THE EFFECTS OF ANIMAL ASSISTED INTERVENTIONS ON CHILDREN WITH AUTISM DURING THE MOVEMENT ASSESSMENT BATTERY FOR CHILDREN-2 (MABC-2)

by

Dannielle L. Miccinello

A thesis submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the degree of Master of Science in Exercise Science

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by
Dannielle L. Miccinello

Approved: __________________________________________________________
Nancy Getchell, Ph.D.
Professor in charge of thesis on behalf of the Advisory Committee

Approved: __________________________________________________________
Todd D. Royer, Ph.D.
Chair of the Department of Kinesiology and Applied Physiology

Approved: __________________________________________________________
Kathleen S. Matt, Ph.D.
Dean of the College of Health Sciences

Approved: __________________________________________________________
Charles G. Riordan, Ph.D.
Vice Provost for Graduate and Professional Education
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# TABLE OF CONTENTS

LIST OF TABLES ........................................................................................................ vi
LIST OF FIGURES ..................................................................................................... viii
ABSTRACT .................................................................................................................. ix

Chapter

1 INTRODUCTION ........................................................................................................ 1

2 LITERATURE REVIEW ............................................................................................ 6

   Autism Spectrum Disorders (ASD) ................................................................. 7
   Movement Proficiency and Autism Spectrum Disorders ...................... 13
   Animals in Therapy ...................................................................................... 20
   Animal Assisted Interventions and Therapies and Children with Autism .... 30
   Precautions When Working with Animals ............................................. 35
   Conclusion ................................................................................................. 37

3 METHODOLOGY ..................................................................................................... 39

   Overview ...................................................................................................... 39
   Participants ................................................................................................. 40
   Procedure .................................................................................................. 43
   Therapy Dog .............................................................................................. 49
   Movement-Assessment Battery for Children-2 (MABC-2) ................... 51
   Actiheart .................................................................................................. 54
   Engaged and Off Task Behaviors .............................................................. 55
   Statistics ..................................................................................................... 58

4 RESULTS ............................................................................................................... 60

   Movement Assessment Battery for Children-2 Scores ....................... 60
   Heart Rate ............................................................................................... 62
   Engaged and Off Task Behavioral Variables ......................................... 63
   Qualitative ................................................................................................. 65
   Individual Participant Summaries .......................................................... 66
5 DISCUSSION ................................................................................................... 84  
Movement Assessment Battery for Children-2 (MABC-2) .......................... 84
Heart Rate (bpm) .................................................................................................. 86
Engaged and Off Task Behaviors ..................................................................... 89
Handler/Audience .............................................................................................. 91
Limitations ........................................................................................................ 93
Future Directions .............................................................................................. 94
General Conclusions ......................................................................................... 96

REFERENCES ............................................................................................................. 98

APPENDIX ................................................................................................................ 110
1 Informed Consent and Assent Forms ............................................................. 111
2 Assumption of Risk Form .............................................................................. 117
3 Developmental Coordination Disorder Questionnaire 2007 (DCDQ’07)..... 120
4 Movement Assessment Battery for Children-2 (MABC-2) ......................... 131
5 Adapted Version of Michael Metzler’s ALT-PE Microcomputer Data Collection System (MCDS) ................................................................. 134
6 “Feelings Scale” ............................................................................................. 137
7 Layout of Testing Room With Therapy Dog Present ................................... 139
8 Interview Questions & Participant and Parent Responses ......................... 143
9 Institutional Review Board Approval Letters .............................................. 174
### LIST OF TABLES

<p>| Table 1 | Overview of MABC-2 for children 7-11 and 11-16 years. .......................... | 52 |
| Table 2 | Behavioral Variable Overview. ............................................................... | 56 |
| Table 3 | Mean Total Test Score and Categorical Component Scores of the MABC-2 over Visits 1, 3 &amp; 4. ...................................................... | 61 |
| Table 4 | Mean heart rate (bpm) during MABC-2 over Visits 1, 3 &amp; 4. ................ | 62 |
| Table 5 | Percentage of time spent in engaged and off task behaviors during MABC-2 over three visits. ........................................................... | 64 |
| Table 6 | Participant 1: Categorical Component MABC-2 score and mean heart rate breakdown.............................................................................. | 68 |
| Table 7 | Participant 1: MABC-2 Total Test Score and mean heart for entire assessment..................................................................................... | 68 |
| Table 8 | Participant 2: Categorical Component MABC-2 score and mean heart rate breakdown.............................................................................. | 70 |
| Table 9 | Participant 2: MABC-2 Total Test Score and mean heart for entire assessment ..................................................................................... | 70 |
| Table 10 | Participant 2: Behavioral variable breakdown. ........................................ | 70 |
| Table 11 | Participant 3: Categorical Component MABC-2 score and mean heart rate breakdown.............................................................................. | 73 |
| Table 12 | Participant 3: MABC-2 Total Test Score and mean heart for entire assessment ..................................................................................... | 73 |
| Table 13 | Participant 3: Behavioral variable breakdown. ........................................ | 73 |
| Table 14 | Participant 4: Categorical Component MABC-2 score and mean heart rate breakdown.............................................................................. | 75 |</p>
<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 15</td>
<td>Participant 4: MABC-2 Total Test Score and mean heart for entire assessment</td>
<td>75</td>
</tr>
<tr>
<td>Table 16</td>
<td>Participant 4: Behavioral variable breakdown.</td>
<td>76</td>
</tr>
<tr>
<td>Table 17</td>
<td>Participant 5: Categorical Component MABC-2 score and mean heart rate breakdown</td>
<td>77</td>
</tr>
<tr>
<td>Table 18</td>
<td>Participant 5: MABC-2 Total Test Score and mean heart for entire assessment</td>
<td>78</td>
</tr>
<tr>
<td>Table 19</td>
<td>Participant 5: Behavioral variable breakdown.</td>
<td>78</td>
</tr>
<tr>
<td>Table 20</td>
<td>Participant 6: Categorical Component MABC-2 score and mean heart rate breakdown</td>
<td>80</td>
</tr>
<tr>
<td>Table 21</td>
<td>Participant 6: MABC-2 Total Test Score and mean heart for entire assessment</td>
<td>81</td>
</tr>
<tr>
<td>Table 22</td>
<td>Participant 6: Behavioral variable breakdown.</td>
<td>81</td>
</tr>
<tr>
<td>Table 23</td>
<td>Participant 8: Categorical Component MABC-2 score and mean heart rate breakdown</td>
<td>83</td>
</tr>
<tr>
<td>Table 24</td>
<td>Participant 8: MABC-2 Total Test Score and mean heart for entire assessment</td>
<td>83</td>
</tr>
<tr>
<td>Table 25</td>
<td>Participant 8: Behavioral variable breakdown.</td>
<td>83</td>
</tr>
</tbody>
</table>
LIST OF FIGURES

Figure 1  Mean Total Test Score for the MABC-2 among Visits 1, 3 & 4. Significance was not seen among Total Test Scores for Visits 1, 3 & 4 (p=0.096). ................................................................. 61

Figure 2  Changes in mean heart rate (bpm) over the entire assessment for Visits 1, 3 & 4. Significance was not seen among visits (p =0.651); however, similar patterns can be seen in Participants 1 and 3 having highest mean heart rate at Visit 3 as well as Participants 2, 5, and 6 having lowest mean heart rate at Visit 3. ....... 63

Figure 3  These bar graphs depict that the percentage of time participants as a whole were engaged (p=0.873) and off task (p=1.0) during the MABC-2 did not differ significantly among Visits 1, 3 & 4. ............... 64
ABSTRACT

The number of children diagnosed with autism spectrum disorders (ASD) is rapidly increasing. Due to the unique needs of children with ASD, therapeutic services may be sought to improve daily living skills and motor skills. In addition to deficits in communication and language abilities, as well as repetitive, stereotyped behaviors and interests, behavior problems and a lack motivation can be present in anyone with ASD. These characteristics may create unforeseen obstacles and challenges for a therapist or researcher during a motor skills evaluation.

In various settings the use of an animal assisted intervention (AAI), commonly introducing a therapy dog to a familiar or stressful situation, has been shown to be beneficial in increasing engagement and attention while decreasing disruptive behaviors and physiological. This study was exploratory in nature and therefore, no predictions were made. The purpose of this study was to observe the effects of a therapy dog on children with ASD during a standardized motor skills assessment. Specifically, Total Test score of the Movement Assessment Battery for Children-2 (MABC-2), heart rate and percentage of time engaged and off task during the assessment were monitored for this study.

This study employed an ABA design, in which seven boys with ASD (10.3 ± 1.1 years) completed the MABC-2 three times - twice without a therapy dog present
(A) and once with a therapy dog present (B). While no significant statistical differences were found among baseline and intervention conditions, the slight emergence of common themes could be seen in qualitative reports. Older participants had a decreased heart rate and percentage of time off task whereas younger participants had an increased heart rate and percentage of time off task with the therapy dog present. While generalizations cannot be made, future studies should aim to increase the number of participants to observe if the therapy dog effects score, heart rate or percentage of time spent engaged and off task during a motor skills assessment.
Chapter 1
INTRODUCTION

Autism is a pervasive developmental disorder characterized by deficits in communication and language abilities as well as marked by repetitive, stereotyped behaviors and interests. Variations lie in level of ability and impairment making autism a spectrum disorder (Kanner, 1943; Center for Disease Control and Prevention [CDC], 2009). Autism spectrum disorder (ASD) is an umbrella term including the diagnoses of autism, asperger’s syndrome (AS), and pervasive developmental disorder not otherwise specified (PDD-NOS). Although the cause of autism is unknown, there has been a dramatic increase in the prevalence of children in the United States diagnosed with an ASD. From 2002 to 2006 there was a 57% increase in the number of 8 year old boys diagnosed with autism from ten Autism and Developmental Discipline Monitoring (ADDN) Networks in the United States (CDC, 2009). An increase in prevalence can be due to bettering screening methods and public knowledge about early symptoms of the disorder. Due to an increase in prevalence, more children will receive therapeutic treatments and interventions to overcome deficits presented in this population.

While autism is a spectrum disorder and each person posses his or her own personality traits, certain characteristics and tendencies of this population may make
interacting and care-giving challenging. Whether in a research or clinical setting children with ASD may exhibit behaviors that make interactions difficult and practitioners may not get a true understanding of their capabilities. Behavior problems may include very specific interests in activities or objects, strict adherence to a precise schedule or routine, tantrums or outbursts (Grandin, 2004). Individuals with ASD may lack motivation or desire to interact with another person or complete an activity presented to them. Additionally, when entering a new and unfamiliar setting with unfamiliar people, a child may become nervous, hesitant, and over stimulated by the unique environment. These characteristics may create unforeseen obstacles and challenges for a therapist or researcher aiming to evaluate or provide care. This can impact the quality of the treatment given by a therapist or data collected by a researcher (Grandin, 2004; Koegel & Egel, 1979; Shipley-Benamou, Lutzker, & Tauban, 2002; Walting, Deitz, Kanny, & McLaughlin, 1999).

Previous research has shown that children with ASD display significant motor skill deficits on standardized exams (Berkeley, 2001; Fournier, Hass, Naik, Lodha, & Caurbaugh, 2010; Green, Charman, Pickles, Chandler, Loucas, Simonoff, & Baird, 2008; Jansiewicz, Goldberg, Newschaffer, Denckla, Landa, & Mostofsky, 2006; Kopp, Beckung, & Gillberg, 2010; Sahlander, Mattson, & Bejerot, 2008; Staples & Reid, 2010). Motor skills are necessary and pivotal to improve due to the effect they have on many domains of life including academic achievement (Baranek, 2002), daily living skills (Shipley-Benamou, et al., 2002), physical activity (Stodden, Goodway,
Langedorfer, Roberton, & Rudisill, 2008), and perceived competence (Piek, Baynam, & Barrett, 2006). Standardized tests of motor proficiency are used clinically and in research settings to assess deficits and also determine appropriate treatment and intervention services when appropriate (Henderson, Sugden, & Barnett, 2007). However, if a child is not engaged nor interested in the test, the assessment may not be reflective of a child’s true abilities. An assessment session should reflect optimal performance and valid results in the most time efficient manner.

Although motor skill impairments are evident, Dawson and Watling (2000) note that there is “relatively little systematic, controlled research on effectiveness of various interventions.” In such cases, an additional, appropriate motivational agent may be needed to keep children with autism attentive to the task presented to them. One such motivator may be introducing a therapy dog to the testing session which has shown to work in other settings with other populations.

Therapy dogs have been shown beneficial on different populations of adults and children (Barker & Dawson, 1998; Cole, Gawlinski, Steers, & Kotlerman, 2007; Havener, Gentes, Thaler, Megel, Baun, Driscoll, Beiraghi, & Agrawal, 2001; Jalongo, Astorino, & Bomboy, 2005; Macauley, 2006; Nagengast, Baun, Megel, & Leibowitz, 1997). Roles of the therapy animal include helping people make gains either in daily activities or to achieve predetermined goals set by a therapist (Delta Society, 2009). AAI and AAT dogs are with a beneficiary for a short amount of time as they serve as transitional objects to bring out short term changes (Triebenbacher, 1998). Previous
research has shown that people with autism do have an affinity for dogs over people (Celani, 2002) and that the presence of a dog has created a more positive environment when working with a therapist (Martin & Farnum, 2002; Redefer & Goodman, 1989; Sams, Fortney, & Willenbring, 2006). However, research has yet to investigate the effects of animal assisted intervention (AAI) while a child with autism completes a standardized motor skills assessment.

As stated earlier, people with ASD present motor skill impairments as well as behaviors and characteristics that can make evaluation and treatment challenging and difficult. However, previous literature has shown that while in the presence of a therapy dog children with developmental disabilities have decreased problematic behaviors and remained engaged in an activity longer than if left alone or with another person (Heimlich, 2001; Martin & Farnum, 2002; Prothmann, et al., 2009). While exploratory in nature, the purpose of this study is to determine the effects that a therapy dog has on boys with ASD while completing the Movement Assessment Battery for Children-2 (MABC-2). Specifically, this study will look to see if the presence of a dog has an effect on heart rate, motor skill performance, and on and off task behaviors.

**Specific Aim:** To determine the effect of a therapy dog on children with ASD during the Movement Assessment Battery for Children-2 (MABC-2).

**Exploratory Research 1:** Will a therapy dog influence changes in heart rate of a child with ASD during the MABC-2?
**Exploratory Research Question 2:** Will a therapy dog impact the performance of a child with ASD on the MABC-2?

**Exploratory Research Question 3:** Will the presence of a therapy dog effect engaged and off task behaviors of a child with ASD during the MABC-2?
Chapter 2

LITERATURE REVIEW

Autism is a pervasive developmental disorder characterized by impairments in social and communication skills, as well as abnormal behavior such as stereotyped interests (American Psychiatric Association, 2010). In addition, individuals with autism spectrum disorders (ASD) exhibit motor skill deficits and movement abnormalities from infancy through adolescence (Dewey, Cantell, & Crawford, 2007; Esposito & Venuti, 2008; Fuentes, Mostofsky, & Bastian, 2009; Provost, Heimerl, & Lopez, 2007; Teitelbaum, Teitelbaum, Nye, Fryman, & Maurer, 1998). Impairments in this domain have been associated with health complications and deficits in activities of daily living. Due to characteristics and behaviors of people with autism, it may be difficult to administer standardized motor skill assessment tools and get a valid understanding of their skill levels and abilities. Research has shown that working with therapy animals has a positive impact on adults and children in a variety of contexts (Cole, 2007; Havener, Gentes, Thaler, Megel, Baun, Driscoll, et al., 2001; Jalongo, Astorino, & Bomboy, 2005; Macauley, 2006; Nagengast, 1997). Children with autism have shown an interest in interacting with dogs and have exhibited a greater use of language, decreased problem behaviors, and have been more focused and engaged in an activity when a dog is present (Martin & Farnum,
Therefore, the purpose of this study is to explore the effects that the presence of a dog has on children with autism while completing a standardized motor skills assessment test, the Movement Assessment Battery for Children-2 (MABC-2).

**Autism Spectrum Disorders (ASD)**

*Overview.* Autism is a pervasive developmental disorder characterized by impairments in social interaction, communication and restricted, repetitive, stereotyped interests and behaviors (American Psychiatric Association, 2010). Autism is a spectrum disorder due to the range of abilities and deficits a person exhibits (CDC, 2009). While people on the spectrum display some degree of communication, socialization, and behavior impairments, those with mild deficits in intellectual abilities (IQ > 70) are considered high functioning (HFA) and those with greater deficits in intellect are considered low functioning (LFA) (Carpenter, Soorya, Halpen, 2009; Szatmari, 2009).

The proposed revision to the DSM-V will read:

“Autism Spectrum Disorder

Must meet criteria 1, 2, and 3:

1 Clinically significant, persistent deficits in social communication and interactions, as manifest by all of the following:

   a. Marked deficits in nonverbal and verbal communication used for social interaction:
b. Lack of social reciprocity;

c. Failure to develop and maintain peer relationships appropriate to developmental level

2 Restricted, repetitive patterns of behavior, interests, and activities, as manifested by at least TWO of the following:

a. Stereotyped motor or verbal behaviors, or unusual sensory behaviors

b. Excessive adherence to routines and ritualized patterns of behavior

c. Restricted, fixated interests

3 Symptoms must be present in early childhood (but may not become fully manifest until social demands exceed limited capacities)”

(American Psychiatric Association, Autistic Disorder, Proposed Revision, 2010).

Characteristics of Autism. ASD are commonly identified by a person’s unusual associations with peers or people in one’s environment. As cited in Orsmond, et al., the American Psychiatric Association (APA) describes "the social deficits of autism [to be] marked by impairment in the use of non-verbal behaviors to regulate social interaction (e.g., gestures, eye contact), difficulty establishing and maintaining peer relationships, a lack of shared enjoyment of interests and accomplishments with others, and a general lack of social or emotional reciprocity" (Ormond, Krauss, & Seltzer, 2004). A person with ASD often has flat affect or an “ambiguous expression” reflecting no observable emotion or reaction (Yirmiya, Kasari, Sigman, & Mundy, 1989), as well as no response to another individual’s changing expression (Sigman, Kasari, Kwon, & Yirmiya, 1992). A survey addressed to 235 parents with adolescents
and young adults with ASD found that only 8% of individuals had peers that were friends ("a same aged friend with whom varied, mutually responsive, and reciprocal activities were engaged in outside of organized settings," ADI-R definition cited in Orsmond, 2004) and nearly 50% met criteria for having no peer relationships (Orsmond, et al., 2004). Adolescents and adults with ASD are also less likely to engage in casual, social activities with family members, community members, but rather take part in activities that do not require any social interactions, such as walking and having individual hobbies and interests (Eaves & Ho, 2008; Kanner, 1943; Orsmond, et al., 2004).

Due to a lack of desire to interact with individuals, those administering a standardized test to a child with ASD may be presented with a challenge. Children with ASD may not feel the need to please the administrator and engage in the activity presented to them. The child may complete the task quickly or without effort and, therefore, masking a true representation of his/her skills. Additionally, social phrases are less rewarding for people with ASD and, therefore, those looking to motivate the child will have to continuously search for new sources of motivation (Grandin, 2004). This possesses challenges and obstacles when asking a child to perform skills assessments.

People with autism can display persistent, challenging, self-stimulatory behaviors that are not socially acceptable. They may also become non-compliant and irritable which in conjunction with inappropriate behavior can disrupt the learning
environment (Matson, Mahan, Hess, Fodstad, & Neal, 2010; Smith & Matson, 2010; Tomanik, Harris, & Hawkins, 2004). It was reported that males with autism engage in disruptive behavior to escape uncomfortable stimuli or to gain or maintain items of specific interest (Reese, Richman, Belmont, Morse, 2005). Additionally, people with autism display attention deficits (Pierce, Glad, & Schreibman, 1997).

As a consequence of these behaviors those who aim to provide care to a child with ASD may encounter obstacles and opposition (Shipley-Benamou, Lutzker, & Taubman, 2002; Walting, Deitz, Kanny, & McLaughlin, 1999). In order to get a true understanding of a child’s motor skill abilities, the child must remain comfortable and engaged through the entire testing procedure. If a child loses interest, becomes distracted or upset the testing procedure may become interrupted and data may become invalid or inaccurate. Additionally, temper tantrums and problem behaviors can lengthen the time for testing and increase parental stress (Estes, Munson, Dawson, Koehler, & Zhou, 2009; Tomanik, et al., 2004). Therefore, creative methods must be designed to keep a child engaged and comfortable without tampering with the design of the assessment tools.

**Diagnosing Autism.** A child is typically diagnosed with autism around 3 years through a series of parent reports and standardized screening questionnaires used by a multidisciplinary team including neurologists, psychologists, speech pathologists, or psychiatrists (Autism Fact Sheet). Because the cause of ASD is unknown and there are no known genetic or biological indicators developmental observational and interview
assessments are used in conjunction to help support a diagnosis (CDC, 2009). Parent reports are used to learn about a child’s history while a physician or psychologist can assess a child’s current state through observational assessment (Filipek, Accardo, Ashwal, Baranek, Cook, & Dawson, 2000). Standardized tools focus on investigating a child’s communication, social and play skills, repetitive and restricted behaviors and problematic behaviors (Lord, Risi, Lambrecht, Cook, Leventhal, & DiLavore, 2000; Lord, Rutter, & Le Couteur, 1994; Perry, Condillac, Freeman, Dunn-Geier, & Belair, 2005). The Autism Diagnostic Observation Schedule (ADOS) and the Autism Diagnostic Interview-Revised (ADI-R) are both considered the “gold standard” for diagnosing autism (Lord, et al., 1994; Lord, et al., 2000). Although highly reliable, a considerable amount of training is for mastery, administration can take over 90 minutes and scoring can be complicated (Lord, et. al., 1994; Lord, et al., 2000).

**Social Responsiveness Scale.** The Social Responsiveness Scale (SRS) is a 65-question survey in which parents use a 4-point Likert scale to assess their child’s current and past behaviors. Questions in the survey address the following: social awareness, social cognition, social anxiety, and autistic mannerisms (Constantino, Davis, Todd, Schindler, Gross, Brophy, et al., 2003). This parent-reported scale has been has been shown to “[compare] very favorably with the ADI-R…” (Constantino, et al., 2003).

Although the cause of ASD is unknown, earlier diagnosis leads to earlier interventions and services to improve a child’s outcome (Filipek, et al., 2000). Earlier
diagnosis introduces families to counselors and therapists who can provide appropriate interventions and treatments. A person does not “outgrow” ASD, but with appropriate resources an individual can live a full, healthy and meaningful life (Autism Society of America, 2010).

Reinforcers as a Source of Motivation. Reinforcers, specifically food, have been used as incentives to motivate a child with ASD when social praises fail. Using incentive based rewards has shown to be an effective way of keeping adolescents with ASD focused and productive (Lalli, Vollmer, Progar, Wright, Borrero, Daniel, et al., 1999). When given the choice between having a food item or a break from work, children preferred food (Kodak & Lerman, 2007). Schreck & Williams found that children with ASD prefer foods that are sweet (e.g. cookies, cakes, white bread, ice cream, etc) rather than those that are sour or bitter when given a choice (Schreck & Williams, 2006). Food incentives are easily distributed making them a popular and attractive method for parents and teachers (Kodak & Lerman, 2007). Lalli et al. observed more positive behavior changes when food was used as a reinforcer compared to a break or escape from work (Lalli, 1999). Although these may encourage appropriate behavior, unhealthy food consumption puts a person at a greater risk for weight gain. In 2005, Curtin et al. classified 42 American children and adolescents with autism as either at risk of being overweight or overweight. The prevalence for at risk of being overweight or overweight were 23.8% and 14.2% for 2-5 years, 37.8% and 18.8% for 6-11 years, and 80% and 50% for 12-19 years (Curtin,
Bandini, Perrin, Tybor, & Must, 2005). Therefore, new methods that increase motivation, involvement and appropriate behavior need to be sought.

