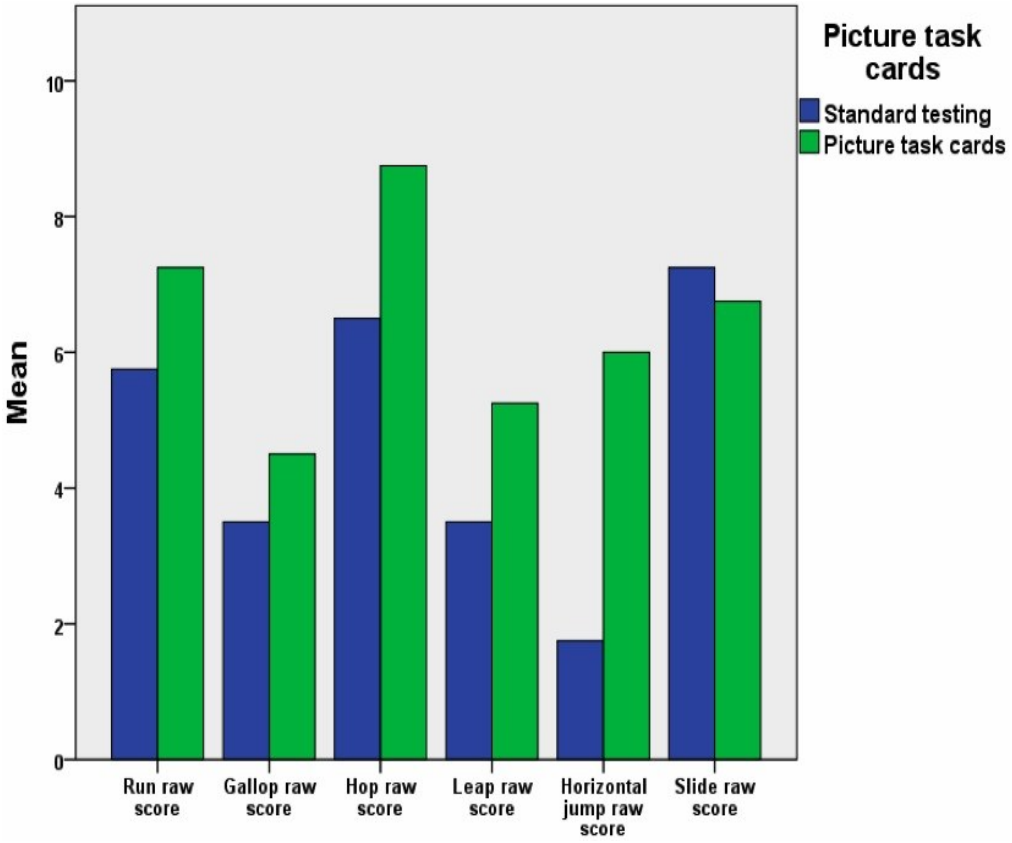
Appendix F. Complete SRS Score Report

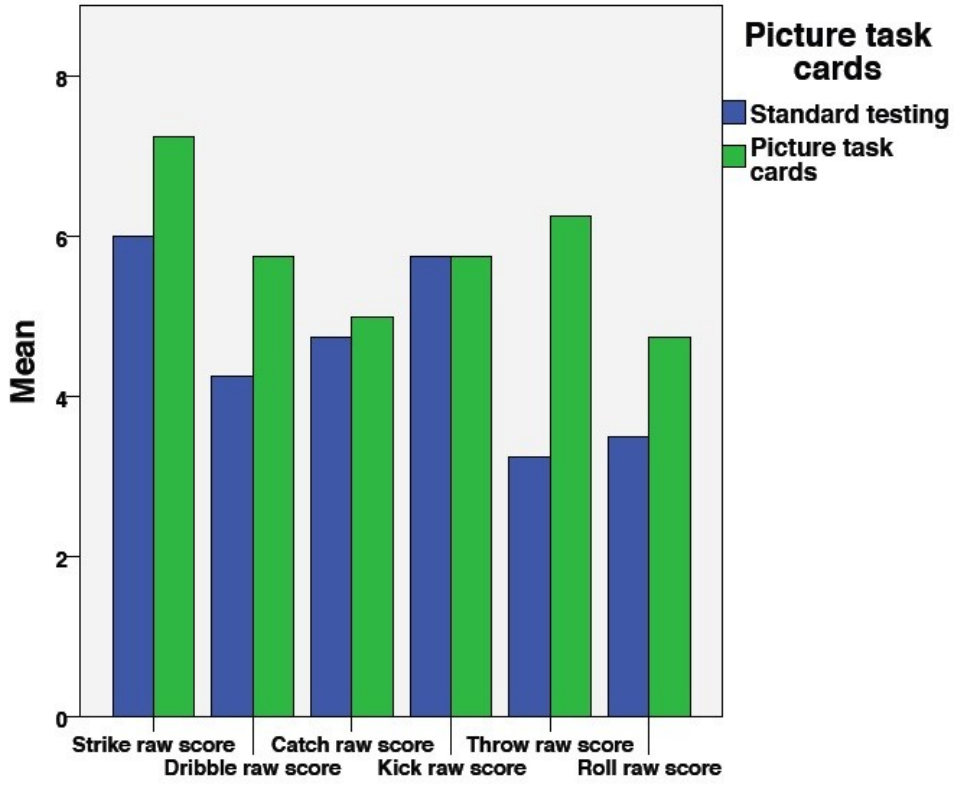

Picture task cards
Standard testing
Picture task cards
Mean
100
80
60
40
20
0
SRS t-score
Social awareness t-score
Social cognition t-score
Social communication t-score
Social motivation t-score
Autistic mannerisms t-score

Appendix G. Age Equivalents


Picture task cards
Standard testing
Picture task cards
Mean
0
2
4
6
8
10
12
Age (chronological age)
Locomotor (age equivalent)
Obejct control (age equivalent)

Appendix H. Locomotor and Object Control Skill Scores


Picture task cards
Standard testing
Picture task cards
Mean
0
2
4
6
8
10
Run raw score
Gallop raw score
Hop raw score
Leap raw score
Horizontal jump raw score
Slide raw score


Picture task cards
Standard testing
Picture task cards
Mean
0
2
4
6
8
Strike raw score
Dribble raw score
Catch raw score
Kick raw score
Throw raw score
Roll raw score

ABSTRACT

The purpose of this study was to investigate the use of picture task cards on performance of the Test of Gross Motor Development-2 (TGMD-2) (Ulrich, 2000) in youth with Autism Spectrum Disorder (ASD) to see if such use will enhance the understanding of activities in physical education and therapeutic settings for children with ASD. Participants were divided into two groups: one received standard TGMD-2 procedures, and the other received standardized procedures with addition of picture task cards. A total of eight participants, all male, ranging from ages 8 to 15 were tested at Wedgewood Academy in Fort Worth, TX. Analysis was done as an independent t-test (group by task) in SPSS version 18.0. The groups include picture task card and non-picture task card, and the tasks include object control and locomotor standard scores. Another t-test was run to compare groups with mean SRS scores. Results were not significant due to low sample size, but there was a high effect score for locomotor raw and standard scores, object control raw and standard scores and the majority of each skill in the picture task card condition. Although there was a low sample size, the findings suggest that the use of visual supports on TGMD-2 testing improved the individual with ASD's locomotor and object control raw and standard scores.