**Movement Proficiency and Autism Spectrum Disorders**

Atypical language development, social interactions, and behaviors are key identifiers in diagnosing autism, however, children with autism consistently exhibit unusual movement patterns and motor skill deficits. Due to different methods and standards for diagnosing ASD, researchers looking at motor skills and physical activity have been inconsistent in the ways of verifying their participants’ diagnosis. Some researchers rely on a diagnosis from a specialist (i.e. educational diagnostician or clinical psychologist) (Provost, 2007), the educational services a child receives (Pan, 2006), support based off Diagnostic and Statistical Manual criteria (Rinehart, Bellgrove, Tonge, & Brereton, 2006; Weimer, Schatz, Lincoln, Ballantyne, Trauner, 2001), scores based on standardized questionnaires or observation scales (Fuentes, et al., 2009; Jansiewicz, Goldberg, Newschaffer, Denckla, Landa, & Motstofsky, 2006; Ozonoff, Young, Goldring, Greiss-Hess, Herrera, Steele, et al., 2008) or a combination (Berkeley, Zittel, Pitney, & Nichols, 2001; Green, Charman, Pickles, Chandler, Loucas, Simonoff, & Baird, 2009; Kopp, 2009; Staples & Reid, 2010). Additionally, some studies only include children fitting a criteria for autism (Berkeley, et al., 2001; Rinehart, et al., 2006) or AS (Sahlander, et al., 2008) while other studies group people with HFA and AS into a “homogeneous representation” (Pan & Frey, 2005; Pan & Frey, 2006).
Currently, the Diagnostic and Statistical Manual of Mental Disorder IV recognizes autism and Asperger’s syndrome (AS) as two different disorders. However, their presentations are very similar (Carpenter, et al., 2009; Sanders, 2009). Both are identified by impairments in social interactions and unusual behaviors and interests (American Psychiatric Association, 2010). The primary difference between autism and ASD is the absence of language and cognitive delays in people with AS help distinguish between AS and HFA (Carpenter, et al., 2009; American Psychiatric Association, 2010). Additionally, differences may lie in level of function rather than manifestation or cause (Carpenter et al., 2009; Sanders, 2009). This has been addressed by the creators of the DSM and a proposal for a new diagnostic criteria for autistic disorders will include the former diagnosis of autistic disorder (autism), Asperger’s disorder, childhood disintegrative disorder, and pervasive developmental disorder not otherwise specified (PDD-NOS).

In February 2010, Lopez-Duran supported researchers recruiting people with autism and AS as a sample for studies prior to release of the new DSM guidelines (Lopez-Duran, 2010). The possible merge of diagnostic criteria for AS and autism will allow researchers to have a larger population base to recruit with the same diagnosis. Therefore, research investigating motor skills of people with autism and people with AS can be representative of one another. People falling on any end of the spectrum likely exhibit motor skill deficits and impairments.
Although it has been noted that people with AS display “motor clumsiness” and those with autism show “abnormal posturing” (Rinehart, et al., 2006), quantitative results conclude that individuals with autism and individuals with AS both exhibit motor skill impairments on tests of motor proficiency (Berkeley, et al., 2001; Fournier, Hass, Naik, Lodha, & Cauraugh, 2010; Green, et al., 2009; Jansiewicz, et al., 2006; Kopp, 2010; Sahlander, et al., 2008; Staples & Reid, 2010). In fact, delayed motor milestones may be an earlier indicator of autism than language deficits (Pope, Lynch, Liu, & Getchell, 2009) and, therefore, researchers urge for impaired motor skills to be included in the diagnostic criteria (Teitelbaum, et al., 1998). When comparing people with HFA and people with AS no significant differences on any measure of motor performance were observed (Jansiewicz, et al., 2006; Manjiviona & Priori, 1995). The extent of motor impairment is great. Using the Test of Gross Motor Development (TGMD), Berkeley (2001) found that 80% of HFA participants scored 1.5 or more standard deviations below the average performance (Berkeley, et al., 2001). While Staples & Reid (2010) found 16% of a mixed ASD group (12 autism, 11 PDD-NOS, 2 AS) scored within the lowest standardized score for both object control and locomotor subtests (Staples & Reid, 2010).

Aside from the standardized tests of motor proficiency, people with ASD show poor gestural posture, motor coordination, handwriting, and atypical gait patterns (Dewey, et al., 2007; Esposito & Venuti, 2008; Fuentes, et al., 2009). The true cause of these deficits has not been established, however, research has suggested that
problems can arise from motor planning deficits (Rinehart, et al., 2006) and
cerebellum abnormalities (Courchesne, 1997).

As stated previously, people with ASD display a range of social and
communication skills, therefore, it is not surprising that motor skill proficiency varies
as well. When separated by IQ, children a low IQ (< 70) presented as having more
impaired motor skills than those with a high IQ (>70) on Movement Assessment
Battery for Children (MABC) (Green, et al., 2009).

Movement Assessment Battery for Children-2 (MABC-2). The Movement
Assessment Battery for Children-2 (MABC-2) is a common assessment practitioners
working with children with ASD may administer. This standardized test of motor
proficiency detects movement difficulties in children 3 years 0 months to 16 years 11
months (Henderson, Sugden, & Barnett, 2007). This tool distinguishes three age
bands (3-6 years, 7-10 years, and 11-16 years) and provides age appropriate tasks in
the domains of manual dexterity, balance and aiming & catching. The MABC-2 has
been shown to have high test-retest reliability (.92 to .98) and has been shown to have
good comparability (.60 to .90) to the “gold standard” Bruininks-Oseretsky Test of
Motor Proficiency (Croce, Horvat, & McCarthy, 2001). The MABC-2 has been used
with people having developmental coordination disorder (DCD), neurological
dysfunction, attention deficit hyperactivity disorder (ADHD) and autism (Bart,
Podoly, & Bar-Haim, 2010; Green, et al., 2009; Peters, Maathuis, & Hadders-Algra,
2010; Vanvuchelen, Roeyers, & Deweerdt, 2007).
**Importance of Motor Skill Proficiency.** Motor skill development is a pivotal component from infancy through adolescence. Between 8 and 13 years, children form a foundation in fine and gross motor skills and further development is likely the result of deliberate practice (Haywood & Getchell, 2009). Motor skills are used in areas of daily living (i.e. feeding and dressing) (Shipley, et al., 2002), academic tasks (i.e. cutting with scissors and writing) (Baranek, 2002) and play skills (i.e. hopping, skipping and jumping). Deficits hinder a person’s ability participate in physical activity (Stodden, 2008), achieve satisfactory physical fitness (Haga, 2009) and form friendships or relationships (King, Law, King, Rosenbaum, Kertoy, & Young, 2003).

As mentioned, motor skill proficiency increases physical activity participation (Stodden, 2008) which has been shown to decrease self-stimulatory (Kern, Koegel, Dwyer, Blew, & Fenton, 1982) and aggressive behaviors (Lang, Koegel, Ashbaugh, Regester, Ence, & Smith, 2010), diminish stress (Baranak, 2002) and increase academic performance (Lang, et al., 2010).

Proper motor skill development promotes participation in daily activities and improves or maintains quality of life. For example, studies have concluded that infants with autism display atypical movement patterns (Teitelbaum, et al., 1998), mildly and significantly delayed motor skills (Provost, et al., 2007) and achieve developmental movement benchmarks later than typically developing peers with the greatest discrepancy for the onset of walking (Ozonoff, et al., 2008). Inadequate
abilities prohibit infants from exploring their environment and initiating social interactions (Jasmin, Couture, McKinley, Reid, Fombonne, & Gisel, 2009).

Due to the necessity for motor skill proficiency, it is of importance that skills are mastered and developed on an appropriate developmental time line. While children with ASD may not understand the importance of mastery, it is necessary to find ways to keep them engaged and motivated in their practice and learning. Additionally, a test may become compromised by behavioral challenges as well as a lack of engagement. If children are not motivated to perform well, a low score may be the result of a lack of effort rather than a lack of skill and ability. Finding ways to get the most reliable measures of child on a standardized test is pivotal.

*Autism Spectrum Disorders & Appropriate Services.* When a child is diagnosed with autism, he or she will likely be referred to therapy. Myers & Johnson state: “The primary goals of treatment are to maximize the child’s ultimate functional independence and quality of life by minimizing the core [ASD] features, facilitating development and learning, promoting socialization, reducing maladaptive behaviors, and educating and supporting families” (Myers & Johnson, 2007). Due to variability within the autism population, therapies need to be specific for the individual’s needs, goals (Baranak, 2002) and stage of life (i.e. infancy, toddler, early childhood, etc) (Aman, 2005).

Providing services to children with autism is often a collaborative effort between speech-language therapists, occupational therapists, teachers, and parents. In
a study by McLennan, Huculak, & Sheehan (2008), 78% of parents reported that their child with ASD most commonly attended occupation therapy. (McLennan, Huculak, & Sheehan, 2008). Improving fine and gross motor skills used in educational settings and activities of daily living (Autism Speaks, 2010) helps fulfill the mission of the American Occupational Therapy Association to assist people with autism to fully participate in their communities (AOTA’s Societal Statement, 2009). Services can also include evaluating proper completion of age appropriate tasks, providing services covering developmental activities, play activities, facilitating communication and socialization with peers (AOTA’s Societal Statement, 2009).

Sensory and auditory interventions are often received by people with ASD. Children with ASD have heightened sensitivity to sensory stimuli (noise, touch, taste, light, temperature) (Baranek, David, Poe, Stone, & Watson, 2006) or exhibit sensory seeking behavior. Adaptive functioning may be compromised (Rogers, Hepburn, & Wehner, 2003) and targeted in therapy.

As stated previously, standardized tests of motor proficiency indicate presence and degree of motor skill impairments. Motor skills are tested in school and clinic based physical and occupational therapies or for research purposes. Motor skill development may be monitored over time to assess improvements or regression in ability levels. Therefore, it is imperative that a true and valid assessment is given to children. When completing motor skills assessments for children with ASD, there is often question if a child is able to understand the directions (Grandin, 2004), convey
questions about the procedure, and if a best effort is reflected. Characteristics and natural tendencies of people with ASD may make providing services challenging due to a lack of motivation, a lack of interest in working with a therapist and problematic behaviors that can interrupt the flow and progression of a session. A test administrator must overcome challenges without altering assessment procedure or guidelines. Therefore, a method must be devised to keep the child engaged and on task while completing specified activities.

In a review article, Dawson and Watling (2000) point out that although it is evident people with autism have deficits in motor skills, there is relatively little research that is systemic and controlled describing effective interventions (Dawson & Watling, 2000). Characteristics of autism and abnormal behaviors may make assessment and treatment of motor skills difficult. However, studies have shown introducing a therapy dog to children in a variety of settings has improved attention, engagement and interest and decreased anxiety and fear in children. Specifically, children with autism have expressed greater interest in interacting with a dog compared to a human and have had positive changes in behavior and communication in their presence (Jasmin, et al., 2009; Sams, et al., 2006).

Animals in Therapy

History of Animals in Therapy. Dating back to Florence Knightingale, animals in a therapeutic setting have had a positive impact on people. In Knightingale’s Notes on Nursing (1880), she notes a small pet “is often an excellent companion for the sick, for
long chronic cases especially” when a bird was in the room of a patient with a mental disability. The York Retreat in England, an establishment run by Quakers in the late 18th century, used farm animals as a component of therapy for people with mental illnesses (Netting cited in Heimlich, 2001). It was found that “…[the animals] are not only the means of innocent pleasure; but that the intercourse with them, sometimes tends to awaken the social and benevolent feelings” (as cited in Fine, 2006).

In 1962 psychologist Boris M. Levinson unintentionally learned about the positive effect that a dog could have on reserved and withdrawn child when his dog, Jingles, walked into the waiting room. Rather than escaping, the child greeted to the dog. For subsequent sessions Levinson allowed the dog to stay in the room during therapy sessions. Ultimately, the dog acted as a liaison for the child to be more vocal leading to rehabilitation. Levinson attributes his success to the fact that, “the establishment of a relationship with an animal is less threatening and thus leads to the establishment of a comfortable, nonthreatening, reality-oriented therapy with the child” (Levinson, 1962). The biophilia hypothesis and a learning theory can be supported by the natural affinity and tendency to remain engaged with an animal companion.

**Biophilia Hypothesis.** In 1984, Edward O. Wilson developed the biophilia hypothesis, the notion that humans have a natural tendency to be attracted to other living beings (humans, animals, plants). If a relationship is formed between a human and an animal (Melson, 2003) increased feelings of comfort and warmth in a new
environment can emerge (Nimer & Lundahl, 2007). Additionally, an animal can help children develop a relationship that they were not able to have with peers (Solomon, 2010). A dog can support a child’s social needs by walking while the child holds the leash or retrieving a ball the child has thrown (Haraway as cited in Solomon, 2010). Having interest in a relationship while having a sense of relaxation and safety can be used optimally in clinical settings (Kruger & Serpell, 2006). For example, a dog can be used as an agent to alleviate separation and social anxiety. A child, a dog, and a therapist may take a dog for a walk to get the child out of an office setting and briefly away from parents. As a relationship is established between the child and the dog, the child may become more comfortable and confident (Fine, 2006).

A Learning Theory. This learning theory states that if an activity is pleasing and pleasurable, there is a greater likelihood of it reoccurring in the future. If an activity is enjoyable, then it will become self-reinforcing (Kruger & Serpell, 2006). For example, in speech therapy context patients with aphasia all reported being more motivated to attend therapy when they knew a dog would be present (Macauley, 2006). This theory offers that through repeated contact with an animal a person becomes more self-motivated to engage in an activity. Additionally, anxiety and stress should decrease as well (Kruger & Serpell, 2006).

Animals in a Therapeutic Context. From such successes, the role of animals in health care has expanded. As defined by the Delta Society, animal assisted therapy (AAT) “is a goal-directed intervention directed and/or delivered by a health/human
service professional with specialized expertise, and within the scope of practice of his/her profession. AAT is designed to promote improvements in human physical, social, emotional, and/or cognitive functioning” (Delta Society, 2009). AAT is incorporated into formal, scheduled therapy in which the dog helps a patient achieve predetermined, difficult goals set by a therapist or facilitates outcomes that can be achieved through working with a dog (Nimer & Lundahl, 2007; Friedmann & Thomas, 1995). Alternatively, an animal assisted activity (AAA) is not goal directed, but aims to improve quality of life through time spent with an animal (Friedmann & Thomas, 1995).

AAT and AAA animals are different from service animals. A service or assistance dog is specifically trained to provide support, protection and safety to a person with a disability (Delta Society, 2009). For example, seeing-eye dogs are trained to work for people with vision impairments. Duties of service dogs may include: leading a person who is blind, retrieving an item for a person with a physical disability, or sensing if a person is going have a seizure (Wisch, 2007). Formal training makes the distinction between AAI, AAT, a service animal and a pet (Wisch, 2007). A pet is technically an untrained and perceived as a social support or companion (Delta Society, 2009).

In contrast, in AAT and AAI the animal is used for comfort and decreasing stress when establishing a relationship between a caregiver and patient (Fine, 2006). Positive outcomes associated with the interaction between a child and an animal are
short term and may not be present when the pair is no longer together (Melson & Fine, 2006). Animal assisted therapy has been used in conjunction with speech therapy, physical therapy, occupational therapy, and for general therapy sessions (Nimer & Lundahl, 2007). All have seen benefits of a therapy dog during patient recovery.

A patient is generally assigned to one canine team, a dog and a handler (Stanley-Hermanns & Miller, 2002). Dogs are selected for AAT based on temperament and health (Stanley-Hermanns & Miller, 2002). Once selected for an organized program, teams go through extensive obedience and behavioral conditioning (Stanley-Hermanns & Miller, 2002).

Characteristics, disposition and role of a dog are likely contributors for successes when an animal is present during therapy. A dog can act as a non-judgmental, non-biased companion for a person during an uncomfortable or stressful situation (Friesen, 2010). The dog cannot interrupt or criticize, but will rather be patient and calm (Levinson, 1962). The dog may provide emotional and social support in both therapeutic and educational settings (Friesen, 2010).

In a social context, a dog may act as a facilitator for relationships. People seen in the company of dogs attract peers, acquaintances, and strangers whom initiate conversations (McNicholas & Collis, 2000). To a patient, a therapist may seem “…happier, friendlier, less threatening, and more relaxed…” which would facilitate the establishment of a comfortable relationship (Fine, 2006).
The use of AAT has elicited positive physiological responses for people in stressful situations. After a 12 minute visit with a therapy dog, patients with advanced heart failure reported decreased anxiety and had decreased neurohormones suggesting a positive autonomic nervous system response from a pleasant environment or stimulus (Cole, et al., 2007). Similarly, animals decreased more hospitalized psychiatric patients’ anxiety levels than traditional therapeutic recreation (Barker, 2008) and had a calming effect on speech therapy patients (Macauley, 2006).

The effectiveness of AAT is clear when comparing attitudes and progress with and without a dog present. For example, patients with aphasia reported being more motivated, excited, and less stressed with a dog present during speech therapy (Macauley, 2006). In physical and speech therapy settings, the AAT, specifically the presence of a dog, has increased attention and participation in activities (Herbert & Green, 2001; Macauley, 2006). For example, Hebert & Green (2001) monitored walking distance of 10 female, geriatric patients with and without a dog. When accompanied by a dog, patients walked significantly farther (p=0.05) than when walking alone (Herbert & Green, 2001). These results suggest motivation and engagement can increase with a dog. Additionally, schizophrenic patients receiving weekly AAT for one year showed increased awareness for self care and personal hygiene as well as improved social functioning compared to a control group receiving therapeutic recreation (Barak, Savorai, Mavashev, & Beni, 2001). Accounts such as these, help demonstrate that when a dog is present positive changes can be made.
Animal Assisted Interventions and Therapies and Children  

Dogs have not only been successful in helping adults with disabilities, but children as well. Animals have been shown to increase self concept (Cawley, Cawley, & Retter, 1994) and decrease prompting during memory tasks (Gee, Crist, & Carr, 2010). Additionally, the presence of a dog has been used to help children with emotional disturbances become more open and comfortable talking about their feelings (Levinson, 1962).

Gee, Harris, and Johnson (2007) observed 14 preschool children (10 male, 4 female) completing gross motor skills tasks (i.e. long jump, high jump, etc.) with and without a canine present. When the AAT was employed, the therapy dog served as a model by either completing the tasks before the child or at the same time as the child. In this study, it was found that children completed the tasks more quickly and without compromising accuracy except for balance with a dog present (Gee, Harris, & Johnson, 2007). It is hard to determine how valid the motor skills assessments are because researchers did not use a standardized and validated tool.

The presence of a dog has been shown to have positive effects on children in health care settings. Canines have been shown to decrease perception of pain, decrease stress, and improve mood (Havener, et al., 2001; Nagengast, et al., 1997; Sobo, Eng, & Kassity-Krich, 2006). In a study by Sobo, Eng, and Kassity-Krich (2006), a convenience sample of 25 children ages 5-18 years in a tertiary care hospital were invited to participate in canine visitation therapy (CVT) post-operatively. Using validated, visual analog scales, participants rated perceived physical pain and
emotional distress before and after CVT. During the intervention, the participant decided what level of interaction (passive, low, or high) they desired with the canine. There was a significant difference ($p = 0.01$) for perceived physical and emotional pain after canine visitation therapy (Sobo, et al., 2006). This study provides quantitative data illustrating that dogs do serve as a distraction from perceived discomfort for children post-operatively.

Having a canine present has been shown to decrease stress and anxiety in children nervous or anxious about undergoing a dental visit. In a study of 40 children ages 7-11 years, half were assigned to a control group and the other half had a canine companion. Using the Observational Scale of Behavioral Distress and a telethermometer, observable behavior and physiologic stress were monitored before, during, and after the examination. Improvements were found only in children who verbalized distress at the beginning of the visit (Havener, et al., 2001). A lack of significant findings can be the result of not choosing participants who had initial fear or anxiety about the dentist. During recruitment, participants should have indicated their stress level and following the dental procedure been asked if the presence or absence of a dog would have made the experience better.

Similarly, Nagengast, Baun, Megel, & Leibowitz (1997) monitored physiological arousal and behavioral distress of 23 preschool aged children undergoing a physical examination with and without a dog present (Nagengast et al., 1997). Using a within subjects design, Nagengast, et al. determined that the presence
of a therapy dog elicited decreases in mean arterial blood pressure, systolic blood pressure and heart rate indicating physiologic reductions in stress levels. Additionally, scores on the Observational Scale of Behavioral Distress decreased from 0.9 in the control condition to 0.4 with a dog present (Nagengast, et al. 1997). Nagengast et al. does note a “see-saw” effect for heart rate during the control and intervention trials possibly resulting from the comfort levels during different parts of the exam.

Other literature has noted increases in heart rate and blood pressure in the presence of an animal (Kaminski, Pellino, & Wish, 2002; Nagengast, 1997); however, Baun, Bergstrom, Langston, & Thoma (1984) attribute some increases to the “greeting effect” (Baun, Bergstrom, Langston, & Thoma, 1984). In a study examining the physiological effects in known and unknown dog conditions, people had an initial increase in systolic (p < 0.01) and diastolic (p < 0.04) pressure under the familiar dog condition which decreased after 3 minutes. Initial increases can be attributed to the “greeting response” caused by the excitement of introduction to a familiar dog (Baun, et al., 1984). When comparing heart rate during the known and unknown dog conditions, there were no statistically significant differences between groups (Baun, et al., 1984). Kaminski, Pellino, & Wish (2002) noticed an increase in heart rate when a child finished participating in pet-facilitated therapy compared to before therapy.

While physiological measures and behavioral observations indicate a positive effect of a dog on a child during a stressful medical procedure, parents and health care
workers also note the positive impact on a child’s mood as well. In a convenience sample of 70 hospitalized children, 40 participated in one session of traditional child-life group activities while 30 participated in one session of an AAT. After AAT, parents rated their children happier than those attending traditional activities (Kaminski, et al., 2002). Similarly, parents noted an improvement in children’s affect and mood after interacting with a therapy dog (Kaminski, et al., 2002). Additionally, nurses working with pediatric oncology patients attributed a better working environment during an AAT. A child was able to focus their attention on the dog rather than on the treatment (Bouchard, Landry, Belles-Isles, & Gagnon, 2004).

Animal Assisted Therapies and Interventions and Children with Disabilities.

Few studies have looked that the effects that a therapy dog as on children with disabilities. Esteves and Stokes (2008) investigated the effect that the presence of a therapy dog would have on positive behaviors of three children (2 boys and 1 girl) 5 to 9 years with developmental disabilities. Using a multiple baseline design, social behaviors toward a teacher were assessed when the child was surrounded with toys, a stuffed dog, a leash, dog biscuits, and a brush. Once trends in data stabilized, a therapy dog was added to the classroom. Children showed increased positive verbal (e.g. “Happy,” “Fun,” or “More” expressions) and non-verbal (e.g. smiling or laughing) behaviors and social responsiveness while decreasing negative verbal (e.g. “No” and “Stop” statements) and non-verbal (e.g. disinterest or displeasure such as frowning, crying, or turning away from the teacher) behaviors (Esteves & Stokes,
This study provides evidence that a dog elicits positive changes in social behaviors for children with developmental disabilities. However, having no control group and only three children included in the study make results difficult to generalize.

Although results could not be generalized, Heimlich (2001) found a general trend in improvements of engaged behaviors during AAT (Heimlich, 2001). In a study by Kathryn Heimlich, 14 children ages 7-19 years with multiple disabilities participated in a multiple baseline design study. Children met twice a week for eight weeks and were assessed using the Measurement of Pet Intervention (MOPI). The MOPI uses a Likert scale to address attention span, physical movement, communication, and compliance. A general trend showed improvements in all areas. Due to low inter-rater reliability, results could not be generalized. Heimlich attributes a lack of success to: no proof of internal validity for the MOPI, a lack of administrative support for AAT, and stress on the service animal (Heimlich, 2001). In future studies, pro-active measures should be taken to avoid such obstacles when involving AAT and multiple video coders.

Animal Assisted Interventions and Therapies and Children with Autism

Initial literature suggests that dogs may help overcome some of the obstacles associated with working with a child with ASD. First, research has shown that while children with ASD may not seek peer relationships, they do express an interest in interacting with animals (Celani, 2002; Matrin & Farnum, 2002; Prothmann, Ettrich, 2008).
& Prothman, 2009). In a study by Prothmann, et al. (2009) 14 children (3 females and 11 males) with autism were given the choice to interact with a therapy dog, an adult, or an inanimate object throughout three, 20 minute long sessions. Sessions were video-recorded and later coded using Interact software to analyze frequency and duration of choice and engagement. Children with autism chose to interact with the dog twice as often as with the person and more than 16 times more often than the toy. Additionally, children with autism spent four times the amount of time engaged and interacting with the dog compared to a person (Prothmann, et al., 2009).

Martin & Farnum (2002) observed 10 children (8 males and 2 females) with ASD (7 PDD-NOS, 2 Asperger’s syndrome, 1 autism) under three conditions – with a ball, stuffed dog, or live dog. Each child participated in three, 15-minute long sessions per week for 15 weeks. The child was exposed to each condition once a week. Video-recordings were later coded for frequency and duration of behavior and verbal communication. Children laughed more, decreased time spent looking around the room, had a more playful mood, were more focused and aware of their social environment when the live dog was present (Martin & Farnum, 2002).

Prothmann et al. (2009) and Martin & Farnum (2002) both provide evidence that a child with ASD does show an affinity for a dog. Additionally, having a dog present, elicited a better attitude and increased frequency and duration of on task behaviors. The addition of a therapy dog may be a useful agent to help a child engage
in a therapeutic activity. If creatively planned, some goals may be able to be achieved while a child interacts with a therapy dog.

The presence of a dog has brought about a greater use of language, social interactions, and decreased problematic behaviors in children with autism (Redefer & Goodman, 1989; Sams, Fortney, & Willenbring, 2006). In an earlier study looking at the effect an animal has on a child with ASD, Redefer and Goodman (1989) observed behavior patterns of 12 subjects (3 girls and 9 boys) with autism under 3 baseline sessions with no dog present, 18 sessions with a dog was present, 3 post-treatment sessions and a month later with baseline conditions. With the dog present, there was an increase in social interactions (6.5 standard deviations) and a decrease in isolation (5 standard deviations). At the one month follow up, social interactions toward an adult had decreased (Redefer & Goodman, 1989). This study provided foundational evidence that children with autism interact more with peers when a dog is present. However, small sample size and no control group can partially mask if changes occurred because a child had become familiar with the therapist by the time a dog was introduced to the study.

Sams, Fortney & Willenbring (2006) observed social interactions and language use of 22 children ages 7 to 13 years with autism during traditional occupational therapy and during AAT with a llama or a dog present. Children did not all participate in the same number of sessions, however, the number of intervention versus traditional sessions was kept proportional for each child. All sessions focused on sensory
integration, language use, and motor skills. Sessions were video-recorded and later analyzed for use of language and social interaction. Results found that during animal therapy, children had a significantly greater use of language (p < 0.05) and social interactions (p < 0.01). Findings support that the presence of an animal may serve as a motivational agent for a child with ASD to increase communication and language use; however, this study does not report if the presence of an animal made delivering motor skills activities easier or more effective or if the child became comfortable and confident as time elapsed (Sams, et al., 2006).

Research has begun to support that there may be potential benefits to having children with disabilities interact with therapy animals. Research has begun to show that while in the company of a dog pro-social behaviors may increase and problematic behaviors may be reduced. In the presence of a dog, socially unacceptable behaviors including reduced anxiety, tantrums, and isolation decrease, calmness increases, and a positive cortisol response is seen in children with autism (Burrows & Adams, 2008; Redefer & Goodman, 1989; Viau, Arsadult-Lapierre, Fecteau, Champagne, Walker, & Lupier, 2010). In a study by Viau, Arsadult-Lapierre, Fecteau, Champagne, Walker, & Lupier (2010), 42 children with ASD (34 autism, 6 PDD-NOS, 2 AS) were given service dogs to live with. Two weeks before the intervention and while the dog was present in the household, parents were asked 11 questions about their child’s behavior. Results indicated a significant (p < 0.001) decrease in reported problem behaviors (Viau et al., 2010).
Similarly, Burrows, Adams, & Spiers (2008) had 10 families with a child with autism have a service dog remain with their family for up to one year. Through observation and periodic parent interviews, benefits were noted for having a canine companion for the child with autism. Parents reported that their child had an increased sense of calmness during daily activities (such as bathing and remaining seated at meals), decreased anxiety and tantrums, and appeared happier overall with the dog present (Burrows & Adams, 2008).

In both the Viau et al. (2010) and Burrows et al. (2008) studies, it was reported that children demonstrated improvements in behavior. However, these results are qualitative and taken from parent report. More formal, structured, quantitative evidence is needed to further support the improvements in positive behavior and reduction in problematic behaviors.

Lastly, a dog can help engage a child in motor skill activities. After a dog had been introduced to a family, parents noted increased motivation for a child with autism to learn new skills (Burrows & Adams, 2008). When the dog could be included in motor skill practice, the child was willing to cooperate and participate. For example, a child was more engaged in learning to throw a ball if the dog could retrieve it. Additionally, the child was more willing to learn fundamental steps for food preparation (opening a lid on a jar, pouring food into a bowl, etc) when the meal was for the dog (Burrows & Adams, 2008).
Such parental reports are promising and shed insight that by including a dog during a treatment session, a child may be more engaged in learning motor skills and skills necessary for activities of daily living. Quantitative data should be found to support the improvements in ease of teaching. Additionally, a control group should be added to determine if engagement in motor skills tasks and activities of daily living is improved with the presence of a dog.

To summarize, previous literature has reported that children with autism do show an interest in working with dogs. Although literature is limited, studies have begun to see that when engaged in an activity with a canine companion, children show increased attention, motivation, and pro-social behaviors as well as decreased anxiety and problematic behaviors. Therefore, the presence of a dog may help a child stay attentive during motor skills assessments. This will allow for easier administration of the assessment as well as less opportunity to veer from standardized guidelines for administration. The dog may act as a motivator for a child to actively participate and ultimately increase treatment gains (Sams et al., 2006). While there are benefits when a child with autism is in the presence of a therapy dog, precautions must be taken to ensure the safety for the participant as well as the canine.

**Precautions When Working with Animals**

Dogs are commonly selected for AAT and AAI due to their training and social skills (Dimitrijevic, 2009); however, precautions are necessary to eliminate risks and create a safe environment for the animal as well as participant. Potential risks posed
by dogs include “zoonoses” and allergic reactions to dander. The World Health Organization defined “zoonoses” as “those diseases and infections naturally transmitted between vertebrate animals and man” (The World Health Organization 1959 as cited in Brodie, Biley, & Shewring, 2002). Second, although animal dander has the potential to induce allergies, North American allergists reported it only affected 6% of patients (Elliot, Tolle, Goldberg, & Miller, 1985). To minimize the risks, dogs should be up to date on vaccinations, be regularly bathed, properly groomed, and if possible not shed (Friesen, 2010; Jalongo, et al., 2002). A properly cared for animal has little risk of transmitting a disease (Hines & Fredrickson, 1998). Additionally, therapy dogs are trained not to lick or scratch to reduce the likelihood of any transmission (Jalongo, et al., 2002). Lastly, proper hand washing before and after contact with a dog, further decreases potential health risks (Friesen, 2010; Jalongo, et al., 2002). In the unlikely event that a dog becomes ill and vomits, urinates or defecates in an undesignated area, the handler should be responsible for properly cleaning and sanitizing of the space (Jalongo, et al., 2002). Overall, Hines & Fredrickson summarize that the benefits of AAT do outweigh the risks (Hines & Fredrickson, 1998).

A person who has a fear of dogs or is timid should never be forced to interact with an animal. Jalongo et al (2004) advises, “It will take a calm, gentile, and sensitive [dog] to counteract such expectations or to reduce the anxiety caused by previous frightening encounters with canines” (Jalongo, et al., 2002).
a distance while a peer models how to interact with a dog may be beneficial (Jalongo, et al., 2002).

When working with a therapy dog from an organization, certain standards and guidelines adhere. Prior to a child interacting with a therapy dog, permission slips should be signed by parents or legal guardians and all dogs should be insured (Jalongo, et al., 2002). Additionally, dogs should remain on a leash while interacting with a child (Jalongo, et al., 2002).

While the safety of the participants is of importance, the protection and comfort of the dog is also a priority. Canines should have regular veterinary check-ups, up-to-date vaccinations and a good diet (Brodie, et al., 2002; Jalongo, et al., 2002). Dogs should not be overscheduled to avoid exhaustion (Jalongo, et al., 2002) and should be monitored for signs of stress (Friesen, 2010). Indications of stress: shaking, ears back, tail between the legs and persistent licking (Friesen, 2010). To avoid injury or discomfort for both the dog and participant, the participant should be informed by the handler the best way to interact, talk to, and pet the canine (Friesen, 2010). For the safety of a dog as well as a child, a handler should always be present, attentive, and engaged when appropriate during the interaction (Friesen, 2010; Jalongo, et al., 2002).

**Conclusion**

In conclusion there is a growing prevalence of the number of children being diagnosed with ASD (CDC, 2009). Research has already shown that people with
autism display motor skill deficits which can impact their success in many domains of life, including academics, vocational, and daily living skills (Baranek, 2002; Shipley-Benamou, et al., 2002). Although people with autism score low on standardized tests of motor proficiency (Dewey, et al., 2007; Esposito & Venuti, 2008; Fuentes, et al., 2009; Provost, et al., 2007; Rinehart, et al., 2006; Teitelbaum, et al., 1998), individuals may lack motivation during the assessment and not perform to their true abilities or may present challenging behaviors that make completion of the assessment difficult (Grandin, 2004). In a limited number of studies, research has begun to show that children with autism may have an interest in animals and may have greater attention and engagement in activities when a dog is present (Heimlich, 2001; Martin & Farnum, 2002; Prothmann, et al., 2009). Previous studies have used physiological indicators to monitor stress and comfort in various settings with and without a therapy dog present (Baun, et al., 1984).

Therefore, the purpose of this study is to explore the effect that a trained therapy dog has on a child with autism during a motor skills assessment. Specifically, quantitative data will be collected for heart rate, percentage of time engaged and off task, and score on the MABC-2 to monitor changes in comfort, behavior, and performance on the MABC-2 during baseline and intervention conditions. Qualitative data collected from a “Feeling Scale” report and follow up interviews will be collected to get an increased understanding of how a child felt during the assessment.
Chapter 3
METHODOLOGY

Overview

Eight boys with autism spectrum disorders (ASD) participated in this mixed methods, multiple case study project. This study employed an A-B-A design in which participants completed the Movement Assessment Battery for Children-2 (MABC-2) three times within a month period (Sessions 1, 3, 4). Sessions 1 and 4 represented the baseline and return to baseline conditions (A); whereas, Session 3 was the intervention condition (B) where a therapy dog from Pet Assisted Visitation Volunteer Services (PAWS) for People was present during the assessment. A-B-A is the minimum requirement in which the effects of an intervention can be seen compared to two baseline conditions (Schloss & Smith, 1998). If effects were seen during the intervention condition, stronger support could have been elicited with an A-B-A-B design (Schloss & Smith, 1998), however, with the scope and timeline of this study, this design was not possible. Session 2 was a scheduled “Meet and Greet” visit with the canine team before they were present for the motor skills assessment.

Quantitative variables investigated in this study were skill, heart rate, and percentage of time engaged and off task. Skill was assessed by Total Test Score as well as categorical component scores (manual dexterity, aiming & catching, and
balance scores) of the MABC-2. Qualitative data from a “Feelings Scale” after each session and data collected from a brief interview were obtained to help closely identify the participants’ experiences (Hesse-Biber, 2010). A mixed methods design, with case studies was used to observe common themes in the data.

In a single-subject design an individual acts as his/her own control. Therefore, researchers are able to observe changes and effects that an intervention has on an individual rather than collectively as a group. By using a single-subject design for each participant in the study, individual responses to the intervention were able to be compared to baseline conditions (Cooper, Heron, & Heward, 2007).

**Participants**

Participants in this study were eight males, 10.3 ± 1.1 years with a diagnosis of an autism spectrum disorders (ASD). Diagnoses included autism (n=6) and Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS) (n=2). Diagnoses were reported by parents and supported by the Social Responsive Scale (SRS) (162.5 ± 15.5). Parents reported an average score of 40.4 ± 9.7 on the Developmental Coordination Disorder Questionnaire 2007 (DCDQ’07) suggesting a suspicion of motor impairments (Wilson, 2007). Female participants were not included in this study due to the greater prevalence of ASD in boys than girls (CADDE, 2011). Only one participant was living with a dog at the time of the study; however, participants lived an average of 3.1 ± 3.8 years with a dog during their lifetime.
Inclusion criteria included: 1) male, 2) between 8 and 11 years, 3) diagnosis of autism, Asperger’s Syndrome (AS), or PDD-NOS, 4) receiving a score between 24 and 57 on the DCDQ’07, 5) receiving a Total Raw Score on the Social Responsiveness Scale above 60, 6) comfortable being around dogs assessed from parental report and 7) comfortable wearing chest electrodes. Exclusion criteria included: 1) physical disabilities (e.g. cerebral palsy), 2) severe problem behaviors (i.e., self-injurious behaviors), 3) extreme language impairments (i.e., non-verbal), 4) an injury or a hospitalization in the past 6 months due to a broken bone or sprain, 5) an allergy to dogs, and 6) aggression towards animals. One participant was excluded because he refused to wear chest electrodes; therefore, quantitative and qualitative data was collected for seven participants. This study had approval from the University of Delaware Institutional Review Board. Informed consent and assent forms as well as an Assumption of Risk form were signed by the participant and a parent/guardian prior to data collection.

Recruitment. Eight participants were recruited for this study; however, one failed to meet inclusion criteria. Participants were recruited from the Delaware Adapted Sports Club at the University of Delaware, MarriOtters, or the Delaware Autism Program (DAP) all based in Newark, DE. The MarriOtters is a parent organization that meets approximately one to two times per month and allows children with autism to socialize with peers and participate in swimming activities. The Delaware Adapted Sports Club meets once a week during the school year and
provides extra opportunities for children with ASD to engage in physical activity. The researcher met with the program coordinators to explain the project. Upon approval the researcher attended MarriOtters and Delaware Adapted Sports Club sessions to meet children and their parents and give a short presentation about the study. DAP is an educational system in Delaware that provides services specifically for children with ASD. The researcher met with the assistant principle of DAP and then observed students working at art and cooking classroom centers. Children who met inclusion criteria were sent home with information regarding the study.

All potential participants or interested parents received consent forms, Assumption of Risk forms, the SRS, the DCDQ’07 and a participant information form (see Appendix 1, 2, & 3 for copies of forms). If interest was expressed, the researcher contacted the parent within one week of receiving the completed forms. At this time the study’s purpose and procedures were reviewed again with the parent and additional questions were answered. Sessions 1-4 were scheduled. Once availability was established, the researcher contacted PAWS for People to find a canine team (dog and handler) that were available for Sessions 2 and 3.

Recruitment was most successful at the Delaware Adapted Sports Club (n=7) when the researcher was able to speak directly to parents and have forms filled out at first meeting if interest was shown. This ensured that the researcher had contact information and was able to follow-up with parents. Recruitment was less successful when organizations sent out e-mail announcements or forms were sent home with
students. Parents may have disregarded or over-looked this information and the researcher had no way to follow-up with individual families. One participant from the MarriOtters group and none from DAP were recruited.

Procedure

This study took place in the Developmental Motor Control Laboratory at the University of Delaware. Participants came to the laboratory four times within one month during Fall 2010. There were at least 24 hours between sessions and no more than 2 sessions per week. Testing sessions were scheduled as closely to the same time of day for each visit. If possible, all sessions either place during the week (Monday through Friday) or on the weekend.

Testing materials were set up or laid out prior to the participant’s arrival. Procedures at Sessions 1, 3, and 4 remained the same expect for the presence of the canine team at Session 3. Efforts were made to keep the testing room quiet and to deter any unforeseen interruptions. This included unplugging telephones in the room and covering any windows with paper.

The graduate researcher was the only person administering the MABC-2 (see Appendix 4). The MABC-2 is a standardized, quantitative evaluation; therefore, it was acceptable that the principal investigator is not blind to study variables. Skill was assessed based on MABC-2 component and Total Test scores. All sessions were videotaped for later analysis of engaged and off task behaviors using an adapted version Michael Metzler’s ALT-PE Microcomputer Data Collection System (MCDCS)
(See Appendix 5). An Actiheart was used to monitor changes in heart rate throughout each session.

*Session 1.* Session 1 took place in the Developmental Motor Control Laboratory. At this session, the study was again explained to the participant and his parent/guardian. Any questions were answered by the researcher. The participant completed the informed assent document. The child’s height and weight were taken using a standard tape measure and scale. The researcher palpated the radial artery on the left wrist and took heart rate for 15 seconds. This information was used to calculate the child’s resting heart rate for one minute. Using this information, the Actiheart was programmed on a computer in the Developmental Motor Control Laboratory. At this time, participants were given an identification number which only the researcher and undergraduate researcher were aware of. Identification numbers were based on order of arrival for Session 1. For example, the first child to begin Session 1 was P001. While the Actiheart was being programmed, the researcher talked to the child about the Actiheart and addressed any concerns or anxieties he may have had. This took approximately 10-15 minutes. The researcher presented the child with the Actiheart, alcohol wipes, and electrodes. The child felt the alcohol wipes and sticky side of the electrodes with his finger. The Actiheart was placed on the participant as recommended in the Actiheart User Manual (CamNtech Ltd). Procedures were followed for skin preparation as directed in the manual; however, if the child was more comfortable, his parent may have cleaned the skin under the
guidance of the researcher. Placement of the Actiheart on the skin was done by the researcher only. If tolerable, an ace bandage was used to secure the Actiheart to the child. Next, the researcher explained that the participant was going to watch a short video and then complete the MABC-2.

Once the Actiheart was on the child, he watched a 9-11 minute episode of the Nickelodeon television show “Doug” from www.youtube.com. This gave the participant sufficient time to become comfortable in the environment with the Actiheart device on his skin (Nagengast, Baun, Megel, & Leibowitz, 1997). Approximately two minutes before the show ended, videotaping began. The time stamp on the video recording corresponded to the time on the Actiheart.

Promptly, at the completion of the episode, MABC-2 testing began. MABC-2 testing followed procedures from the MABC-2 manual. When instructing the participant for each activity, the researcher would state, “I want to see you do the best job that you can.” In order to standardize the number of attempts participants had for each activity, all participants were given a practice trial as well as two attempts to complete each activity rather than advancing to the next if a satisfactory score was achieved. Testing lasted approximately 45 minutes.

When the MABC-2 was completed, the child was asked to rate his level of “happiness” based on a 3-point, color coded “Feelings Scale” which had representations of faces and words describing each level (see Appendix 6). The “Feeling Scale” is a color-coded, 3 point scale helping to assess how a child enjoyed
an activity. Cartoon faces corresponding to each level, “I LIKED it a lot,” “I am not sure if I liked it,” and “I did NOT like it,” were illustrated as well. A child was asked to report how he liked the activities done during the assessment. This scale has not been validated nor assessed for reliability. Next, the Actiheart was removed from the child and the researcher explained that at the next session the participant would be meeting a therapy dog.

Session 2 – Meet and Greet. Session 2 allowed the participant to meet and become familiar with the therapy dog prior to MABC-2 assessment with the dog present. At Session 2, the PAWS for People therapy team arrived 15-20 minutes prior to the participant. This allowed the dog sufficient time to adjust to the testing room and have the opportunity for water according to her handler.

The researcher met the participant at the entrance to the building. While walking to the testing room, the researcher reminded the child that there was a dog in the room. The child and parent were introduced to the canine team. The researcher told the participant that he was there to meet the dog and at the next session the dog would be watching him perform the MABC-2.

A standard PAWS for People introduction about the therapy dog was given by the handler. This included informing the participant about breed of the dog, basic commands, how to pet the dog and other sites the therapy dog assisted (e.g. educational and nursing home settings). The participant practiced giving the dog basic commands such as sit and lay and was allowed to brush and pet the dog under the
direction of the handler. The remaining 15-20 minutes of the session the participant and the therapy dog played a modified game of ‘hide and go seek.’ The participant and parent were given the opportunity to ask questions at any time which either the handler or the researcher addressed. Each participant was given a PAWS for People business card with a picture of the therapy dog on it to take home. At the completion of the session, the participant was reminded that the therapy dog would be at the next testing session to watch him complete the activities. This session lasted approximately 30-45 minutes.

Session 3. Procedures for Session 3 followed what was described previously in ‘Sessions 1’ except for the presence of a therapy dog. The PAWS for People therapy team arrived at the Developmental Motor Control laboratory approximately 15-20 minutes prior to the participant arriving for Session 3. The handler believed this gave the therapy dog ample time to get water and become settled in the room. When the participant arrived, the Actiheart was placed on his chest and he was reintroduced to the canine team. The participant was told that the dog was there to watch him complete the MABC-2 activities he had done previously. The participant was told he could pet the dog during the television episode and in between activities. To ensure that session time did not increase due to the introduction of the therapy dog, the participant was only instructed that he had the time between clean up and set up of activities to pet the dog if he desired. The times required for set up and clean up of activities remained consistent from baseline to intervention.
Allowing the child time to watch television with the therapy dog gave time to overcome the greeting effect without affecting heart rate due to exercise or movement (Baun, 1984).

During the assessment the therapy dog sat, stood or lay next to or facing the participant throughout the session. When instructing the participant for each activity, the researcher would state, “[The therapy dog] and I want to see you do the best job that you can.” During the manual dexterity and static balance tasks, the dog remained next to the child. During the aiming and catching tasks, the dog remained about 10 feet away from the participant, however, faced the participant during the activity. During dynamic balance tasks, the dog remained at the start of the activity and watched the child complete the task. In order to avoid having participants rush through activities to be with the therapy dog, the dog remained at the beginning (see Appendix 7 for a diagram of the room setup with the canine team present. Note: the room is not drawn to scale and not all activities were set up at the same time due to limited space and equipment).

Session 4. Procedures at Session 4 followed what was previously described in ‘Session 1.’ Aside from Session 1, the Actiheart was programmed prior to the child arriving.

In addition to the MABC-2 assessment and “Feeling Scale” parents and participants took part in a brief interview immediately following Session 4. At the initial scheduling, the researcher asked if the same parent could be present at all
sessions. This helped ensure that a parent would see how his/her child behaved and responded in each situation. Parents were present during participant interviews.

During the parental interview, participants were present and allowed to watch videos previously chosen by the parent on www.youtube.com in the Developmental Motor Control Laboratory. Questions focused on the impact that the therapy dog had on study variables. Appendix 8 includes the interview questions as well as participant and parent responses. All interviews were recorded and transcribed within 48 hours. Parents were emailed a copy of the transcription to verify that the interview was correctly interpreted and also given the opportunity to provide more feedback.

**Therapy Dog**

A two and a half year old, female, pure-bred chocolate Labrador retriever and her handler volunteered to assist with the eight study participants. The canine team was recruited from PAWS for People based in Hockessin, DE because an earlier study at the University of Delaware by Dr. Iva Obrusnikova and Dr. Albert Cavalier established a relationship with this organization. The following information regarding PAWS for People was contributed by Dr. Obrusnikova:

“The dogs and their handlers who will participate in this study belong to the **PAWS for People** non-profit organization that focuses on providing pet-assisted services to individuals with and without disabilities in DE, PA, MD, and NJ. Based in Hockessin, DE, PAWS for People includes programs for children such as PAWS for Reading, the UD Early Learning Center Mobility Project, the PAWS Autism Initiative, the PAWS Drug and Alcohol Treatment Program, Pet-Assisted Physical Therapy/Occupational Therapy/Speech Therapy, and
the Bancroft NeuroHealth Program. Dogs are pre-selected for temperaments that include the characteristics of calmness, patience, and tolerance for a wide range of actions and noises from humans around them. Dogs are required to be up to date on rabies and distemper vaccines and a yearly examination that their vet signs off on. Their records are in the Paws for People office and a copy will be brought to each session. The dogs and their handlers also will have received a minimum of 11.5 hours of training to meet standards of certification that are designed to establish excellent command control and to instill a gentle and tolerant demeanor around children and adults with disabilities. The certification is based on testing procedures and requirements adapted from Delta Society, AKC’s Canine Good Citizen, and Therapy Dog International. The test has been approved and accepted by Intermountain Therapy Animals; Christiana Care Hospitals; Union Hospital; St. Francis Hospital; Exceptional Care; Brandywine, Red Clay, and Christiana School districts, and UD sites including College School, The Early Learning Center, and the Lab Preschool. The training includes the following: (a) intake screening (1 hour), (b) orientation to PAWS and pet therapy (2 hours), (c) standards of excellence training and testing workshop (2 hours), (d) training (4 hours), (e) assisted first visit and on-site training (1.5 hours), and (f) the actual test (1 hour)… The dog handlers will monitor stress of the dogs (e.g., dog is trying to leave, is avoiding interaction, or is shaking). If the dog ever expresses either audibly or behaviorally that s/he is experiencing discomfort or stress, either the role of the dog in the activity will be changed (i.e., instead of participating in the activity, s/he will be standing on the sideline) or the activity will be avoided. If these symptoms continue after these modifications, the session or possibly the research study will be ended for that dog. In such a situation, the experimental participant will become one of the classmates or, if requested by the parents, will leave the program. Similarly, if a child ever expresses, either verbally or behaviorally, that he is experiencing discomfort and simply does not want to be around the dog any longer, the session will be ended for that child. Parents will be informed that, despite all of these safeguards, the risk that a dog might scratch or bite their child can never be completely eliminated. PAWS for People carries an insurance plan that covers everything the dog handlers or their dogs might do to the participants on and off-leash (e.g., bites, scratches, tripping over the dog). When off-leash, the participants will be closely monitored by the dog handlers. The parents and the handlers will be asked to sign an Assumption of Risk Form that was created in collaboration with the Mrs. Linsay Crawford, Assistant
Counsel, Office of the General Counsel. The handlers and the parents will be informed that, if an injury occurs, we will give immediate medical attention, but that any continuing medical costs will be their responsibility. The Assumption of Risk form was reviewed by the PAWS for People director.”

**Movement-Assessment Battery for Children-2 (MABC-2)**

(Henderson, Sugden, & Barnett, 2007). The Movement-Assessment Battery for Children-2 (MABC-2) is a standardized tool used in research and clinical settings to determine the amount of fine and gross motor skill impairment in children. This tool specifically targets three skill categories: manual dexterity, aiming and catching and balance. The test is broken into specific age bands (I: 3-6 years, II: 7-10 years, and III: 11-16 years) with appropriate subtests to determine the level of deficiency. For the selected age group, participants completed the following tasks:
Table 1  Overview of MABC-2 for children 7-11 and 11-16 years.

<table>
<thead>
<tr>
<th>Age Band</th>
<th>Task 1</th>
<th>Task 2</th>
<th>Task 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual Dexterity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>Placing Pegs</td>
<td>Threading Lace</td>
<td>Drawing Trail 2</td>
</tr>
<tr>
<td>III</td>
<td>Turning Pegs</td>
<td>Triangle with Nuts and Bolts</td>
<td>Drawing Trail</td>
</tr>
<tr>
<td>Aiming &amp; Catching</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>Catching with Two Hands</td>
<td>Throwing Beanbag onto Mat</td>
<td>---</td>
</tr>
<tr>
<td>III</td>
<td>Catching with One Hand</td>
<td>Throwing at Wall Target</td>
<td>---</td>
</tr>
<tr>
<td>Balance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>One-Board Balance (static)</td>
<td>Walking Heel-to-Toe Forwards</td>
<td>Hopping on Mats (Dynamic)</td>
</tr>
<tr>
<td>III</td>
<td>Two-Board Balance (static)</td>
<td>Walking Toe-to-Heel Backwards (Dynamic)</td>
<td>Zig-Zag Hopping (Dynamic)</td>
</tr>
</tbody>
</table>

When completing manual dexterity tasks, the child sat at a table where his feet comfortably reached the ground and faced the researcher. When performing balance and ball skills tasks the child faced away from windows in the room to avoid distraction. As mentioned previously, during the directions the researcher would say, “I want to see you do the best job that you can” during the baseline conditions and “[The therapy dog] and I want to see you do the best job that you can” during the intervention condition for each activity. The MABC-2 is used in both research and clinical settings. Further, this assessment was selected due to the fact that many activities are stationary and do not require large amounts of physical energy to be exerted for great durations compared to other standardized assessments such as the
Test of Gross Motor Development-2 (TGMD-2). If a participant needed to be more active for the assessment, heart rate could have been influenced by activity rather than comfort or response to stress in the environment.

Although the MABC-2 manual states that tasks need to be completed only once if done sufficiently and twice is not done sufficiently during the first trial, for the purposes of this study all tasks were completed twice regardless of the first performance. This was done to help standardize the amount of trials each participant attempted and to account for poor skill, but high concentration as well as high skill, but low concentration.

When scoring the assessment, raw scores used in the calculation reflected a participant’s best effort (i.e., best score, faster time) of the two trials per activity. The best performance was reflected in the scoring according to MABC-2 manual guidelines. Raw scores were converted into standard scores. Standard scores were based on a child’s age in relation to standard age scores provided by the MABC-2. If a task required a participant to use both sides of the body, the following formula was used to calculate a raw score: “add the standard scores for each side and divide by two. If the resultant value is more than 10 then round upwards. If it is below 10 then round downwards” (Henderson, 2007). Tables provided in the MABC-2 manual were used to determine standard scores and percentile ranks for manual dexterity, aiming & catching, and balance. Total test scores as well as categorical component scores (manual dexterity, aiming & catching and balance) of the MABC-2 were analyzed.
Actiheart

The Actiheart is a portable, lightweight device used to record physical activity, heart rate, and variability of R-R inter-beat interval (IBI) (CamNtech Ltd). For the purposes of this study, only heart rate data was reviewed. Actiheart software was run on a computer with Microsoft XP in the Developmental Motor Control Laboratory. The Actiheart had a short term and advanced energy expenditure setup with a 15 second epoch recording interval; therefore, recording beats per minute (BPM) every 15 seconds. Height (cm), weight (kg), resting heart rate, gender and date of birth were necessary to program the Actiheart. The Actiheart was connected to a computer using a USB cable to setup and download recorded data.

Before placing the Actiheart on the skin, the participant was allowed to feel the alcohol wipes and monitoring electrodes. The participant was told they may feel cold and sticky. The skin where the Actiheart was placed was cleaned with rubbing alcohol wipes and allowed to fully dry before Actiheart was placed on the skin. Standard 3MT Red DotT Foam Monitoring Electrodes 9640 were used to secure the Actiheart to the child. The round end of the Actiheart was placed approximately 2 inches below the clavicle and 1 inch to the left of the sternum and the remaining end was placed horizontally across the sternum as recommended by the Actiheart manual to avoid an error reading. After each session all Actiheart data was downloaded onto a password protected computer in the Developmental Motor Control Laboratory and backed up on an external hard-drive.
Recordings of 0BPM occurred if the participant touched the Actiheart or if data was not collected for an unknown reason. All 0BPM were removed for data analysis. Heart rate data collected every 15 seconds was averaged and compared for total visit (television program, MABC-2 assessment and Feeling Scale) as well as each categorical section of the MABC-2. The start of categories was defined as when the researcher directed the participant’s attention directly to the activity often by giving the directions. The end of the category was marked by the participant completing the motor activity and researcher expressing to the participant that they finished the current task.

**Engaged and Off Task Behaviors**

A Sony Handycam was used to videotape all testing sessions. Appendix 7 provides a layout of the room including where the camera person remained during the session. The time stamp on the video-recording was set to match the Actiheart data. Videotaping began approximately two minutes before the television program concluded. At the completion of each session, videos were loaded onto a password protected computer in the Developmental Motor Control Laboratory and backed up on an external hard-drive.

When reviewing the session recordings, engaged and off task behaviors were coded every 15 seconds using an adapted version of Michael Metzler’s Learner Moves Levels. Coding began when the participant was seated at the table and the researcher began instructing or directing the participant’s attention to the MABC-2. Coding
ended when the child completed the final activity of the MABC-2 (see Appendix 5).

Table 2 outlines the coding system used.

### Table 2  Behavioral Variable Overview.

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Key Label</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engaged, Motor Responding</td>
<td>M</td>
<td>Participant is performing an activity, either practice or trial.</td>
</tr>
<tr>
<td>Engaged, Indirect Participation</td>
<td>I</td>
<td>Participant is involved in an activity, but not directly involved with the immediate actions. This may include cleaning up an activity or transitioning (walking) to the next activity.</td>
</tr>
<tr>
<td>Engaged, Cognitive</td>
<td>C</td>
<td>Cognitive involvement related to instruction. This may include listening to directions or watching the researcher demonstrate how to complete an activity.</td>
</tr>
<tr>
<td>Not Engaged, Waiting</td>
<td>W</td>
<td>Time during an activity when the student is waiting for help or to participate. This may include when the researcher is setting up the next activity.</td>
</tr>
<tr>
<td>Not Engaged, Off Task</td>
<td>O</td>
<td>Participant is disengaged from the activity or acting in a manner that is not appropriate for a testing session. This may include talking excessively about an unrelated topic, walking away from an activity that is in progress or using equipment inappropriately.</td>
</tr>
<tr>
<td>Dog</td>
<td>D</td>
<td>The participant’s focus is on dog. For example, he may be petting the dog or asking the handler questions related to the dog.</td>
</tr>
<tr>
<td>ActiHeart</td>
<td>A</td>
<td>Assessment has to be paused in order to adjust an ActiHeart or ace bandage.</td>
</tr>
</tbody>
</table>
During Summer 2010 the principal investigator completed coding training for on and off task behaviors for children with Asperger’s Syndrome interacting with a therapy dog for the study, *Effects of Dog-Assisted Exercise on Children with Autism Spectrum Disorders*. The researcher independently coded roughly seven hours of video for the study. An undergraduate research assistant completed approximately 6 hours of training with the researcher to become familiar with the coding system.

Inter-rater reliability between the researcher and undergraduate research assistant was calculated using Cohen’s kappa coefficient. Required interrater reliability was between .9 and 1.0 demonstrating high reliability (Cohen, 1960). To establish inter-rater reliability, the two researchers independently coded 20 minutes of video (10 minutes of baseline and 10 minutes of intervention). Segments of video were selected to ensure that each component of the MABC-2 was coded for reliability. The researcher also completed a reliability check with herself. Twenty minutes of video (10 minutes of baseline and 10 minutes of intervention) previously coded from Participants 2, 3, and 4 were randomly selected. About one month after this was coded, the researcher coded it again. Cohen’s kappa was used to determine reliability.

Once coding was completed, the researcher went through segments coded Dog (D). If the therapy dog was distracting to the participant or the participant directed his attention to the dog rather than the activity, this was re-coded as Off Task (O). However, if the child was petting the dog during a transition this was re-coded as
Indirect Participation (I). Coding for Waiting (W) and Actiheart (A) were removed from all analyses.

A custom LabView program was created to calculate the frequency of each variable coded as well as percentage of time engaged in each variable. A separate assessment was done in which codes for Motor Responding (M), Indirect Participation (P), and Cognitive (C) were combined into one category Engaged (E). LabView was again used to determine the frequency and percentage of time engaged in each variable.

Percent of time spent in each variable (Motor Engaged, Indirect Participation, Cognitive, Off-Task) as well as for data combined for Engaged were analyzed for the total MABC-2 assessment.

Statistics

Due to the small sample size and variation within each participant, a mixed methods design was used for this study. A within-subject design was used to compare data from Sessions 1, 3, and 4. MABC-2 score (total test score and categorical scores), average heart rate for the assessment and engaged and off task data were analyzed non-parametrically. All participants with data were included in all statistical tests. SPSS version 17.0 was used to calculate K-related samples (Friedman’s test) analyses.

Due to the fact that generalizations could not be made, replication across participants for qualitative and quantitative data was sought (Flyvbjerg, 2006). After
data was analyzed statistically and no significance was observed, the researcher
looked to see if any themes could be seen within the participants’ quantitative data.
Once it was determined which participants exhibited similar changes in quantitative
data, common themes from “Feelings Scale” responses, participant and parental
interviews as well as demographic information were sought.
Chapter 4

RESULTS

Inter-rater reliability was established between the researcher and the undergraduate researcher. Using Cohen’s kappa, inter-rater reliability was found to be .927 (Cohen, 1960). Test-retest reliability for the researcher was found to be .934.

Quantitative and qualitative data were drawn from this study. This created a mixed method design in which qualitative data helped support quantitative data by revealing prevailing themes. All participants were included in the non-parametric analyses.

Movement Assessment Battery for Children-2 Scores

When comparing Visits 1, 3 & 4, there were no significant differences in Total Test Score (p=0.096) nor individual category component scores of the MABC-2 (see Table 3). Although there were no significant changes, Total Assessment scores did vary slightly between baseline and intervention conditions (see Figure 1).
Table 3  Mean Total Test Score and Categorical Component Scores of the MABC-2 over Visits 1, 3 & 4.

<table>
<thead>
<tr>
<th></th>
<th>Visit 1</th>
<th>Visit 3</th>
<th>Visit 4</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual Dexterity</td>
<td>11.6 ± 5.9</td>
<td>14 ± 7.3</td>
<td>16.3 ± 11.1</td>
<td>0.141</td>
</tr>
<tr>
<td>Aiming &amp; Catching</td>
<td>11.3 ± 2.2</td>
<td>11.3 ± 2.9</td>
<td>12 ± 2.4</td>
<td>0.522</td>
</tr>
<tr>
<td>Balance</td>
<td>17.7 ± 7.8</td>
<td>17 ± 6.4</td>
<td>19.7 ± 8.2</td>
<td>0.651</td>
</tr>
<tr>
<td>Total Test Score</td>
<td>40.6 ± 11.6</td>
<td>42.3 ± 11.1</td>
<td>48 ± 18.4</td>
<td>0.096</td>
</tr>
</tbody>
</table>

Figure 1  Mean Total Test Score for the MABC-2 among Visits 1, 3 & 4. Significance was not seen among Total Test Scores for Visits 1, 3 & 4 (p=0.096).
Heart Rate

No significant differences were seen in mean heart rate data (beats per minute (bpm)) over the entire assessment (p=0.651) nor heart rate for components of the MABC-2 as a group (see Table 4). Although not significant, mean heart rate was lowest during Visit 3 for all individual components of the assessment and the entire assessment. Further investigation found similar changes in heart rate for individual participants (see Figure 2). During Visit 3, with the therapy dog present, Participants 1 and 3 had their highest mean heart rate while participants 2, 5, and 6 had their lowest mean heart rate. Participant 4 had a steady decrease in average heart rate over the sessions, while Participant 8 had a steady increase.

<table>
<thead>
<tr>
<th></th>
<th>Visit 1</th>
<th>Visit 3</th>
<th>Visit 4</th>
<th>P (non-parametric)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Manual Dexterity</strong></td>
<td>105.4 ± 13.7</td>
<td>99.5 ± 13.6</td>
<td>105.3 ± 14.9</td>
<td>0.223</td>
</tr>
<tr>
<td><strong>Aiming &amp; Catching</strong></td>
<td>120.7 ± 14.2</td>
<td>119.9 ± 12.4</td>
<td>132 ± 19.7</td>
<td>0.223</td>
</tr>
<tr>
<td><strong>Balance</strong></td>
<td>125.4 ± 18.4</td>
<td>123.4 ± 15.7</td>
<td>132.5 ± 19.8</td>
<td>0.223</td>
</tr>
<tr>
<td><strong>Complete Assessment</strong></td>
<td>111.2 ± 13.2</td>
<td>109.3 ± 14</td>
<td>112.2 ± 13.5</td>
<td>0.651</td>
</tr>
</tbody>
</table>
Figure 2  Changes in mean heart rate (bpm) over the entire assessment for Visits 1, 3 & 4. Significance was not seen among visits (p =0.651); however, similar patterns can be seen in Participants 1 and 3 having highest mean heart rate at Visit 3 as well as Participants 2, 5, and 6 having lowest mean heart rate at Visit 3.

Engaged and Off Task Behavioral Variables

No significant differences were found in percentage of time engaged (E) (p=0.923) nor percentage of time off task (O) (p=1.00) between baseline and intervention conditions (see Table 5 & Figure 3). Further, there were no significant differences in Motor Responding (M) (p=0.513), nor Cognitive (C) (p=0.311) variables. Significant differences were seen in Indirect Participation (I) between Visits 1, 3, and 4 (p=0.042). However, when sub-categories of Engaged were combined (Motor Responding, Cognitive and Indirect Participation) no significant differences between visits (p=0.873) were found.
Table 5  Percentage of time spent in engaged and off task behaviors during MABC-2 over three visits.

<table>
<thead>
<tr>
<th></th>
<th>Visit 1</th>
<th>Visit 3</th>
<th>Visit 4</th>
<th>P (non-parametric)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Motor Responding (M)</strong></td>
<td>53.2 ± 5.2</td>
<td>50.1 ± 2.8</td>
<td>53.3 ± 6.6</td>
<td>0.513</td>
</tr>
<tr>
<td><strong>Indirect Participation (I)</strong></td>
<td>12.8 ± 4.3</td>
<td>17.3 ± 4.9</td>
<td>15.8 ± 5.7</td>
<td>0.042*</td>
</tr>
<tr>
<td><strong>Cognitive (C)</strong></td>
<td>18.2 ± 7.4</td>
<td>16.9 ± 4.7</td>
<td>16.2 ± 4.0</td>
<td>0.311</td>
</tr>
<tr>
<td><strong>Off-Task (O)</strong></td>
<td>15.8 ± 6.4</td>
<td>15.8 ± 6.8</td>
<td>14.7 ± 5.9</td>
<td>1.0</td>
</tr>
<tr>
<td><strong>Engaged (E)</strong></td>
<td>84.3 ± 6.5</td>
<td>84.3 ± 6.9</td>
<td>85.2 ± 6.0</td>
<td>0.873</td>
</tr>
</tbody>
</table>

*Significant at the 0.05 level (2-tailed).

Figure 3  These bar graphs depict that the percentage of time participants as a whole were engaged (p=0.873) and off task (p=1.0) during the MABC-2 did not differ significantly among Visits 1, 3 & 4.
Qualitative

Participant Summary. After baseline and intervention visits, six participants reported green, “I LIKED it A LOT!” on the “Feelings Scale.” One participant responded yellow, “I am NOT SURE if I liked it or not.” Overall, responses on the “Feelings Scale” did not change between baseline and intervention conditions.

During the interview, six participants said they enjoyed participating, while one responded that he did not enjoy coming. During the interview, all participants correctly remembered the therapy dog’s name. Five participants reported that the assessment was more fun with the dog present, one said it was more fun without the dog, and one said it did not matter to him whether or not the dog was present. Six participants reported that they enjoyed having the therapy dog watch while they completed the MABC-2. One participant had no response when asked. Five participants reported that they felt they did a better job when the therapy dog was present, one was not sure, and one had no response. Five participants reported that the therapy dog made them feel happy or great, while one participant reported that he did not feel any differently with the therapy dog present.

Parent Summary. When asked if their child ever spoke about any aspect of the study, six parents reported that their child spoke specifically about the therapy dog, while one parent reported that her son did not mention anything regarding the study. Overall, six parents felt their child had positive feelings about participating in the study, while one parent reported that her son was ambivalent. The majority of parents
believed their child acted as they would have assumed with and without the therapy dog present. However, two parents reported that their children’s behavior was better than expected with the therapy dog present, while another reported that she felt her son’s behavior was worse than expected with the therapy dog present. One parent reported her son worked slower than she would have expected without the dog present; however, he completed the assessment more quickly during the intervention condition. Five parents believed that having the therapy dog present had no impact on their son’s performance of the motor skills activities. Four parents thought their child was happier and more comfortable with the therapy dog. Four parents believed that greater differences in behavior, outcome, and enjoyment would be seen if their child interacted with a therapy dog in a less structured setting.

**Individual Participant Summaries**

*Participant 1 (P1)*

At the time of data collection, Participant 1 was 9 years and 6 months. He had a diagnosis of autism, received a SRS score of 156 and a DCDQ'07 score of 42. Currently, the participant was not living with a dog, however, a he had lived with a dog for six years previously. Throughout the study the participant’s component scores on the MABC-2 changed very slightly, if at all. Total Test score was highest with the therapy dog present (36), however, there was only a 1 and 4 point difference between the intervention condition and Visits 1 and 4 (see Table 6). With the therapy dog present, Participant 1 had his highest average heart rate for the entire assessment (see
Table 6). Due to video-camera malfunctions, average heart rate could not be determined for component scores of the MABC-2 or frequency of engaged and off-task behaviors for Visit 4. Therefore, no further analysis of average heart rate and no analysis for engaged and off-task behaviors were completed for this participant.

Participant 1 indicated *green,* “I LIKED it A LOT!” on the Feelings Scale after each visit and reported that he enjoyed participating in the study; however, he enjoyed it more with the therapy dog present than without her present. He reported that he enjoyed having the therapy dog watch him do his work. He felt he did a good job on the MABC-2 but a better job when the therapy dog was watching. The participant reported that the therapy dog made him feel great. The participant also acknowledged that he enjoyed playing with [the therapy dog] during the meet and greet visit, Visit 2.

The participant’s parent reported that the family posted the PAWs business card on their refrigerator at home and that Participant 1 talked about the therapy dog only when he saw the card. The parent reported that the participant acted as expected at baseline conditions, however, “was surprised he was not more off task by the dog. [The parent] thought he would be distracted by it, but he sat and did his work. [The parent was] surprised he did not try to pet it more. [The parent thought] the session to meet [the therapy dog] helped.” Complete participant and parent interviews can be found in Appendix 8.
Table 6  Participant 1: Categorical Component MABC-2 score and mean heart rate breakdown.

<table>
<thead>
<tr>
<th></th>
<th>Manual Dexterity</th>
<th>Aiming &amp; Catching</th>
<th>Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>V1</td>
<td>V3</td>
<td>V4</td>
</tr>
<tr>
<td>MABC-2 Score</td>
<td>7</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Mean Heart Rate (bpm)</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
</tbody>
</table>

Table 7  Participant 1: MABC-2 Total Test Score and mean heart for entire assessment

<table>
<thead>
<tr>
<th></th>
<th>V1</th>
<th>V3</th>
<th>V4</th>
</tr>
</thead>
<tbody>
<tr>
<td>MABC-2 Score</td>
<td>35</td>
<td>36</td>
<td>32</td>
</tr>
<tr>
<td>Mean Heart Rate (bpm)</td>
<td>110.3</td>
<td>126.9</td>
<td>117.1</td>
</tr>
</tbody>
</table>

Participant 2 (P2)

At the time of data collection, Participant 2 was 11 years and 11 months. He had a diagnosis of autism, received a SRS score of 177 and a DCDQ’07 score of 24. Currently, the participant was living with a dog and had lived with a dog for approximately 10 years. At Visit 4, two female undergraduate researchers were present for videotaping rather than only the one that was present for Visits 1 and 3.

Throughout the study the participant’s individual component scores on the MABC-2 changed slightly (see Table 7). Visits 1 and 3 had similar component and Total Test scores (51 and 52) with the greatest difference being only 2 points in the
manual dexterity component. With the therapy dog present, Participant 2 had his lowest mean heart rate for the total assessment as well as each individual component section of the assessment. For the total assessment, average heart rate with the therapy dog present was 15.4 and 9.4 beats per minute (bpm) lower at Visit 3 than at Visits 1 and 4 (see Table 7). Although slight, Participant 2 spent more time engaged (84.56%) and less time off task (15.44%) in Visit 3 compared to Visits 1 and 4. The greatest differences were seen between Visits 1 and 3 (see Table 8).

Participant 2 indicated green, “I LIKED it A LOT!” on the Feelings Scale after each visit and reported that he enjoyed participating in the study, however, he enjoyed it more with the therapy dog present. The participant reported, “I like it better with [the therapy dog] than without [the therapy dog] because without [the therapy dog] it’s kind of boring.” He reported that he enjoyed having the therapy dog watch him do his work because “she is a nice girl.” He felt he did a good job on the MABC-2 but it was “…easier when [the therapy dog] was in the room with [the handler].” The participant reported that the therapy dog made him feel happy.

Participant 2’s parent reported that the participant only talked about the therapy dog and nothing else about the study at home. His parent indicated that she felt he “acted more like a class clown” and was performing during Visits 3 and 4. His parent reported that she felt “he was more open socially when the dog was here” and tried to engage the handler in conversation. His parent did not notice an observable difference on his performance on the MABC-2. His parent felt he was generally
happy to come to the assessment and that the therapy dog made a positive impact on Participant 2. His parent also pointed out that often their family dog will sit near him while he completes his nightly homework. Complete participant and parent interviews can be found in Appendix 8.

Table 8 Participant 2: Categorical Component MABC-2 score and mean heart rate breakdown.

<table>
<thead>
<tr>
<th>Manual Dexterity</th>
<th>Aiming &amp; Catching</th>
<th>Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>V1</td>
<td>V3</td>
</tr>
<tr>
<td>MABC-2 Score</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>Mean Heart Rate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(bpm)</td>
<td>125.3</td>
<td>110.9</td>
</tr>
</tbody>
</table>

Table 9 Participant 2: MABC-2 Total Test Score and mean heart for entire assessment

<table>
<thead>
<tr>
<th></th>
<th>V1</th>
<th>V3</th>
<th>V4</th>
</tr>
</thead>
<tbody>
<tr>
<td>MABC-2 Score</td>
<td>51</td>
<td>52</td>
<td>46</td>
</tr>
<tr>
<td>Mean Heart Rate</td>
<td>131.6</td>
<td>116.2</td>
<td>125.6</td>
</tr>
<tr>
<td>(bpm)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 10 Participant 2: Behavioral variable breakdown.

<table>
<thead>
<tr>
<th></th>
<th>M%</th>
<th>I%</th>
<th>C%</th>
<th>E%</th>
<th>O%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visit 1</td>
<td>53.28</td>
<td>8.2</td>
<td>17.21</td>
<td>78.69</td>
<td>21.31</td>
</tr>
<tr>
<td>Visit 3</td>
<td>49.26</td>
<td>17.65</td>
<td>17.65</td>
<td>84.56</td>
<td>15.44</td>
</tr>
<tr>
<td>Visit 4</td>
<td>61.68</td>
<td>8.41</td>
<td>14.02</td>
<td>84.11</td>
<td>15.89</td>
</tr>
</tbody>
</table>
Participant 3 (P3)

At the time of data collection, Participant 3 was 9 years. He had a diagnosis of autism, received a SRS score of 152 and a DCDQ’07 score of 50. Currently, the participant was not living with a dog; however, he had lived with a dog for approximately 6 years in the past. MABC-2 Total Test scores and component scores varied for Participant 3 (see Table 9). Neither component nor Total Test scores were highest with the therapy dog present. Average heart rate varied slightly for the total assessment as well as during the balance activities (see Table 9). Heart rate was highest with the therapy dog present (124.3 bpm) and slightly lower at Visits 1 (116.9 bpm) and 4 (121.6 bpm). At Visit 3, Participant 3 spent 24.5% time off task whereas at Visits 1 and 4 he was off task 18.18% and 17.7% of the assessment (see Table 10).

Participant 3 indicated green, “I LIKED it A LOT!” on the Feelings Scale after each visit; however, he was the only participant to state that he enjoyed the assessment more without the dog present. During the parent interview, his parent clarified the response that it did not “mean he didn’t like the dog he said he enjoyed doing the exercises more without the dog.” Further, Participant 3 answered that he liked having the therapy dog watch him do his work and felt the activities were easier with the dog present. Participant 3 stated that the therapy dog made him feel happy.

Participant 3’s parent reported that the participant never spoke about the study or therapy dog at home, however, when she reminded him about the study before each visit he was excited. His parent was confident to report that she felt her son enjoyed
participating in the study, “I think he had a lot of fun. I mean he said [points to
green/happy on the Feelings Scale], and I know he really meant it.” The parent
expressed she was not surprised how her son behaved during each visit.

Participant 3’s parent went on to further state how the “…situation was not the
most comfortable because it’s not a natural situation…he didn’t enjoy it as much was
that it’s not his dog. It’s a dog that is handled by somebody and they have to tell him
what to do, what not to do to the dog because it’s their dog. But if it were to have
been, say, his dog and he’s comfortable with the dog and he can touch the dog
everywhere he would have been more comfortable…he doesn’t have the freedom
to…do whatever he wants. And that makes a big difference for kids like him because
that adds a little bit of stress.” The parent did note, however, that when Participant 3
was petting the therapy dog, she thought he was probably the most comfortable and
enjoying the dog’s presence. The parent felt Participant 3 would have benefited more
if he was able to freely interact with the animal. Additionally, the parent did not seem
confident that there would be vast differences between Visits 3 and 4, but possibly
Visits 1 and 3 due to the fact that he may have become more comfortable with the
environment. Complete participant and parent interviews can be found in Appendix 8.
Table 11  Participant 3: Categorical Component MABC-2 score and mean heart rate breakdown.

<table>
<thead>
<tr>
<th></th>
<th>Manual Dexterity</th>
<th>Aiming &amp; Catching</th>
<th>Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>V1</td>
<td>V3</td>
<td>V4</td>
</tr>
<tr>
<td>MABC-2 Score</td>
<td>11</td>
<td>20</td>
<td>22</td>
</tr>
<tr>
<td>Mean Heart Rate (bpm)</td>
<td>109.3</td>
<td>120.2</td>
<td>116.9</td>
</tr>
</tbody>
</table>

Table 12  Participant 3: MABC-2 Total Test Score and mean heart for entire assessment

<table>
<thead>
<tr>
<th></th>
<th>V1</th>
<th>V3</th>
<th>V4</th>
</tr>
</thead>
<tbody>
<tr>
<td>MABC-2 Score</td>
<td>49</td>
<td>52</td>
<td>62</td>
</tr>
<tr>
<td>Mean Heart Rate (bpm)</td>
<td>116.9</td>
<td>124.3</td>
<td>121.6</td>
</tr>
</tbody>
</table>

Table 13  Participant 3: Behavioral variable breakdown.

<table>
<thead>
<tr>
<th></th>
<th>M%</th>
<th>I%</th>
<th>C%</th>
<th>E%</th>
<th>O%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visit 1</td>
<td>57.58</td>
<td>11.11</td>
<td>13.13</td>
<td>81.82</td>
<td>18.18</td>
</tr>
<tr>
<td>Visit 3</td>
<td>46.49</td>
<td>14.04</td>
<td>14.91</td>
<td>75.44</td>
<td>24.56</td>
</tr>
<tr>
<td>Visit 4</td>
<td>56.86</td>
<td>12.75</td>
<td>12.75</td>
<td>82.36</td>
<td>17.65</td>
</tr>
</tbody>
</table>

Participant 4 (P4)

At the time of data collection, Participant 4 was 9 years and 5 months old. He had a diagnosis of autism, received a SRS score of 168 and a DCDQ’07 score of 30. The participant was not living with a dog at the time of the study and never had in the
past. Participant 4’s total and component scores for the MABC-2 were relatively stable, with the greatest differences only being 4 points for balance and total test score (see Table 11). During the three assessments, manual dexterity and aiming & catching scores only varied by 1 point. Overall, Participant 4’s heart rate continuously decreased as the sessions progressed. During Visit 3, Participant 4 spent the most time off task (17.21%) compared to Visits 1 (10.94%) and 4 (15.84%) (see Table 12).

Participant 4 indicated green, “I LIKED it A LOT!” on the Feelings Scale after each visit and reported that he enjoyed participating in the study; however, he enjoyed it more with the therapy dog present. When given different ways to describe the therapy dog (i.e. happy or sad, nice or mean, etc), Participant 4 stated that the therapy dog was happy, nice and fun.

Participant 4’s parent confirmed that the participant was excited to be in the study because “he asked to come…He was excited. Because I interrupted his routine and he was okay with interrupting his routine to come down here.” After meeting the therapy dog, the parent reported that “…the next day he wanted to come back and see [the therapy dog]. The next time I mentioned he was going to see [the therapy dog] he was very excited.” Overall, the parent believed the participant was more cooperative than expected and more interested in the therapy dog than anything else. The parent believed the participant enjoyed having the therapy dog present and resulted in him being happier and reduced his stress. With the therapy dog present, the parent believed the assessment was more enjoyable for the participant because it broke the
monotony. If given the opportunity, the parent believed the participant would do very well with the therapy dog in a less structured environment where they could more freely interact. Complete participant and parent interviews can be found in Appendix 8.

Table 14  Participant 4: Categorical Component MABC-2 score and mean heart rate breakdown.

<table>
<thead>
<tr>
<th>MABC-2 Score</th>
<th>Manual Dexterity</th>
<th>Aiming &amp; Catching</th>
<th>Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1</td>
<td>V3</td>
<td>V4</td>
<td>V1</td>
</tr>
<tr>
<td><strong>MABC-2 Score</strong></td>
<td>8</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td><strong>Mean Heart Rate (bpm)</strong></td>
<td>105.5</td>
<td>88.9</td>
<td>89.05</td>
</tr>
</tbody>
</table>

Table 15  Participant 4: MABC-2 Total Test Score and mean heart for entire assessment

<table>
<thead>
<tr>
<th>MABC-2 Score</th>
<th>V1</th>
<th>V3</th>
<th>V4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MABC-2 Score</strong></td>
<td>28</td>
<td>29</td>
<td>32</td>
</tr>
<tr>
<td><strong>Mean Heart Rate (bpm)</strong></td>
<td>105.8</td>
<td>97.6</td>
<td>91.5</td>
</tr>
</tbody>
</table>
Table 16  Participant 4: Behavioral variable breakdown.

<table>
<thead>
<tr>
<th></th>
<th>M%</th>
<th>I%</th>
<th>C%</th>
<th>E%</th>
<th>O%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visit 1</td>
<td>48.44</td>
<td>15.63</td>
<td>25</td>
<td>89.07</td>
<td>10.94</td>
</tr>
<tr>
<td>Visit 3</td>
<td>47.54</td>
<td>22.13</td>
<td>13.11</td>
<td>82.78</td>
<td>17.21</td>
</tr>
<tr>
<td>Visit 4</td>
<td>45.54</td>
<td>21.78</td>
<td>16.83</td>
<td>84.15</td>
<td>15.84</td>
</tr>
</tbody>
</table>

Participant 5 (P5)

At the time of data collection, Participant 5 was 11 years old. He had a diagnosis of PDD-NOS, received a SRS score of 180 and a DCDQ’07 score of 44. The participant was not living with a dog at the time of the study and never had in the past. It should be noted that the participant was celebrating his birthday the night of Visit 1. While neither the participant nor parent referenced this during the interview, the researcher noted that the participant continuously asked when he could leave during Visit 1 to get home for his celebration.

Throughout the study, there was a steady increase in Manual Dexterity, Balance and Total Test Scores of the MABC-2 (see Table 13). Specifically, Total Test score increased from 53 to 60 from Visit 3 to Visit 4. Heart rate was lowest during the intervention condition (108.6 bpm) compared to 111.07 and 115.2 bpm at Visits 1 and 4 (see Table 13). No common changes can be observed from percentage of time spent engaged and in off task behaviors (see Table 14).

Participant 5 indicated green, “I LIKED it A LOT!” on the Feelings Scale after each visit. He reported that he enjoyed participating, but preferred it with the therapy dog present. The participant enjoyed having the therapy dog watch him do his work
because “...the therapy dog liked [him].” Further, the participant felt that the activities were easier and that he performed better with the therapy dog present. The participant did note that “it was easier when [the therapy dog] tickled [him]” and that the therapy dog made him happy.

Participant 5’s parent believed that the participant enjoyed partaking in the study equally with and without the therapy dog present. The parent noted that the participant was excited about the therapy dog and behaved as expected partially due to medication. Overall, the parent believed the participant had a positive experience with the therapy dog; however, the parent did not feel as if the therapy dog aided in his motor skills performance. From observation, the parent noticed that “[the participant] liked when he got to do things with the dog. He was more interested [during Visit 2, the meet and greet] than the day that [the therapy dog] was just watching him.”

Complete participant and parent interviews can be found in Appendix 8.

Table 17  Participant 5: Categorical Component MABC-2 score and mean heart rate breakdown.

<table>
<thead>
<tr>
<th></th>
<th>Manual Dexterity</th>
<th>Aiming &amp; Catching</th>
<th>Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>V1</td>
<td>V3</td>
<td>V4</td>
</tr>
<tr>
<td>MABC-2 Score</td>
<td>22</td>
<td>25</td>
<td>29</td>
</tr>
<tr>
<td>Mean Heart Rate (bpm)</td>
<td>99.9</td>
<td>97.35</td>
<td>107.5</td>
</tr>
</tbody>
</table>
Table 18  Participant 5: MABC-2 Total Test Score and mean heart for entire assessment

<table>
<thead>
<tr>
<th>MABC-2 Score</th>
<th>V1</th>
<th>V3</th>
<th>V4</th>
</tr>
</thead>
<tbody>
<tr>
<td>53</td>
<td>53</td>
<td>60</td>
<td></td>
</tr>
</tbody>
</table>

| Mean Heart Rate (bpm) | 111.07 | 108.6 | 115.2 |

Table 19  Participant 5: Behavioral variable breakdown.

<table>
<thead>
<tr>
<th></th>
<th>M%</th>
<th>I%</th>
<th>C%</th>
<th>E%</th>
<th>O%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visit 1</td>
<td>52.17</td>
<td>19.57</td>
<td>6.52</td>
<td>78.26</td>
<td>21.74</td>
</tr>
<tr>
<td>Visit 3</td>
<td>53</td>
<td>23</td>
<td>12</td>
<td>88</td>
<td>12</td>
</tr>
<tr>
<td>Visit 4</td>
<td>54.26</td>
<td>23.4</td>
<td>12.77</td>
<td>90.43</td>
<td>9.57</td>
</tr>
</tbody>
</table>

Participant 6 (P6)

At the time of data collection, Participant 6 was 10 years and 11 months. He had a diagnosis of autism, received a SRS score of 132 and a DCDQ’07 score of 48. The participant was not living with a dog at the time, however, had lived with one for three years in the past. Participant 6’s MABC-2 scores remained fairly consistent over Visits 1, 3, and 4 (see Table 15). The greatest differences were seen during Visits 3 and 4 for manual dexterity and aiming & catching. Total Test score only varied by 4 points between Visits 1, 3, and 4 – with the participant receiving a score of 28 at Visits 3 and 4. During each component of the assessment as well as during the entire assessment, heart was lowest during Visit 3 (102.45bpm) compared to 115.03 and 119.9 bpm for Visits 1 and 4 (see Table 15). Very slight differences were seen in
behavioral variables; however, off task behavior reduced from 5.3% and 6.38% in Visits 1 and 4 to 4.95% during Visit 3 (see Table 16).

Participant 6 indicated green, “I LIKED it A LOT!” on the “Feelings Scale” after each visit and later reported enjoying participating, especially when the therapy dog was present. The participant indicated that the activities appeared easier and he felt as if he did better with the therapy dog. Overall, Participant 6 felt that the therapy dog was a “nice dog” and that she made him feel happy.

The same parent was not able to be present for all visits, however, the same parent was available for Visits 3 and 4 and subsequently completed the parental interview. Both parents were given the opportunity to review the transcription and provide input based off of their observations and conversations with the participant. Participant 6’s parent believed that “…[the participant] enjoyed coming for the activities. [The parent thought] he was more excited for [the therapy dog] but all in all it [was] a fairly good experience for him either way.” The parent noted that “…after the first session where [the therapy dog] was involved [the participant] wanted to call the owner of [the therapy dog] to talk to [the therapy dog] from the house.” The participant’s behavior was as his parent expected. The parent believed the participant’s motor skill competency was unaffected by the presence of the therapy dog; however, having the dog present may have “challenged him more, made him more confident and more relaxed...[as well as] …more distracted with [the therapy dog] being here...” The parent felt a longer “rebonding” time or greater interaction
between the participant and the therapy dog would have elicited “more of an emotional connection with [the therapy dog] as [if Visit 3 would have been more like Visit 2].” Complete participant and parent interviews can be found in Appendix 8.

Table 20  Participant 6: Categorical Component MABC-2 score and mean heart rate breakdown.

<table>
<thead>
<tr>
<th>MABC-2 Score</th>
<th>Manual Dexterity</th>
<th>Aiming &amp; Catching</th>
<th>Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>V1</td>
<td>V3</td>
<td>V4</td>
</tr>
<tr>
<td>MABC-2 Score</td>
<td>6</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>Mean Heart Rate (bpm)</td>
<td>109.3</td>
<td>95.6</td>
<td>115</td>
</tr>
</tbody>
</table>
### Table 21  Participant 6: MABC-2 Total Test Score and mean heart for entire assessment

<table>
<thead>
<tr>
<th></th>
<th>V1</th>
<th>V3</th>
<th>V4</th>
</tr>
</thead>
<tbody>
<tr>
<td>MABC-2 Score</td>
<td>24</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>Mean Heart Rate (bpm)</td>
<td>115.03</td>
<td>102.45</td>
<td>119.9</td>
</tr>
</tbody>
</table>

### Table 22  Participant 6: Behavioral variable breakdown.

<table>
<thead>
<tr>
<th></th>
<th>M%</th>
<th>I%</th>
<th>C%</th>
<th>E%</th>
<th>O%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visit 1</td>
<td>60.6</td>
<td>9.09</td>
<td>25</td>
<td>94.69</td>
<td>5.3</td>
</tr>
<tr>
<td>Visit 3</td>
<td>53.47</td>
<td>16.86</td>
<td>24.75</td>
<td>95.08</td>
<td>4.95</td>
</tr>
<tr>
<td>Visit 4</td>
<td>56.38</td>
<td>13.83</td>
<td>23.4</td>
<td>94.53</td>
<td>6.38</td>
</tr>
</tbody>
</table>

**Participant 8 (P8)**

At the time of data collection, Participant 8 was 11 years and 4 months. He had a diagnosis of PDD-NOS, received a SRS score of 166 and a DCDQ’07 score of 50. The participant was not living with a dog at the time of the study and never had in the past. Component and Total Test scores of the MABC-2 were similar for Visits 1 and 3; however, dramatically increased for Visit 4 (see Table 17). For instance, Total Test score increased from 44 and 46 at Visits 1 and 3 and leaped to 76 at Visit 4. Mean heart rate data tended to increase through the course of the study (see Table 17). Off task behavior increased and on task behavior decreased during the study (see Table 18).
Participant 8 was the only participant to select yellow, “I am NOT SURE if I liked it or not” after each visit and the only participant to report that the activities completed were not fun. To the participant, “it didn’t really matter” if the therapy dog was present for the assessment. The participant did enjoy having the therapy dog watch him complete the MABC-2; however, he did not perceive if the activities were easier or harder nor could he decide if he did better or worse with the dog present. Having the dog present had no impact on how the participant felt.

The participant’s parent felt that he was ambivalent in his involvement in the study. Further, the participant only talked about how well trained the therapy dog was. The parent was surprised by how slowly and silly the participant acted during baseline conditions. She believed that the “extra audience,” including the handler, could have sped up the assessment. The parent thought that, “[the therapy dog] was interesting to [the participant] but not motivating…and that [the therapy dog] probably did not have an effect” due to the fact that she felt “[he] was really more focused on [the researcher] than on [the therapy dog].” The parent was unsure if the dog’s presence impacted his performance on the MABC-2. Lastly, the parent believed that if there was more of an interaction between the participant and the therapy dog a greater effect would have been seen. Complete participant and parent interviews can be found in Appendix 8.

Table 17. Participant 8: MABC-2 score and mean heart rate breakdown.
Table 23  Participant 8: Categorical Component MABC-2 score and mean heart rate breakdown.

<table>
<thead>
<tr>
<th></th>
<th>Manual Dexterity</th>
<th></th>
<th>Aiming &amp; Catching</th>
<th></th>
<th>Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>V1</td>
<td>V3</td>
<td>V4</td>
<td>V1</td>
<td>V3</td>
</tr>
<tr>
<td>MABC-2 Score</td>
<td>17</td>
<td>19</td>
<td>32</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>Mean Heart Rate</td>
<td>83.3</td>
<td>84.01</td>
<td>84.6</td>
<td>98.2</td>
<td>103.4</td>
</tr>
</tbody>
</table>

Table 24  Participant 8: MABC-2 Total Test Score and mean heart for entire assessment

<table>
<thead>
<tr>
<th></th>
<th>V1</th>
<th>V3</th>
<th>V4</th>
</tr>
</thead>
<tbody>
<tr>
<td>MABC-2 Score</td>
<td>44</td>
<td>46</td>
<td>76</td>
</tr>
<tr>
<td>Mean Heart Rate</td>
<td>87.8</td>
<td>89.14</td>
<td>94.8</td>
</tr>
</tbody>
</table>
Chapter 6

DISCUSSION

Seven boys with autism spectrum disorders (ASD) participated in this study to see the effects that a therapy dog would have during a standardized motor skills assessment. Specifically, three quantitative variables were monitored using a mixed methods design during the Movement Assessment Battery for Children-2 (MABC-2): standardized score on the assessment, heart rate, and percentage engaged and off task during the assessment. Although no significance was found for any study variable, the majority of participants reported that the assessment was more enjoyable with the therapy dog present. In addition, six participants reported that they liked having the therapy dog watch while they completed the MABC-2. Furthermore, all participants were able to recall the name of the therapy dog after their last meeting. While no significant differences were found, common themes seen in the data that can be further explored.

Movement Assessment Battery for Children-2 (MABC-2)

When looking at participants’ best MABC-2 Total Score from Visits 1, 3 and 4, six out of seven participants scored within or below the ninth percentile. Of these participants, scores suggest that two were “at risk” for a motor disability while four
presented with “significant movement difficulties” (Henderson, Sugden, & Barnett, 2007). These results are similar to previous literature finding that children with ASD display motor deficits on the Movement Assessment Battery for Children (MABC) or MABC-2 (Green, Charman, Pickles, Chandler, Loucas, Simonoff, & Baird, 2009; Vanvuchelen, Roeyers, & Deweerdt, 2007).

No significant differences were found when comparing Total Test Score as well as individual component scores (manual dexterity, aiming & catching, and balance) of the MABC-2 among baseline and intervention conditions. Further, no parent reported that they felt their son’s motor skill performance changed with the therapy dog present. Therefore, the therapy dog had no effect on the score of the standardized motor skills assessment. Since no statistical differences were seen among baseline and intervention conditions, the therapy dog may not have interfered with the evaluation process. Further, no parent reported that their child’s performance on the MABC-2 changed with a therapy dog present. Therapy dogs have shown to be beneficial companions in various settings such as pain and psychiatric treatment, speech therapy and the education system (Barker & Dawson, 1998; Braun, Stangler, Narveson, & Pettingell, 2009; Briggs Newlin, 2003; Macauley, 2006). If

Although not significant (p=0.096), Total Test Score as well as categorical component scores did improve as sessions progressed. Multiple repetitions and practice have shown to improve motor learning (Schmidt & Wrisberg, 2008). Due to
the short time span among visits, participants may have demonstrated motor learning
due to the standardized and repeated procedures of the MABC-2 assessment.

**Heart Rate (bpm)**

Mean heart rate (beats per minute, bpm) was calculated for the total as well as
manual dexterity, aiming and catching and balance segments of the assessment. No
statistical differences were seen in mean heart rate during the total assessment
(p=0.651). Further, there were no changes reported in the “Feeling Scale” data among
baseline and intervention conditions. Same responses from the “Feeling Scale” could
indicate that the participant enjoyed the assessment during both baseline and
intervention conditions.

In looking at the total assessment, Participants 1 and 3 achieved their highest
mean heart rate with the therapy dog present. An increase in heart rate can be the
result of emotional stressors, including excitement, fright, or anxiety (Marieb &
Hoehn, 2007). Participant 3’s parent reported that the unnatural situation of having a
dog present and not being able to interact with it freely as well as having the handler
present could increase stress. Interestingly, these participants were two of the three
youngest involved in the study, both with a diagnosis of autism and one having lived
with a dog previously. A study by Prothmann, et al., (2009) found that children with a
mean age of 11.5 years showed a preference and responsiveness to animals over
people (Prothmann, Ettrich, & Prothmann, 2009). Although this study does not
specifically reveal how participants individually responded, the age range of the
participants was 6-14 years, with only 4 participants between 6-8 years. If developmental differences were witnessed by Prothmann, et al., (2009), support could be attributed to developmental differences as to the effects of a therapy dog on a child with ASD. Further exploration should aim to see if a developmental effect impacts how a child with ASD responds to a therapy dog.

Participants 2, 5 and 6 had their lowest mean heart rates for the total assessment during the intervention condition. A decrease in heart rate has been noted when people feel calm, relaxed, and comfortable (Marieb & Hoehn, 2007). Previous works have illustrated that typically developing children experience a decrease in physiological indicators of stress during stressful situations in the company of a therapy dog (Jalongo, Astorino, & Bomboy, 2004; Kaminski, Pellino, & Wish, 2002; Nagengast, Baun, Megel, & Leibowitz, 1997). Participants 2, 5 and 6 were amongst the three of four oldest participants in the study, respectively.

In a study by Baun, Bergstrom, Langston & Thoma (1983), differences in blood pressure were seen when a person spent time with a familiar, unfamiliar dog and reading quietly. When participants were allowed to pet a familiar dog, the greatest decrease in blood pressure was observed (Baun, Bergstrom, Langston & Thoma, 1983). Researchers attributed this to the established bond between the companion and participant (Baun, et al., 1984). The “Meet and Greet” (Visit 2) was implemented to familiarize the participant with the therapy dog. Procedures for the “Meet and Greet” remained the same for all participants; however, results may suggest that having only
one session with the therapy dog prior to the motor skills assessment may not have helped the younger participants feel comfortable with the therapy dog. Some researchers may interpret this to a lack of a bond formed between the participant and the therapy dog (Baun, et al., 1984). Parents of the three older participants indicated that their children exhibited an increase of socializing behaviors with the therapy team, possibly indicating that a relationship had formed between the participant and the therapy dog. Additionally, when asked if the MABC-2 activities were easier to complete with or without the therapy dog present, an older participant responded, “It was easier when [the therapy dog] tickled me.” Previous works have shown that petting a dog does elicit a decreased physiological response and a calming effect during resting and reading (Friedmann, Katcher, Thomas, & Messent, 1983).

In the future, more opportunities to interact with the therapy dog prior to assessment may be beneficial to younger children with ASD. While reports from parents of Participants 2 and 6 may suggest an established relationship, Participant 3’s parent specifically noted that adding more sessions to meet the dog would have helped to discern a difference between visits as the child becomes more comfortable with the intervention.

Participant 4, one of the youngest participants, showed a steady decline in heart rate over the three assessment sessions. A decrease in heart rate can be due to the possibility that the participant became more comfortable and relaxed in the environment over time.
Similar patterns in heart rate were seen among older and younger participants. Developmental effects may influence how the presence of a therapy dog may affect heart rate of children with ASD during the MABC-2. In the future, this study may be replicated with a larger sample and investigate if such differences do exist. Increasing the number of interactions prior to assessment may be beneficial to see reduced heart rates in response to the MABC-2 assessment.

Engaged and Off Task Behaviors

No significance was found when comparing percentage of time engaged and off task among baseline and intervention conditions. Although significance was not found, the slight emergence of common themes can begin to be seen among participants.

Percentage of time engaged decreased and, consequently, percentage of time off task increased with the therapy dog present for Participants 3 and 4. Participants 2 and 6 showed decreased off task behaviors and increased time engaged during the intervention condition. As stated earlier, these four participants have a diagnosis of autism; Participants 3 and 4 are among the youngest involved in the study, while Participants 2 and 6 are two of the oldest participants. Previous studies have monitored behaviors of participants with various disabilities over a greater number of sessions with a therapy dog. When observations were taken over numerous sessions, there were greater trends for children with moderate to severe mental retardation to increase attention span and compliance (Heimlich, 2001) and children with Down’s
Syndrome to increase focus and cooperation (Limond, Bradshaw, & Cormack, 1997). Other studies that addressed the effects of animal assisted interventions on individual’s behaviors have collected data over multiple sessions with the therapy animal present (Macauley, 2006; Sams, et al., 2006). Therefore, assessing only engaged and off task behaviors once with a therapy dog may not have provided enough time to see an effect occur. However, similar changes in the data began to show that having a therapy dog present may alter a child’s behavior during a motor skills assessment. This study should be replicated with larger samples to see the effect a therapy dog has on engaged and off task behaviors.

Participant 5’s data shows increased engagement over the progression of the three assessment sessions. At the time of scheduling visits, the researcher was unaware that Visit 1 had been scheduled for the night of the participant’s birthday until his arrival. Although not stated by the parent or participant during the interview, the novelty of his birthday served as an obvious distraction from Visit 1, potentially skewing his data for baseline assessment. Due to scheduling conflicts Visits 3 and 4 were on a weeknight and afternoon during the weekend, respectively. When asked if Participant 5’s behavior changed at all, Participant 5’s parent responded, “I think he was more focused on Sunday [Visit 4] because he had his medicine first. At night he can’t have his medicine.”

Participant 8 was the oldest involved in the study and the only to report yellow, “I am NOT SURE if I liked it or not” on the “Feelings Scale” after all visits. When
asked if the activities of the MABC-2 were more fun with or without the therapy dog, the participant responded, “It didn’t really matter.” Furthermore, when asked how the therapy dog made him feel Participant 8 responded, “The same as when she wasn’t here…” During the parent interview, Participant 8’s parent noted, “I think [Participant 8] was kind of ambivalent…I think [the therapy dog] was interesting to him, but not motivating.” Therefore, when examining Participant’s 8 data it is not surprising that the therapy dog had no effect on heart rate or behavior. *In future studies, greater lengths should be taken during participant recruitment to ensure that potential participants do express an interest interacting with a therapy animal.*

**Handler/Audience**

To be in accordance with insurance company’s specifications, when the services of a therapy dog are sought, it is common procedure for the canine’s handler to be present at all times following (Jalongo, Astorino, & Bomboy, 2004; PAWS Visiting Etiquette). Due to these guidelines, it is difficult to determine and make conclusions if changes in stress and behavior were due solely to the introduction of the therapy dog. In the follow-up interviews, three parents did report that the handler served as an “extra audience” or may have been distracting to the participant. Therefore, the handler may partially have influenced study variables. Some studies report a handler being present or handler being trained to work with the canine (Braun, et al., 2009; Martin & Farnum, 2002) while others fail to mention the presence or absence of a handler (Gagnon, Bouchard, Landry, Belles-Isles, Fortier, & Fillion,
2004; Kaminski, Pellino, & Wish, 2002). Additionally, some studies report that AAT or AAI was used, but fail to mention if a handler was present (Barak, Savorai, Mavashew, & Beni, 2001; Macauley, 2006). In other situations, the researcher may in fact be the owner of the therapy dog (Levinson, 1962); therefore, the handler would not be a factor in outcomes if he/she administered baseline and intervention assessments. Ideally, if a handler was able to provide baseline and follow-up assessments a truer representation of outcomes would be given seeing that the only variable manipulated was the presence of a therapy dog.

Previous works have illustrated that the presence of a therapy dog has been utilized to increase social interactions for children with developmental disabilities (Levinson, 1962; Sams, Fortney & Willenbring, 2006). Although not an aim of this study, it is important to note this phenomenon was witnessed by three parents. Parents of Participants 2, 5 and 6 noted an increase in their children’s social interactions pertaining to the therapy team. Participant 2’s parent noted that “he was more open socially when the dog was here,” Participant 6’s parent stated, “[the participant] wanted to call the owner of [the therapy dog] to talk to [the therapy dog] from [their] house.” Additionally, Participant 5’s parent noted he would ask when the therapy dog would be at the assessment. This data presents the need for further investigation in future studies. In this study, older participants may have sought an interaction or relationship with the therapy dog.
Limitations

The major limitations posed by this study are the small sample size and limited number of sessions allowed for baseline and intervention conditions. Using an A-B-A-B design and, therefore, completing the study during the intervention condition, would have provided stronger support if statistical differences were seen between baseline and the animal assisted intervention conditions (Schloss & Smith, 1998).

Further, as evidenced by similar data from baseline and intervention conditions, the participants selected may have not in fact needed an intervention to complete the MABC-2. Those selected may have had mild or no problems needed to be addressed by an intervention. If there are no challenges at baseline, an effect would not be seen from the intervention. Future studies should more carefully select participants that do have anxiety or display disruptive behaviors during a standardized motor skill assessment.

Prior to this study, five of the seven participants had informally worked with the researcher in a summer camp setting. Having previously been in the company of the researcher may have diminished the novelty and uncertainty of the assessment setting. This may have increased their comfort level in the environment as well as behavior.

Attention-deficit hyperactivity disorders (ADHD) are co-morbidities commonly associated with ASD (Simonoff, Pickles, Charman, Chandler, Loucas, & Baird, 2008). Often medications are used to treat these conditions. If participants
were taking medications to control the side effects of ADD and ADHD, the effect of the drug could have influenced attention and behavior during the assessment. Therefore, it would be unclear if changes in behavior were caused by the therapy dog or influenced by medication. No information was collected to see which medications participants were taking, if any; however, during the interview two parents did state the medication could have affected how their children’s behavior. Medication information should have been collected for all participants. Future studies should collect this information. Time of day was controlled as best as possible so that if a participant was taking a medication, it would have the same influence at each visit.

**Future Directions**

Future studies should use larger samples to replicate this study in the study in order to make generalizations. Specifically, researchers should aim to see if any statistical differences emerge in quantitative data when a therapy dog is and is not present during a motor skills. Future studies can also explore if developmental differences exist between children younger and older children with ASDs. Females with ASD should be included. In this study, no participants with a diagnosis of Asperger’s Syndrome (AS) were recruited. Future studies should observe the effect that a therapy dog has on this population as well.

Continuous heart rate monitoring was used in this study to see if the therapy dog affected stress levels during the assessment. Since the results were not significant and changes in heart rate were slight compared to baseline and intervention
conditions, monitoring cortisol levels before and after the assessment may be a viable alternative to monitoring stress. In a previous work, Viau, et al. (2010) monitored cortisol levels in children with autism before, during and after a therapy dog was introduced to participants’ homes. With the therapy dog present, results revealed a decrease in morning cortisol levels (Viau, Arsenault-Lapierre, Fecteau, Champagne, Walker, & Lupien, 2010). Cortisol has also been used as a measure of stress when evaluating the effects of pet therapy on hospitalized children (Kaminski, et al., 2002). Therefore, salivary cortisol may be used as a predictive measure of changes in stress with and without a therapy dog present during a motor skills assessment rather than continuous heart rate monitoring.

Further, heart rate variability (HRV) is a more sensitive measure of anxiety and emotional responses (Berntson & Cacioppo, 2004). Sympathetic and parasympathetic responses provide more input in HRV than heart rate measures recorded in beats per minute.

This study monitored three variables during a standardized motor skills assessment. Depending on the context of the assessment (clinical or research based), other variables may be important as well. Possible variables to further explore are social interactions, language use, and mood/affect, similar to Esteves & Stokes (2008), Martin, et al. (2002), and Sams, et al. (2006).

During the interview, it was revealed that parents felt the therapy dog would have had more of an impact on their child with ASD if more opportunities were
provided for interactions and involvement with the animal during the assessment. The aim of this study was to observe the effects that a therapy dog would have during a motor skills assessment, however, it may be more plausible to observe the effects a therapy dog has on a child when incorporated into a treatment regimen. A previous work observing children with developmental disabilities in an occupational therapy setting used llamas, dogs, and rabbits in an occupational therapy treatment context, but only language use and social interactions were monitored (Sams, Fortney, & Willenbring, 2006). Future studies may explore whether a therapy dog is a viable component to help a child with autism make greater gains and progress in treatment or intervention than traditional techniques.

Participant recruitment for this study had a narrow focus. Therefore, future studies should target a broader range of individuals with autism including females, wider age ranges and more diverse levels of functioning to determine if these individuals respond the same way to a therapy dog during a motor skills assessment.

**General Conclusions**

Although significance was not found for any study variable, the emergence of common themes could be seen that warrant further exploration. Due to the nature of this study, generalizations cannot be inferred from the limited number of participants.

In conclusion, while a therapy dog does not alter the MABC-2, the presence of a therapy dog may not be beneficial for all or any children on the autism spectrum.
Future studies should aim to determine if these tendencies can be verified in larger samples.
REFERENCES


PAWS Visiting Etiquette. Pet-Assisted Visitation Volunteer Services, Inc.


Appendix 1

Informed Consent and Assent Forms
**INFORMED CONSENT FORM**  
FOR PARENTS/LEGAL GUARDIANS

**Title:** The Effects of Animal Assisted Intervention on Children with Autism During the Movement Assessment Battery for Children  

**Investigators:** Dannielle Miccinello, Dr. Nancy Getchell, Dr. Iva Obrusnikova  

1. PURPOSE/DESCRIPTION OF THE STUDY:  
We are conducting a research study to help us understand how therapy dogs influence a child with autism as he completes the Movement Assessment Battery for Children-2 (MABC-2). We would like your child to participate in the study because he is a boy, is between the ages 8 and 13 years, has an autism spectrum disorder, and is comfortable around dogs.

2. CONDITIONS OF SUBJECT PARTICIPATION:  
If you give us consent for your child to participate in the study, your child will participate in three sessions of MABC-2 testing and a session to meet a PAWs For People, Inc. therapy dog at the Developmental Motor Control Laboratory at the University of Delaware. These four sessions will take place within one month from September 2010 through December 2010. Each session will last approximately 1 hour.

At sessions 1, 3, and 4 your son will take part in the MABC-2. The MABC-2 is a standardized test that assesses fine and gross motor skills. This tool specifically targets three skill categories: manual dexterity, balance and ball skills. Your child will be asked to participate in the following activities:

<table>
<thead>
<tr>
<th>Category</th>
<th>Activity 1</th>
<th>Activity 2</th>
<th>Activity 3 (if needed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual Dexterity</td>
<td>Turning Pegs</td>
<td>Triangle with Nuts and Bolts</td>
<td>Drawing Trail</td>
</tr>
<tr>
<td>Aiming &amp; Catching</td>
<td>Catching with One Hand</td>
<td>Throwing at Wall Target</td>
<td>--</td>
</tr>
<tr>
<td>Balance</td>
<td>Two-Board Balance (static)</td>
<td>Walking Toe-to-Heel Backwards (Dynamic)</td>
<td>Zig-Zag Hopping (Dynamic)</td>
</tr>
</tbody>
</table>

At sessions 2 and 3 a trained therapy dog will be present. At session 2, your child will meet the therapy dog and his/her handler. During this time, the handler will talk to your child about the proper way to pet, brush, and talk to the therapy dog. At session 3 the therapy dog will be present for the MABC-2 assessment. When your child arrives, he will be given 15 minutes to sit and talk to or brush the dog. During the sessions the dog will sit next to your child while he completes the tasks.

Each session of the MABC-2 assessment will be videotaped. This will allow the investigators to later look at on-task behaviors during the sessions. Your child’s heart rate variability will be recorded using a device called Actiheart. Actiheart will be attached to your child’s chest with two sticky pads. The pads will be put on and taken off your child by a graduate student who has experience with this procedure in a private setting in the beginning and end of each session.

Within one week after your child has finished participating in the study, he will be asked a few questions about if he liked being in the study. A researcher will ask a series of “yes” or “no”
questions and your son will be able to provide more information if he wants. These responses will be audio-recorded.

**You (as a parent) will be asked** to complete three brief questionnaires prior to the study. Two questionnaires will assess the severity of your child’s autistic behaviors. The third will ask you to rate your child’s coordination in comparison to same age peers in three categories: control during movement, fine motor and handwriting, and general coordination. Additionally, you will be asked to complete a form with your availability to participate in the study and some information about your child. Within one week after your child has finished the study, you will be asked to answer questions regarding your child’s participation. The principle investigator will audio-record your responses which will be kept confidential.

**Your and your child’s participation are completely voluntary.** The decision of whether or not you wish your child to participate in this study will not affect his grades in his school or his standing in the physical activity programs he attends. You or your child may withdraw consent and/or stop participation in the study at anytime without penalty. If you withdraw, you can ask us to destroy all previously collected data.

**Your and your child’s answers will be private.** Your child’s or your identity on all surveys, transcripts, and computer files will be kept confidential. As with all research, there is a chance that confidentiality could be compromised; however, we are taking many steps to minimize that chance. For example, codes rather than your child’s or your name will be used in all surveys and other documents. Computer files and audio/video recordings will be securely stored on a password-protected external hard drive in a locked filing cabinet on the UD campus, Newark (DE) indefinitely. The printed surveys or DVDs will also be stored in the locked filing cabinet, but they will be shredded no later than August of 2015. This consent form will be securely stored separately from your and your child’s data and recordings, and it will be shredded no later than August of 2015. Only the investigators and their research assistants will have access to the data. A report of this research study may be published but your and your child’s name and the name of her/his school will not be revealed.

3. **BENEFITS AND RISKS:**

**Benefits:** There are no direct benefits to your child for participating in this research study. Your child might improve his engagement in motor skills tasks, although we cannot guarantee this.

**Risks:** Your child will wear Actiheart that will be attached to his chest with two sticky pads. He might have an allergic reaction to those pads or feel discomfort from wearing the Actiheart. Your child may become disappointed or frustrated if he is not randomly selected to be in the canine intervention group or if a dog is not present at a session he was expecting it to be at. If your child is selected to be in the canine intervention group, there is some risk that your child might get physically injured, scratched, clawed, or bitten whenever interacting with a dog or participating in physical activities in the program. The physical activities in which the participants will engage during the study will be the typical activities that children this age may participate in. The dogs and their handlers who will participate in this study belong to the **PAWS for People** non-profit organization (www.pawsforpeople.org) that focuses on providing pet-assisted therapy and visitation services to individuals with and without disabilities. Dogs are pre-selected for temperaments that include the characteristics of calmness, patience, and tolerance for a wide range of actions and noises from humans around them. The dogs are required to be up to date on rabies and distemper vaccines and have a yearly examination conducted by their vet. Dogs and their handlers also will have received 11.5 hours of training to meet standards of certification that are designed to establish excellent command control and to instill a gentle and tolerant demeanor around children and adults with disabilities. The certification is based on testing procedures and
requirements adapted from Delta Society, AKC’s Canine Good Citizen, and Therapy Dog International. The test has been approved and accepted by Intermountain Therapy Animals; Christiana Care Hospitals; Union Hospital; St. Francis Hospital; Exceptional Care; Brandywine, Red Clay, and Christiana School districts; and UD sites including College School, The Early Learning Center, and the Lab Preschool. In addition, for most of the activities, dogs will be on their leashes held by their handlers. When a dog is off the leash, the handlers will be near the dog. PAWS for People maintains an insurance policy that covers any injuries caused by their therapy dogs or the handler. If an injury occurs, the investigators and their assistants will give immediate medical attention; however, according to University of Delaware policy, any continuing medical costs will be your responsibility. If your child ever expresses, either verbally or behaviorally, that s/he is experiencing discomfort and simply does not want to be around the dog any longer, the session or the research study will end for your child.

4. FINANCIAL CONSIDERATIONS: There are no costs to you or your child for participating in this study. Neither you nor your child will be paid for participating in this study.

5. CONTACTS: If you have questions about the study, you may contact Dannielle Miccinello (302 831 8211) or Dr. Nancy Getchell (302-831-6682) in the Department of Kinesology and Applied Physiology. If you have questions regarding your rights in this study, you may contact the Chair, Human Subjects Review Board, University of Delaware at 302/831-2137.

6. SUBJECT ASSURANCES: I have read the above informed consent document. The nature, demands, risks, and benefits of the study have been explained to me. I understand that I may withdraw my consent and discontinue my child’s participation in this study at any time without penalty.

7. CONSENT SIGNATURES:
Please make an “X” in the box that indicates whether you consent for your child to participate in the research study described above:

☐ I consent    ☐ I do not consent
Parent/Guardian’s Signature: ____________________________ Date: __________
Child’s Name (printed): ____________________________
INFORMED ASSENT FORM

Title: Doing easy movement skills with a dog watching.

Who does the research study? Dannielle Miccinello, Dr. Nancy Getchell, Dr. Iva Obrusnikova; all from the University of Delaware

We would like you to be a part of a research study. A research study is a way to learn about something. We would like to learn if children like to do easy movement skills with a specially trained dog with them. We want you to be in the study because you are 8 to 13 years old. You will be one of 15 children in this research study.

We will ask you to come to the Developmental Motor Control Laboratory at the University of Delaware four times in one month. Three times when you come a graduate student will ask you to do easy movement skills like drawing, catching and throwing, and balancing. Each time the activities will be the same. We will videotape you doing these skills every time. During the sessions, you will wear a special device called Actiheart on your chest. The people who do the research will put it on you in privacy. It will tell us how fast your heart beats.

Two times that you come in, a dog will be with you. The first time you meet the dog, his/her owner will teach you how to pet, brush and talk to the dog. The second time you meet the dog, you will show the dog how well you do the easy movement skills. Nothing will change besides doing your work with the dog and his/her handler in the room. The dog will sit next to you very quietly while you do your work. Before you start your work, you will get to brush and pet the dog for a few minutes.

After the last time you come in, the graduate student will ask you a few questions about if you liked doing the easy movement skills and if you liked the dog watching.

You do not have to take part in this research study. It is your choice. You can say “yes” now and then change your mind later. All you have to do is to tell us you want to stop. No one will be mad at you if you do not want to be in this study or if you start the study now and change your mind later. There is no penalty for stopping. You will not be graded. We want you to have fun.

No one will know that you were in the research study. We will not write your name anywhere. Your answers, the videotapes, and this form will be stored in our locked cabinet at the University of Delaware. Only the people who do the research will have a key to the cabinet. We might write an article about this research study, but we will not use your name or the name of your school. No one who reads the article will know that you were involved in it.

We believe that this research study will help make practicing movement skills more fun for children like you. If you feel uncomfortable or uncertain about being a part of this study, please talk to your parents. You can also talk to you Dannielle with any questions about the study.
CONSENT SIGNATURES:
I have read this form. My parents or the people who will do the study answered my questions. A copy of this form has been given to me. Please make an “X” in the box that matches your interest.

☐ I want to be part in the study. ☐ I do NOT want to be part of the study.

Print your name here: ☒ ______________________________________

Sign your name here: ☒ ______________________________________
Appendix 2

Assumption of Risk Form
ASSUMPTION OF RISK AND GENERAL RELEASE FORM
THIS IS A RELEASE OF LEGAL RIGHTS – READ AND UNDERSTAND BEFORE SIGNING

I am the parent or legal guardian of ____________________________, a minor child. I request that my child participate in an on-campus canine-assisted series of fine and gross motor skills tasks at the Developmental Motor Control Laboratory at the University of Delaware. As a condition of my child’s participation, I confirm that I understand and agree to the following:

1. **Risks Associated with my Child’s Participation in the Program.** I understand that, as a participant in this program, my child will be participating in physical activities and interacting with dogs both on and off their leashes. These dogs have passed PAWS for People’s test of certification and have achieved the Advanced Level for their reliability, good nature, and consistent good behavior. They are all up to date on rabies and distemper vaccines and get a yearly examination that their vet signs off on. As in the case of working with people, there is a risk involved in working with dogs. I understand that, while the dogs are trained to assist children with disabilities and while each dog will be accompanied by the dog handler at all times, there is a risk the dog may behave unpredictably and become aggressive or dangerous without notice. I understand that my child’s participation in this program involves the risk of SERIOUS INJURY, and that my child may be bitten, scratched, clawed, or traumatized by the dogs. I understand that my child’s participation also involves the risk of LOSS OF OR DAMAGE TO PERSONAL PROPERTY.

2. **RELEASE OF LIABILITY.** Knowing and understanding the risks described in the previous paragraph, I agree, on behalf of myself, my child, and my family, to assume all risks and responsibilities associated with my child’s participation in on-campus canine-assisted therapy program. To the maximum extent permitted by law, I agree to indemnify and hold harmless the University of Delaware and its officers, directors, faculty, staff, representatives, employees, and agents from any claims, lawsuits, damages, or actions of any kind, including but not limited to those for personal injury, death, or property damage, arising out of my child’s participation.

3. **Health Insurance.** I understand that I am responsible for having in place medical insurance for my child prior to the commencement of the program and maintaining medical insurance for my child throughout the child’s participation. I certify that I have such medical insurance, and that I will maintain such coverage throughout my child’s participation in the program.

I hereby acknowledge that I have read and fully understand this Assumption of Risk and General Release form and agree to abide by its terms. I CERTIFY THAT I HAVE HAD AN ADEQUATE OPPORTUNITY TO ASK QUESTIONS ABOUT THE TERMS OF THIS DOCUMENT AND CONSULT WITH AN ATTORNEY REGARDING MY RIGHTS.
Appendix 3

Developmental Coordination Disorder Questionnaire 2007 (DCDQ’07)
The Developmental Coordination Disorder Questionnaire 2007 (DCDQ’07)

The Developmental Coordination Disorder Questionnaire 2007 (DCDQ’07) is a parent reported tool used to identify children at risk for developmental coordination disorders (DCD). This standardized instrument asks parents to rate their child’s coordination in comparison to same age peers in three categories: control during movement, fine motor and handwriting and general coordination. Parents are asked questions regarding manual dexterity tasks (i.e. cutting, drawing, and writing), ball skill tasks (i.e. catching different sized balls), gross motor skill tasks (i.e. jumping and running), as well as basic characteristics of the child (i.e. interest in activities, planning). This tool allows parents the opportunity to give their perceptions of their child’s functional abilities in a natural setting (Wilson, Kaplan, Crawford, Campbell, & Dewey, 2000). Parents use a 5 point rating scale ranging from 1 (not at all like your child) to 5 (extremely like your child) to answer 15 questions. The Coordination Questionnaire (DCDQ’07): Score Sheet allows researchers to quickly calculate a child’s score and determine if a child demonstrates DCD tendencies. Scoring a 15-57 is an indication of or suspect for DCD and scoring between 58-75 indicates that a child probably does not have DCD. These scoring values are appropriate for children 10 years and 0 months to 15 years. This tool has been validated for children four years and six months to 15 years and has shown to be highly correlated with the M-ABC (Movement Assessment Battery for Children (Wilson, et al., 2000).
For the purposes of this study, participants were included if they received a score between 25 and 57 on the DCDQ’07. Those receiving a score in the bottom 15% (15-24) were more likely to have extreme motor problems. Therefore, if a child had true DCD, the effects of the treatment were possibly masked due to the severity of motor impairments and not recognized by the MABC-2. Children with DCD were excluded from this study.
THE DEVELOPMENTAL COORDINATION DISORDER QUESTIONNAIRE 2007®
(DCDQ’07)

Wilson, BN, Kaplan, BJ, Crawford, SG, and Roberts, G
October 2007
©B.N. Wilson 2007

Alberta Children’s Hospital
Decision Support Research Team
2888 Shaganappi Trail NW
Calgary, Alberta, Canada T3B 6A8
http://www.dcdq.ca

123
COORDINATION QUESTIONNAIRE (REVISED 2007)

Name of Child: ___________________________ Today’s Date: ___________________________

Person completing Questionnaire: ___________________________ Birth Date: ___________________________

Relationship to child: ___________________________ Child’s Age: ___________________________

Most of the motor skills that this questionnaire asks about are things that your child does with his or her hands, or when moving. A child’s coordination may improve each year as they grow and develop. For this reason, it will be easier for you to answer the questions if you think about other children that you know who are the same age as your child.

Please compare the degree of coordination your child has with other children of the same age when answering the questions. Circle the one number that best describes your child. If you change your answer and want to circle another number, please circle the correct response twice. If you are unclear about the meaning of a question, or about how you would answer a question to best describe your child, please call ___________________________ at ___________________________ for assistance.

<table>
<thead>
<tr>
<th>Not at all like your child</th>
<th>A bit like your child</th>
<th>Moderately like your child</th>
<th>Quite a bit like your child</th>
<th>Extremely like your child</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

1. Your child throws a ball in a controlled and accurate fashion.
   1 | 2 | 3 | 4 | 5

2. Your child catches a small ball (e.g., tennis ball size) thrown from a distance of 6 to 8 feet (1.8 to 2.4 meters).
   1 | 2 | 3 | 4 | 5

3. Your child hits an approaching ball or birdie with a bat or racquet accurately.
   1 | 2 | 3 | 4 | 5

4. Your child jumps easily over obstacles found in garden or play environment.
   1 | 2 | 3 | 4 | 5

5. Your child runs as fast and in a similar way to other children of the same gender and age.
   1 | 2 | 3 | 4 | 5

6. If your child has a plan to do a motor activity, he/she can organize his/her body to follow the plan and effectively complete the task (e.g., building a cardboard or cushion "fort," moving on playground equipment, building a house or a structure with blocks, or using craft materials).
   1 | 2 | 3 | 4 | 5 (OVER)
<table>
<thead>
<tr>
<th>Not at all like your child</th>
<th>A bit like your child</th>
<th>Moderately like your child</th>
<th>Quite a bit like your child</th>
<th>Extremely like your child</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

7. Your child’s printing or writing or drawing in class is fast enough to keep up with the rest of the children in the class.
   
   1 2 3 4 5

8. Your child’s printing or writing letters, numbers and words is legible, precise and accurate or, if your child is not yet printing, he or she colors and draws in a coordinated way and makes pictures that you can recognize.
   
   1 2 3 4 5

9. Your child uses appropriate effort or tension when printing or writing or drawing (no excessive pressure or tightness of grasp on the pencil, writing is not too heavy or dark, or too light).
   
   1 2 3 4 5

10. Your child cuts out pictures and shapes accurately and easily.
    
    1 2 3 4 5

11. Your child is interested in and likes participating in sports or active games requiring good motor skills.
    
    1 2 3 4 5

12. Your child learns new motor tasks (e.g., swimming, rollerblading) easily and does not require more practice or time than other children to achieve the same level of skill.
    
    1 2 3 4 5

13. Your child is quick and competent in tidying up, putting on shoes, tying shoes, dressing, etc.
    
    1 2 3 4 5

14. Your child would never be described as a “bull in a china shop” (that is, appears so clumsy that he or she might break fragile things in a small room).
    
    1 2 3 4 5

15. Your child does not fatigue easily or appear to slouch and “fall out” of the chair if required to sit for long periods.
    
    1 2 3 4 5

Thank you.
## COORDINATION QUESTIONNAIRE (DCDQ'07): SCORE SHEET

### Personal Information

Name: _______________________________ Date: _______________________

Birth Date: __________________________ Age: _______________________

<table>
<thead>
<tr>
<th></th>
<th>Control During Movement</th>
<th>Fine Motor/Handwriting</th>
<th>General Coordination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Throws ball</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Catches ball</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Hits ball/birdie</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Jumps over</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Runs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Plans activity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Writing fast</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Writing legibly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Effort and pressure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Cuts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Likes sports</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Learning new skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Quick and competent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>“Built in shop”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>Does not fatigue</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Scoring

**TOTAL**

<table>
<thead>
<tr>
<th></th>
<th>/ 30</th>
<th>/ 20</th>
<th>/ 25</th>
<th>= / 75</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control during Movement</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fine Motor/Handwriting</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General Coordination</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**For Children Ages 5 years 0 months to 7 years 11 months**

- 15-46: indication of DCD or suspect DCD
- 47-75: probably not DCD

**For Children Ages 8 years 0 months to 9 years 11 months**

- 15-55: indication of DCD or suspect DCD
- 56-75: probably not DCD

**For Children Ages 10 years 0 months to 15 years**

- 15-57: indication of DCD or suspect DCD
- 58-75: probably not DCD

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Decision Support Research Team
Alberta Children’s Hospital
Administration and Interpretation of the DCDQ’07

Overview
The Developmental Coordination Questionnaire (DCDQ) is a parent report measure developed to assist in the identification of Developmental Coordination Disorder (DCD) in children. Parents are asked to compare their child’s motor performance to that of his/her peers using a 5 point Likert scale. It provides a standard method to measure a child’s coordination in everyday, functional activities. As reported in 20001, the internal consistency of the DCDQ is high and the results from discriminant function analyses were appropriately strong for a screening tool.

Developmental Coordination Disorder is a DSM-IV2 diagnosis. An indication of DCD based on the score of the DCDQ fulfills the requirement for Criterion B of this diagnosis. However, the questionnaire cannot be used alone for this purpose. Diagnosis must be made based on the results of several reports and tests. The questionnaire is labeled “The Coordination Questionnaire” to avoid parents becoming concerned that a medical condition is being diagnosed.

The DCDQ’07 presented here is considered to have stronger psychometric properties than the 2000 version because it was developed with a population-based sample and has a larger age range. The research took place between 2004 and 2006, involving 287 typically developing children, as well as 232 children who were reported to have motor coordination difficulties or who were more likely to have DCD. This revised version is appropriate for use with children ages 5 to 15. A brief Report is available; further information on the validation is in preparation and will be posted on this web site.

The DCDQ’07 consists of 15 items, which group into three distinct factors. The first factor contains a number of items related to motor control while the child was moving, or while an object was in motion, and is labelled “Control during Movement”. The second factor contains “Fine Motor and Handwriting” items and the third factor relates to “General Coordination”. These factor scores alone do not provide an indication of whether the child may have DCD. However, when the scores of each of the factors are examined relative to the scores of the other factors and are then compared with formal and informal assessment results, support for the identification of particular motor strengths and challenges a child is experiencing may be provided.

Prior to Administration
Before copying for clinical or research use, it is recommended that a name and phone number be written into the space on the first page so that parents can call if they have questions about the meaning of an item. This contact person should be knowledgeable about the condition of DCD, or know who to refer the question to if questions of this nature arise. The validity of the results will be increased if parents have the opportunity to clarify the intent of an item.

It is recommended that the 2 page questionnaire be copied double sided. The Score Sheet on the 4th page should be kept separate from the questionnaire itself. It is not recommended that parents be given the Score Sheet.

http://www.dcdq.ca
Respondents
This questionnaire was developed for parents, as parents know their children the best and can reliably report developmental problems. In addition, only the data from parent report was used to develop the scoring system. This DCDQ is therefore intended to be used with parents. However, some clinicians and researchers are experimenting with having both parents (or one parent and the child’s primary teacher) complete it. Sometimes two or more respondents have completed the questionnaire separately, but in other situations they have conversed while completing one form. Subjectively, the results appear to be satisfactory but no one has yet studied this approach.

When the perspective of two adults gives a more complete or more accurate evaluation of the child’s motor performance, this practice is likely to increase the validity of the score. However, it must be remembered that the scores were developed solely on parent response, so if the respondents have divergent opinions on the child’s performance, or if the two forms have very different scores, the parent’s score should be the one reported. The fact that others who know the child score the items differently can be noted, but it would be inappropriate to use the score of a teacher or coach alone (for example) in interpreting the results of the DCDQ.

Time to Complete
The DCDQ usually takes parents about 10-15 minutes to complete. As much as possible, arrange for the parent completing the questionnaire to do so in a non-distracting environment.

Administration - Written or Verbal
The DCDQ was designed to be self-administered by parents. In the reference sample of the development of the original DCDQ, however, parents were given the choice of completing a paper version of the questionnaire independently or of completing it over the phone while reading a paper copy along with the interviewer. In the study for the revised DCDQ07, most parents completed a paper copy independently but a small proportion completed it with an occupational therapist following administration of the standardized motor tests. Either method of completion is acceptable.

Missing Items
When the questionnaire is completed or returned, review it for missed items or items where more than one item is circled. Ask the parent who completed it for clarification. **Note:** a total score can only be calculated if **all items are scored.** Missing one score will prevent you from obtaining a total score and having an indication of DCD or not.

If the parent does not know how to grade an item, or has not seen their child in a particular activity, ask them if there is anyone else who would know (e.g., the other parent, a caregiver, a teacher or a coach). You may inquire if the parent can make arrangements to ask that person, or if they will give you permission to do so.

http://www.dcdq.ca
Computing the Chronological Age
Enter the date that the DCDQ was completed and the child’s Date of Birth (D.O.B.) on the first page of the questionnaire. Compute the chronological age by subtracting (first) the days, then the month and finally the year of birth. For example, if the questionnaire was completed on March 21, 2007, and the child was born on February 2, 2000, the child’s chronological age would be calculated as shown in the first table:

<table>
<thead>
<tr>
<th></th>
<th>Year</th>
<th>Month</th>
<th>Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>DCDQ completion</td>
<td>2007</td>
<td>03</td>
<td>21</td>
</tr>
<tr>
<td>Child’s D.O.B.</td>
<td>2000</td>
<td>02</td>
<td>02</td>
</tr>
<tr>
<td>Chrono age</td>
<td>7 years</td>
<td>1 month</td>
<td>19 days</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Year</th>
<th>Month</th>
<th>Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>DCDQ completion</td>
<td>2006</td>
<td>03</td>
<td>15</td>
</tr>
<tr>
<td>Child’s D.O.B.</td>
<td>2000</td>
<td>06</td>
<td>28</td>
</tr>
<tr>
<td>Chrono age</td>
<td>6 years</td>
<td>9 month</td>
<td>23 days</td>
</tr>
</tbody>
</table>

If the day of the month in which the child was born is larger than the day of the month of questionnaire completion, add 30 days to the day of testing and subtract one month from the month of testing. Similarly, if necessary, a month of testing can be borrowed by adding 12 months to the month of testing and subtracting one year from the testing year, as shown above in the table on the right.

Computing a Total Score
Re-enter the numbers circled for all items of the questionnaire onto the Score Sheet (4th page). Total each column to compute the 3 Factor Scores, and add all Factor Scores to compute a Total Score. Double check your addition.

Interpretation of Scores on the DCDQ
Using the child’s chronological age at the time the questionnaire was completed, find the appropriate age grouping on the left column of the table below. Scan across that row to find the range of scores which the child’s score falls within. This range will indicate whether the child’s score is an “Indication of, or Suspect for, DCD”, or “Probably not DCD”.

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Indication of, or Suspect for, DCD</th>
<th>Probably not DCD</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 years 6 months to 7 years 11 months</td>
<td>15 - 46</td>
<td>47 - 75</td>
</tr>
<tr>
<td>8 years 0 months to 9 years 11 months</td>
<td>15 - 55</td>
<td>56 - 75</td>
</tr>
<tr>
<td>10 years 0 months to 15 years</td>
<td>15 - 57</td>
<td>58 - 75</td>
</tr>
</tbody>
</table>

http://www.dcdq.ca
Reporting of DCDQ’07 results
As outlined above, the DCDQ cannot be used alone to identify DCD. When using the questionnaire in a verbal or written report about a child, the terms “indication of possible DCD”, “suspect for DCD”, or “probably not DCD” should be used, as this test alone cannot be used to diagnose DCD.

Sensitivity and Specificity
It is sometimes desirable, especially when a diagnosis is not clear, to report the sensitivity and specificity of the test scores. The most accurate predictive values of the DCDQ’07 are reported in the table below according to the different age ranges. If overall values for the questionnaire are required, however, the overall sensitivity is 84.6% and the specificity is 70.8%.

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Sensitivity and Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 years to 7 years 11 months</td>
<td>Sensitivity=75.0% Specificity=71.4%</td>
</tr>
<tr>
<td>8 years 0 months to 9 years 11 months</td>
<td>Sensitivity=88.6% Specificity=66.7%</td>
</tr>
<tr>
<td>10 years 0 months to 15 years</td>
<td>Sensitivity=88.5% Specificity=75.6%</td>
</tr>
</tbody>
</table>

The purpose of a screening instrument is to identify whether a child has a particular condition. Rarely is a screening tool alone 100% accurate in identifying all children with a condition while at the same time not falsely identifying any children who do not. When evaluating a screening tool such as the DCDQ’07, the degree of accuracy in identifying children with possible DCD (sensitivity) must be compared to the accuracy in correctly identifying children who do not have the condition (specificity). This “trade off” is common to all diagnostic tests because when one of these predictive values increases, the other decreases. By design, the DCDQ’07 is most accurate in identifying children who may have DCD. It may identify children who do not have the condition, but further motor testing should reveal whether DCD is indeed present.

References
Appendix 4

Movement Assessment Battery for Children-2 (MABC-2)
General information for Age Band 3 (9 and 10 years)

Materials Supplied in the Kit

<table>
<thead>
<tr>
<th>Record Form (including Flower Trails)</th>
<th>Target box</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table-top mat</td>
<td>2 jumping stands(posts and bases)</td>
</tr>
<tr>
<td>Peg board</td>
<td>Bean bag</td>
</tr>
<tr>
<td>12 plastic pegs (plus 4 extra)</td>
<td>Tennis ball</td>
</tr>
<tr>
<td>Bolt with fixed nut</td>
<td>Tape measure</td>
</tr>
<tr>
<td>3 loose nuts</td>
<td>Colored tape</td>
</tr>
<tr>
<td>Fine-tipped red pen</td>
<td></td>
</tr>
</tbody>
</table>

Material to be supplied by the tester
Stopwatch
Writing base (clipboard)

Floor Taping

- **Two-hand Catch**
  - Tape
  - 6' (2 m)
  - Clear Wall

- **Throwing Bean Bag into Box**
  - Tape
  - 8' (2.5 m)
  - Target Box

- **Hopping in Squares**
  - 9' (2.7 m)

- **Ball Balance**
  - 9' (3.7 m)
General information for Age Band 4 (11 and 12 years)

Materials Supplied in the Kit

- Record Form (including cutting-out
- Elephants and Flower Trails)
- Table-top mat
- Pegboard
- 12 wooden pegs (plus 4 extra)
- Scissors
- Fine-tipped red pen
- Wall target

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2 balance boards</td>
<td>2 jumping stand bases</td>
</tr>
<tr>
<td>2 jumping stand posts</td>
<td>2 wooden pins</td>
</tr>
<tr>
<td>Weighted cord</td>
<td>Tennis ball</td>
</tr>
<tr>
<td>Tape measure</td>
<td>Colored tape</td>
</tr>
</tbody>
</table>

Material to be supplied by the tester

- Stopwatch
- Writing base (clipboard)

Floor Taping

One-hand Catch

- Tape
- 8' (2 m)

Throwing at Wall Target

- Tape
- 8' (2.5 m)

Walking Backwards

- 16' (4.5 m)

SOURCE: Movement Assessment Battery for Children (Movement ABC) manual (Henderson & Sugden, 1992)
Appendix 5

Adapted Version of Michael Metzler’s *ALT-PE Microcomputer Data Collection System (MCDS)*
Revised from Metzler’s “Learner Moves Level”

**Engaged**

**Engaged Motor Responding (M).** Student is performing a skill.
- This can be during practice or a trial

**Engaged, Indirect Participation (I).** Student is in an activity but not directly involved with the immediate actions (includes assisting others in skill practice). *Examples:* Setting up targets, retrieving balls, and so forth.
- When a child is helping to set up or clean up an activity. For example, putting pegs back into the box or unlacing the thread and board

**Engaged Cognitive (C).** Cognitive involvement related to instruction. *Examples:* listening, questioning, responding verbally, or thinking about the activity.
- Participant is facing researcher, not moving or making noise
- When researcher is explaining an activity and child is watching or listening.

**Not Engaged**

**Pause (P).** Any non-instructional activity that is part of the content-PE activity.
*Examples:* changing side of the net and taking time outs between points
- May not be used?

**Waiting (W).** Time during activity when student is waiting for help or waiting to participate again. *Example:* Being a substitute in a game.
- If participant is waiting for the researcher. This can occur during setup, cleanup, or transition
- During waiting, participant can be talking about irrelevant information; however, if researcher directs participant to a task and he continues discussion, this is off task

**Off-Task (O).** Student is inappropriately disengaged from the lesson.
- Examples: talking or asking questions that are not relevant, inappropriately using equipment; delaying the activity; pausing during activity

**Off-Task due to Dog (D).** The child is not completing his work because he is petting the dog or asking questions about it or the handler.

**Other**

**Actiheart (A).** If the session needs to pause for an Actiheart to be readjusted.

*If equipment falls during a trial or practice:*
I – if participant picks it up
W – if The researcher, parent, or handler picks it up
O – if child is acting inappropriately while someone else picks it up

*During transition:*
W – if the researcher is setting up
I – if participant is moving or helping begin the next activity
O – disruptive behavior, see above
D – if participant is talking to, petting, etc dog
If the researcher is writing → W or O

Clean up or Set up:
W – if the researcher is cleaning up or setting up and participant is not involved, but sitting or watching
O – disruptive behavior, see above
I – if participant is helping or physically engaged
D – if participant is talking to, petting, etc dog
Appendix 6

“Feelings Scale”
<table>
<thead>
<tr>
<th>Rating</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>I LIKED it A LOT!</td>
</tr>
<tr>
<td>2</td>
<td>I am NOT SURE if I liked it or not.</td>
</tr>
<tr>
<td>1</td>
<td>I did NOT LIKE it AT ALL!</td>
</tr>
</tbody>
</table>
Appendix 7

Layout of Testing Room With Therapy Dog Present

Note: room is not drawn to scale
Location of therapy dog during television viewing and Manual Dexterity component of MABC-2.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>🐶</td>
<td>Therapy dog during manual dexterity tasks.</td>
</tr>
<tr>
<td>🐶</td>
<td>Participant during manual dexterity tasks.</td>
</tr>
<tr>
<td>🐶</td>
<td>Therapy dog during television viewing.</td>
</tr>
<tr>
<td>🐶</td>
<td>Participant during television viewing.</td>
</tr>
</tbody>
</table>
Location of therapy dog during Aiming & Catching component of MABC-2.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>🐶</td>
<td>Therapy dog during throwing beanbag onto mat.</td>
</tr>
<tr>
<td>🐱</td>
<td>Participant during throwing beanbag onto mat.</td>
</tr>
<tr>
<td>🐶🐱</td>
<td>Therapy dog during throwing with one or two hands (age bands II &amp; III) and throwing at wall target.</td>
</tr>
<tr>
<td>🐱🐱</td>
<td>Participant during throwing with one or two hands (age bands II &amp; III) and throwing at wall target.</td>
</tr>
</tbody>
</table>
Location of therapy dog during Balance component of MABC-2.

Symbol | Meaning
---|---
[Image 151x434 to 619x697] | Therapy dog during dynamic hopping.
[Image 151x366 to 180x391] | Participant during throwing dynamic hopping.
[Image 153x263 to 177x283] | Participant will move away from therapy dog during dynamic hopping.
[Image 324x60] | Therapy dog during walking.
[Image 178x128] | Participant during walking.
[Image 213x208] | Participant will move away from therapy dog during walking.
[Image 178x158] | Therapy dog during static balance.
[Image 151x158] | Participant during static balance.
Appendix 8

Interview Questions & Participant and Parent Responses
Interview Questions

"How will therapy dogs impact physiological, behavioral, and motor measures when children with ASD take a motor skills test?"

Variables:
- Motor Skill Score
- Heart Rate
- On and Off Task Behaviors

Parent
- Did your child ever talk to you about this study? Either the motor skills assessment or about the therapy dog.
- How do you think your child felt about participating in this study or coming to a session?
- Did you expect your child to behave the way he did during the sessions?
- Did your child’s behavior change at all? Why do you think that happened?
- How do you think your child felt during the assessment with the dog present?
- Do you think having the dog present made either a positive or negative difference during the motor skills assessment?
- Do you think having the dog present helped your child complete the assessment? How so?

Participant
- Were the activities you did fun?
- Was it more fun to do the activities with or without the dog?
- Did you like the dog watching you do your work?
- Were the activities easier to do when the dog was with you?
- Do you think you did a better job on the activities when the dog was watching you?
- How did the dog make you feel?
Participant 1 (001)

Participant
R: Do you remember the name of the dog that was with us yesterday?
P: [Therapy dog]!
R: Very good. I am going to ask you a couple questions about the past couple times you came here, okay?
P: [nod]
R: Were the activities that we did fun? Working at the table? Throwing the ball?
P: Yeah
R: All of them? Which activity was your favorite?
P: All
R: Did you like it when [the therapy dog] watched you do your work?
P: Uh huh [yes].
R: Was it more fun when [the therapy dog] watched you do your work?
P: Yeah.
R: Did you like to come here more when [the therapy dog] was here? Or did you like to come when [the therapy dog] was not here?
P: I liked it more when [the therapy dog] was here.
R: On the activities that you did, do you think you did a good job on them?
P: Yeah.
R: Do you think you did better when [the therapy dog] was here?
P: Yeah.
R: When [the therapy dog] was watching?
P: Yeah.
R: Okay, how did the dog make you feel?
P: Great.
R: Do you have anything else you want to tell me about when [the therapy dog] was here or when you were here?
P: [talks about toys at home]
R: Was it better when [the therapy dog] was here?
P: I liked the trick [the therapy dog] and not tell her where it is [referring to the meet and greet session when he hid a ball for the therapy dog to find]
R: What about when [the therapy dog] watched you work at the table? Did you like that?
P: Yes.
R: And what about when you walked the line?
P: ?
R: Was it easier or was it harder?
P: Easier when [the therapy dog] was here?

**Parent**
R: Did your child ever talk about this study?
P: We had the picture of [the therapy dog] on the refrigerator. When he saw the picture he would talk about him, but that was it.
R: How do you think your child felt about participating in this study or coming to a session?
P: I would tell him before we came and he did not seem to mind.
R: Did you expect your child to behave the way he did during the sessions?
P: When the dog was not here, he behaved as I expected he would. Medication may have had something to do with it. But I was surprised he was not more off task by the dog. I thought he would be distracted by it, but he sat and did his work. I am surprised
he did not try to pet it more. I think the session to meet [the therapy dog] helped. His medication might have helped.

R: Did your child’s behavior change at all? Was he more focused?
P: He did better with [the therapy dog] here, I was surprised.
Participant 2 (P002)

Participant

R: Did you have fun when you came here?
P: Yes
R: Was it more fun with or without the dog?
P: With the dog
R: What was the dog’s name?
P: [the therapy dog]
R: Um, did you like having [the therapy dog] watch you do your work?
P: Yes
R: How come?
P: Cause, cause she was a nice girl.
R: She was a nice girl?
P: Yeah.
R: Were the activities easier when [the therapy dog] was with you?
P: Easier when [the therapy dog] was in the room with [the handler].
R: Were they easier when [the handler] and [the therapy dog] were here?
P: Yeah.
R: How come?
P: Cause, cause I like it better with [the therapy dog] than without [the therapy dog] because without [the therapy dog] it’s kind of boring.
R: Okay. Do you think you did a better job when [the therapy dog] was here?
P: Yes!
R: Okay. How did [the therapy dog] make you feel?
P: Happyy!
R: [the therapy dog] made you feel happy? Okay. You are all set buddy.
Parent

R: Did [Participant 2] ever talk about this study at all whether it was the motor skill part or [the therapy dog]?
P: He talked about the dog. That was it.
R: Okay. How do you think he felt about coming here either with or without the dog?
P: He never minded any time.
R: Okay.
P: He was fine to come. He knew he had an appointment. He knew it was going to start and he knew it was the study so he was, he never questioned, he would just say ‘what time is it; what time are we going?’
R: Did you expect him to behave the way he did without the dog here?
P: Um, no I think I -- the last two times he was here I was very surprised in the way he behaved. The last two times.
R: Better or…
P: Worse. I mean worse in terms of, he was trying to be more of the class clown or something. To me, that’s what it seemed like.
R: You thought it was like that also when [the therapy dog] was here?
P: Yeah, the first time, not the, not the first time and not the time we met the dog before we did the activities but the last two times it kind of seemed like he was performing a little bit to me. But both times. This time I thought he was performing for the girls and the time before I thought he was performing for the dog.
R: Okay. Um, why do you think his behavior changed? Because he had an audience?
P: I think so.
R: Do you think [the therapy dog] had a positive impact on him?
P: Oh yeah. Yeah I think it was positive because he talked to [the handler] a lot which typically he doesn’t do. He did kind of engage him in conversation, you know? That usually he doesn’t do so he seemed to me that he was more open socially when the dog was here I think. And also when the girls were here I thought so too.
R: What about in terms of his performance on any of the activities?
P: That was kind of hard. I couldn’t, I don’t know if I could see a difference without looking at data. I’m not sure. He seemed about the same I think. I think.
R: Okay.
P: I also thought though, I thought with this [points to pegs] he wanted to get to forty seconds.
R: Ohh.
P: So I felt as though he was going slower today purposely to reach forty seconds.
R: Is there a reason for forty seconds?
P: No, I just think on the time before he mentioned forty seconds. One of the times he was mentioning forty seconds and he never got there, he was under forty. And then to me I just think forty was his goal. He wanted to get forty.
R: Do you think he was also like that with the dog? Or do you think he just wanted to get it done as fast as he could?
P: Yeah I don’t think he was like that with the dog. I really noticed it today. ‘was that forty seconds? was that forty seconds?’ [quoting Participant 2]
R: [laughs] Very good. Um, how do you think he felt during the assessment?
P: Each time you mean or just today?
R: Uh each time, in general.
P: [yells at Participant 2 to turn volume down]
P: Was that each time or today? I’m sorry.
R: Like in general. Do you think there was a difference with and without the dog here and how he felt?
P: I don’t know I just think the first two times were different than the last two times. I think he was happy to come and happy to do it.
R: Okay.
P: I think In general he was happy.
R: Okay. Do you think [the therapy dog] made a difference at all?
P: I think he did. Yeah, I think he did.
R: Great. That is…yeah that’s basically it. They’re pretty quick.
P: Okay, because
R: Is there anything else you want to say about it?
P: No, I will also notice it, anecdotally, whenever they do homework in the dining room the dog is on the floor and the cat is on the table.
R: Yeah.
P: So they’re used to doing chores with animals perhaps.
R: Yeah.
P: And even when… [Participant 2 sneezes – tell him to cover mouth]
P: Oh, even the other day my other son was having an exam and he texts me ‘mom, I can’t do this I’m nervous’ and I said “just think you’re in the dining room with the dog and the cat” and he said ‘oh yeah that worked’. I don’t know if it was the visual but you know what I mean?
R: So the dog just provided comfort?
P: I think so. Yeah, in our house I think they do.
Participant 3 (P003)

Participant
R: The name of the dog that was here the other day; what was the dog’s name?
P: [thinking]
R: The brown dog that watched you.
P: [thinking]
R: What was the name of the dog that was here?
P: [the therapy dog]
R: Very good. When you came here did you like what we did?
P: Yeah
R: Okay, was it more fun to come here with or without [the therapy dog]?
P: Without [the therapy dog]
R: You liked to come without [the therapy dog]?
P: Yeah
R: Did you like it when [the therapy dog] watched you do your work?
P: Yeah
R: Was it easier to do the activities when [the therapy dog] was here?
P: Yeah
R: Do you think you did a better job when [therapy dog] was watching you?
P: Yeah
R: How did [therapy dog] make you feel? Happy? Sad?
P: Happy
R: How did [therapy dog] make you feel?
P: Happy
R: [Participant 3], did you like it when [therapy dog] came here?
P: Yeah
R: Okay. Did you like it when [the therapy dog] watched you?
P: Yeah

**Parent**

R: How long did you guys have a dog in your house when [Participant 3] was there?

P: Seven years

R: So [Participant 3] had a dog in the house for six years?

P: Mhmm, more or less.

R: Okay. Do you think he understood the questions I was asking him?

P: I’m not 100% sure. It isn’t so much that he doesn’t understand, it’s if he’s paying attention to what you’re saying.

R: Okay.

P: That’s why he was going like this [touches blue mat] and I told him to put French fry hands [fold hands] so he could concentrate more on what you’re saying because otherwise he’ll say yes to everything you’re saying which is what he did for most of it except

R: with [the therapy dog]?

P: Mhmm.

R: Not a problem.

P: And did you notice he had to write the name of the animal before he told you?

R: Mhmm. But he remembered it?

P: He remembered but he had to write it to get him to say it.

R: That’s interesting. Does he do that with a lot of things?

P: Yes.

R: Got it. Did he ever talk about this study whether it was about [the therapy dog] or about coming here at all?

P: No.

R: No? Okay.

P: No, but he was excited when I reminded him about coming here.
R: About [the therapy dog] specifically or about coming in general?
P: About coming in general.
R: Okay.
P: He was excited last week when I told him he was coming with the dog but he was also excited today.
R: Okay, good. How do you think he felt about participating in this study?
P: Oh, I think he had fun. I think he had a lot of fun. I mean he said [points to green/happy on end of test survey], and I know he really meant it.
R: Okay, this he understands?
P: Oh he’s pretty good when he reads. He’s better and pays more attention when he reads. His reading is a little better or a little bit more accurate than his auditory. He tends to go off easier when he’s hearing. On the other hand sometimes he goes off when he reads but this is not a lot to read.
R: No, it’s pretty straightforward. So this is pretty accurate for him? [pointing to green/happy]
P: Yes.
R: Ok, well that’s good. Did he behave during the sessions without the dog how you expected he would? When [the therapy dog] wasn’t here.
P: Pretty much, pretty much.
R: And did he behave how you expected when [the therapy dog] was here?
P: Mhmm, yes.
R: Okay.
P: He liked the dog. He enjoyed the dog.
R: Okay.
P: But to be honest I think what made it so he didn’t enjoy it as much was that it’s not his dog. It’s a dog that is handled by somebody and they have to tell him what to do, what not to do to the dog because it’s their dog. But if it were to have been, say, his
dog and he’s comfortable with the dog and he can touch the dog everywhere he would have been more comfortable
R: With the dog?
P: Yes. I think the whole situation was not the most comfortable because it’s not a natural situation.
R: Okay.
P: It’s somebody else’s dog and he needs to touch it in a particular way. You know, he doesn’t have the freedom to
R: to do whatever?
P: To do whatever he wants. And that makes a big difference for kids like him because that adds a little bit of stress.
R: Okay. That’s good to know because I’m looking at stress.
P: Yes.
R: Do you think [the therapy dog] helped him do the assessment at all, made it easier, or made him feel more comfortable?
P: I thought that when he was petting [the therapy dog] here with the pegs he was feeling really comfortable. I don’t think that he was terribly comfortable all the time because like I said it’s not a natural situation. It’s like, you know, a controlled situation with the dog. But I thought when he was petting the dog he was really enjoying it.
R: Do you think that if he had met [the therapy dog] a few more times he would have been even more comfortable?
P: That’s a possibility. I think what makes it a little awkward is that [the therapy dog] is with somebody.
R: With the other handler? Okay.
P: Which it has to be like that because that’s his owner.
R: Right.
P: But that I think is what makes it a little bit not as enjoyable.
R: Okay, because it’s someone else’s dog?
P: Yeah. And because that person is all the time saying sit down to the dog or get up. Like, how can I explain it…because he doesn’t have a chance to freely interact with the dog and play with the dog. Like at home he would lie on the floor and the dog would come on top of him and lick him. And even with the cat, he has a cat now and he grabs the cat and puts him over and holds the cat like this [motions to shoulder] so it’s..
R: he doesn’t have control, as much control. [Participant 3], doesn’t?
P: Mhmm.
R: Alright. Do you think having [the therapy dog] here made a positive or negative difference during the assessment?
P: I don’t think it was negative. I don’t think it was a huge - I’m curious to know what you find with the heart rate because I’m not 100% sure if you’re going to find a huge difference between today and the last time.
R: Okay.
P: You may find a difference between the first day and the second but I don’t think you’re going to find a huge difference between today and last time.
R: Do you think there’s a reason for that?
P: I think the more they do something, the more they feel comfortable with it. So I think the sessions should be more, instead of four. One with the dog and one without. I think it should be done with more sessions with the dog and more sessions without the dog because they improve as they do things over and over. Okay?
R: Yeah.
P: And so it’s very hard to differentiate between what’s the improvement, whether it’s because of the dog or whether it’s because they have done it several times.
R: Yeah, that was the hard part, that was the part we were having trouble with, the study design, because we wanted to do it longer but it’s hard to ask parents to keep coming.
P: Well if you need it longer
R: You’re the first one I’ll call!
P: By all means because I want your study to be statistically significant and it’s not going to be statistically significant if you don’t have enough points.
R: Well we are addressing that by saying we’re not looking for statistical significance we’re looking for a trend
P: Oh, okay.
R: To overcome that small aspect.
P: Okay.
R: But overall do you think [the therapy dog] made a difference at all for him here?
P: Slight.
R: Slight, how so?
P: Slight. Not a huge difference. I was very surprised that he told you that he liked it more without the dog.
R: You were surprised by that? How come?
P: Because I thought he liked the dog a lot and to say that he liked doing the things without the dog better than with the dog that’s not what I expected.
R: Do you think part of it could be he didn’t understand the question or that’s how he really felt?
P: Unfortunately I think that might be how he felt. We can ask him a third time you know. Make sure we have his attention. With [Participant 3] and with a bunch of these kids attention is key. If you don’t have their attention their answer is not going to be meaningful because they answer yes to anything to get you out of the way so they can get to what they really want to do.
R: Because he said he didn’t like the dog and I was like ohh…
P: No, not that he didn’t, the question was did you like it more with him or without him and he said without him. So that doesn’t mean he didn’t like the dog he said he enjoyed doing the exercises more without the dog.
R: Oh, so I could’ve phrased the question..

P: And the real reason I think because it was too, it was not spontaneous. It was too controlled.

R: So how do we ask him?

P: I don’t know, let me think about it.

R: Even if you want to ask him at home.

P: Yeah, but I think that’s why he said he liked it more without the dog.

R: Okay, because it’s alright if he didn’t like having [the therapy dog].

P: Again it’s not that he didn’t like having [the therapy dog], I think that he was more comfortable in a way sometimes without [the therapy dog] but I don’t think it was [the therapy dog] itself, it was the situation that [the therapy dog] comes with other people and that we are kind of like you know?

R: Do you think if we asked him if he only liked [the therapy dog], like did you like [the therapy dog]?

P: I don’t know if he can differentiate, like separate them?

R: differentiate, like separate them?

P: Yeah, because it’s a whole situation.

R: Yeah, they came as a package.

P: And I like the man, there’s nothing against him. It’s just as children you know we’re always going don’t do this, don’t do that, don’t do this, don’t do that, so I think that had a little bit of an impact?

R: impact?

P: Uh huh.

R: Okay. Well I’ll be interested to see what his heart rate is too.

P: I am really interested because I have been trying to convince my husband to get a second dog

R: so if we had real data points? [laughs]
P: and my husband is not being very positive about this and I don’t want to have a big family situation and I want him to say yes and not for me to just dump the dog in the house without
R: No, that would not be very good.
P: No. When he got married to me I had four dogs and a cat so
R: so he knew you were an animal lover right off the bat?
P: Yes. But…
R: Just tell him you need a dog, that’s what you’re used to.
P: [laughs]
R: If it was that easy, right? Well is there anything else you’d like to say about the study?
P: I was just a little concerned about being able to make a conclusion with too few data points because of that.
R: Yeah.
P: because they do get better as time goes on if you were able to get [the therapy dog] again then we could see how well he does with [the therapy dog]
R: a second time?
P: Yes, a second time. Because I think you have two data points without [the therapy dog], right?
R: Yes.
P: So it would be interesting to see what happens with [the therapy dog] and just see R: a comparison?
P: Yeah. Because only one he met the dog okay, great and then he did something R: what if he did that something again?
P: Exactly. And I’m all willing to bring him if you can manage to get that. I don’t know if you have to change the whole study?
R: Yeah, that’s the thing. The protocol and the procedure.
P: Exactly.
R: But no that is definitely a good point. That will be noted. We enjoyed having [Participant 3].

P: Yeah and I’m sure he had fun.

R: Hopefully. He did a good job. He paid attention.

P: The other thing that is a variable is that we did the last three things around 5:30 which is very good but the first one we did at 6.

R: A little too late.

P: And I didn’t think about that because I was trying to get everything ready so I could get here on time and that day I was having trouble because I needed to do something else before I got here. But that also makes a big difference because he’s taking the medicine and the medicine starts going off after a certain amount of time. But you saw that he didn’t do as many things today.

R: Yeah, so it’ll be good to compare today with when [the therapy dog] was here?

P: Yeah, so we will see.

R: We’ll see.
Participant 4 (P004)

**Participant**

R: [Participant 4], do you remember the name of the dog that was here?
P: [the therapy dog].
R: [the therapy dog], very good. Were the games that you did here fun?
P: Yeah.
R: Which ones were your favorite?
P: The computer.
R: Which activities were your favorite?
P: Draw.
R: So you like the computer and you like to draw?
P: Yes.
R: Was it more fun to do the activities when [the therapy dog] was here?
P: Yeah.
R: How come?
P: [playing with hands]
R: What do you think about [the therapy dog]? Do you think [the therapy dog] is happy or sad?
P: Happy
R: Do you think [the therapy dog] is mean or nice?
P: Nice.
R: Do you think [the therapy dog] is fun or boring?
P: Fun.
R: So how come you liked having [the therapy dog] here?
P: [playing with hands]
R: [Participant 4], were the activities fun with [the therapy dog] here?
P: Yes.
R: How come?
P: [playing with hands]
R: You did a very good job helping me. Thank you very much.

**Parent**

R: Has [Participant 4] ever lived with a dog?
P: [shakes head No]
R: Did he ever talk about being in this study? Either [the therapy dog] or the motor skills part?
P: He asked to come. That’s what he did.
R: Before or after he met [the therapy dog]?
P: Well after he met [the therapy dog] we went home and the next day he wanted to come back and see [the therapy dog]. The next time I mentioned he was going to see [the therapy dog] he was very excited.
R: Okay good. How do you think he felt about participating or coming here?
P: He likes it.
R: Even without [the therapy dog]?
P: Well I know he likes it because when he comes home the first thing he does is eat a snack. I told him he couldn’t get a snack before this. I just said we were going to eat dinner real quick then we’re going to go. He was excited. Because I interrupted his routine and he was okay with interrupting his routine to come down here.
R: Oh, that’s really good.
P: Normally he’s not okay with interrupting his routine.
R: Good. Did you expect him to act the way he did during the sessions?
P: Actually he was more cooperative than I expected.
R: Good! Do you think his behavior was different when [the therapy dog] was here? The day we did the motor skills part, not the day we just played in the room.
P: I think he was more interested in [the therapy dog] than anything else, definitely.
R: That’s fine. How do you think he felt during the assessment with [the therapy dog] here?
P: I think he was fine with it. He was happier when [the therapy dog] was here.
R: Do you think it helped reduce any stress or anxiety with [the therapy dog] here?
P: Yes, he was less stressed with [the therapy dog] here. [the therapy dog] made it fun.
R: Good. Do you think having [the therapy dog] here made a positive or negative difference during the assessment?
P: Positive.
R: Do you think having [the therapy dog] here helped him complete the assessment at all?
P: Maybe because I think if [the therapy dog] weren’t here he would be kind of bored, like ‘let’s do that again, let’s do that again.”
R: Is there anything else you would want to tell me about?
P: Well on the way here I don’t know why but I made a wrong turn and he said “no!” I didn’t even realize I made the wrong turn until he said it. So he actually knows how to get here. He was excited; he’s ready. He’s knows where he’s supposed to come and he knows how to get here.
R: Good. Do you think [the therapy dog] would have made a difference with [Participant 4], making him less stressed and more cooperative if the session was different – if it was less structured?
P: Yes. If it were like the playful part when they were throwing the ball then [Participant 4] would do everything with [the therapy dog].
Participant 5 (P005)

Participant

R: When you came here, were the activities fun that you did?
P: Yeah
R: Do you remember the name of the dog that was here?
P: [the therapy dog]!
R: Very good. Was it more fun to do the activities when [the therapy dog] was here or when [the therapy dog] was not here?
P: When [the therapy dog] was here.
R: How come?
P: Because he likes me.
R: Because [the therapy dog] likes you?
P: [nods in agreement]
R: Did you like [the therapy dog]?
P: Yep.
R: Did you like having [the therapy dog] watch you do your work?
P: Yep.
R: Was she a good person – or a good puppy?
P: A good puppy!
R: Do you think the activities were easier when [the therapy dog] was here or it didn’t make a difference?
P: It was easier when [the therapy dog] tickled me.
R: It was easier when [the therapy dog] tickled you or it didn’t matter – [the therapy dog] just tickled you the other day?
P: I don’t know.
R: When [the therapy dog] tickled you
P: When I was doing the pegs and the nuts and the bolts
R: Did that help you do your work?
P: Yep.
R: Do you know why?
P: Because he likes me.
R: Okay. Do you think you did a better job when [the therapy dog] was watching you?
P: Yes.
R: Because you did all the activities when [the therapy dog] was watching you and then you did all the activities when [the therapy dog] wasn’t watching you. When do you think you did better?
P: I don’t know.
R: Okay. How did [the therapy dog] make you feel?
P: Happy.
R: How come?
P: Because he likes me.
R: Very good. [Participant 5] you are all set. Is there anything else you want to tell me about when you came here?
P: Well, I want to tell you something about peas in a pod.
R: How about when you came here – is there anything you liked or you didn’t like?
P: Well the camera, the stickers, and the rubbing alcohol.
R: That’s what you didn’t like?
P: Yes.
R: I’m sorry. What did you like? Anything?
P: You and the games.
R: The games?
P: Yes.
R: Alright.
Parent
R: Did [Participant 5] ever live with a dog?
P: No.
R: Okay. Did he ever talk about the study at all – either the motor skills part or [the therapy dog]?
P: The dog. When the dog was going to be here.
R: Was he excited about the dog or was he nervous?
P: He was excited.
R: How do you think he felt about participating or coming here?
P: He wanted to come.
R: More so when he knew [the therapy dog] was going to be here or about the same?
P: No, about the same.
R: Did you expect him to behave the way he did during the sessions?
P: Mhmm. [nods]
R: Do you think his behavior changed at all?
P: What do you mean?
R: If he was more on task or more relaxed or more focused. Anything like that either with or without [the therapy dog].
P: I think he was more focused on a Sunday because he had his medicine first. At night he can’t have his medicine.
R: Okay. How do you think he felt during the assessment with [the therapy dog] here?
P: He liked it.
R: Do you think having the dog here had a negative or positive difference on the assessment – the motor skills assessment?
P: Positive.
R: Do you think having [the therapy dog] here helped him complete the assessment at all?
P: Probably not.
R: Is there anything else you want to tell us about having [Participant 5] involved in the study?
P: He enjoyed it. He really liked the dog.
R: The dog was a big part?
P: Yeah. Not so much watching him do the things but he liked when he got to do things with the dog. When he made him get the bone and he hid it – that he liked. He was more interested that day then the day that [the therapy dog] was just watching him.
R: Okay. That’s it.
Participant 6 (P006)

**Participant**

R: My first question for you is the name of the brown dog that came here and watched you?

P: [the therapy dog]

R: You remember her?

P: Yeah.

R: Okay, I need you to talk as loudly as you can in your outdoors yelling voice right now, okay?

P: Okay.

R: Were the activities that you did here fun?

P: Yeah.

R: Which ones did you like the most?

P: I liked hopping and the beanbag toss.

R: Okay, so you liked hopping and the beanbag toss. Was it more fun to do the activities when [the therapy dog] was here or when [the therapy dog] was not here?

P: When [the therapy dog] was here.

R: How come?

P: I don’t know.

R: You don’t know? Did you like having [the therapy dog] watch you do your work?

P: Yeah.

R: How did [the therapy dog] make you feel?

P: Happy.

R: How come?

P: Because she was a nice dog.

R: Okay. Were the activities easier to do when [the therapy dog] was here or harder?

P: Easier when [the therapy dog] was here.

R: Do you know why they were easier?
P: No.
R: They were just more fun when [the therapy dog] was here?
P: Yeah.
R: Do you think you did a better job when [the therapy dog] was watching you?
P: Yeah.
R: How did [the therapy dog] make you feel?
P: Happy.
R: Okay. That’s all my questions for you.

**Parent**

R: Did [Participant 6] ever talk about this study at all while you guys were home?
P: Yes, after the first session where [the therapy dog] was involved he wanted to call the owner of [the therapy dog] to talk to [the therapy dog] from the house.
R: Nice, so he was really interested?
P: He really was.
R: Good. How do you think he felt about participating or coming here without [the therapy dog]?
P: I think he enjoyed coming here for the activities. I think he was more excited for [the therapy dog] but all in all its been a fairly good experience for him either way.
R: Good. Did you expect him to behave the way he did during all of the sessions?
P: Well I missed the first couple, but from what I observed from this one and last week’s as well he behaved as I would’ve expected. He listened to you and he did pretty much as you asked him.
R: Perfect. How do you think he felt when the dog was here?
P: The way the curriculum was set up for last week the dog was kind of like a bystander if you will. There wasn’t any real interaction. I don’t know if that affected [Participant 6] and the way he handled it knowing the dog was present in the room. It may have challenged him more, made him more confident and more relaxed. Kind of
comparing it from last week to this week, he kind of appeared to do just about the same level of competency.

R: That’s fine. So you think if [the therapy dog] was more involved he would have had even more confidence if [the therapy dog] was doing the activity with him?

P: He might have. I heard he had a great time with [the therapy dog] when it was just the introduction without the activities involved. Last week I think [the therapy dog] was already here by the time we walked into the room. He acclimated real fast. Then we get into activities and [the therapy dog] and his owner were just kind of sitting off to the side. It didn’t seem like there was too much rebonding if you will that might have given him more of an emotional connection with [the therapy dog] as of last week to be more of what it was like the week prior.

R: Great, that’s awesome. Do you think having [the therapy dog] here helped him complete the assessment at all, comparing last week to this week?

P: I think he performed about the same motor ability both weeks. He might have been a little more distracted with [the therapy dog] being here from what I observed last week. I thought he was a little more focused on the activities this week without [the therapy dog] being here.

R: Okay, great. That’s it.
Participant 8 (P008)

R: Do you remember the name of the dog that came here?
P: [the therapy dog]
R: Yes, the dog’s name was [the therapy dog]. When you came here, were the activities that you did fun?
P: No.
R: If you had to pick one activity to be your favorite, which would it be?
P: Hmm... Probably the one where I have to catch the ball and throw it against the wall.
R: Ok, very good. Was it more fun to do the activities with or without [the therapy dog] here?
P: Hmm, it didn’t really matter.
R: Ok, did you like having [the therapy dog] watch you do your work?
P: Mhmm.
R: Yes, you liked having [the therapy dog] watch you do your work?
P: Yeah.
R: Do you think the activities were easier or harder to do when [the therapy dog] was here?
P: Um, I’m not really sure, probably about the same.
R: Do you think you did a better job when [the therapy dog] was watching you or a worse job when [the therapy dog] was watching you?
P: Well, I’m not sure.
R: How come?
P: Well, I’m just not sure I guess.
R: How did having [the therapy dog] here make you feel?
P: Hm, the same as when she wasn’t here I guess.
R: The same as when she wasn’t here? You felt the same when [the therapy dog] was here and when [the therapy dog] was not here?
P: Mhmm [agree]
R: Ok, is there anything else you want to tell me about when you came here? Either with [the therapy dog] here or without [the therapy dog] here?
P: Nah.

**Parent**

R: Has [Participant 8] ever lived with a dog?
P: No.
R: Did he ever talk about this study with you? Either the motor skills assessment or about [the therapy dog]?
P: He talked about [the therapy dog] being well trained. We talked about [the therapy dog] looking at the piece of dog treat on the floor and how he stared at it a long time, especially when the command was not to eat. And that was impressive.
R: How do you think he felt about participating in the study or coming to a session?
P: I think he was kind of ambivalent. I think he was tired because it was the afternoon of a weekday.
R: Did you expect him to behave the way that he did during the sessions?
P: I expected him to move through it a little more quickly and not be so silly.
R: Do you think that his behavior changed at all throughout the three sessions that we did the assessment?
P: I thought that things moved a bit quicker when [the therapy dog] was here.
R: And do you think that was because the dog was here or could it have just been the day?
P: I don’t really know. I can’t really say. I think there was extra audience because [the therapy dog]’s handler was also here. So maybe when there is an extra audience he moves through a bit faster.
R: How do you think he felt during the assessment with [the therapy dog] here?
P: I think [the therapy dog] was interesting to him but not motivating.
R: Do you think having the dog here had either a positive or negative effect on the motor skills assessment?
P: I think that it probably did not have an effect. I think [he] was really more focused on you than on [the therapy dog].
R: So, do you think having [the therapy dog] present helped him complete the assessment at all?
P: I don’t know. I don’t know, but he did enjoy the hide and seek game the first day he met [the therapy dog]. So, I think for that reason, having [the therapy dog] here was interesting the second time, but I don’t know if it affected his performance physically.
R: Do you think that if the activities involved [the therapy dog] more rather than [the therapy dog] watching it would have been a different performance?
P: Oh, yeah, yeah…if [the therapy dog] had had to do a turn and if the performance activity was somehow similar or if it was competitive, it would have made an effect.
R: That is the last question I have, is there anything else you would like to share?
P: No, expect to say thanks for the opportunity and to meet [the therapy dog].
Appendix 9

Institutional Review Board Approval Letters
DATE: August 18, 2010

TO: Dannielle Miccichello
FROM: University of Delaware IRB

STUDY TITLE: [183426-1] The Effects of Animal Assisted Intervention on Children with Autism During the Movement Assessment Battery for Children

SUBMISSION TYPE: New Project

ACTION: APPROVED
APPROVAL DATE: August 18, 2010
EXPIRATION DATE: August 17, 2011
REVIEW TYPE: Expedited Review

Thank you for your submission of New Project materials for this research study. The University of Delaware IRB has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a study design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

This submission has received Expedited Review based on the applicable federal regulation.

Please remember that informed consent is a process beginning with a description of the study and insurance of participant understanding followed by a signed consent form. Informed consent must continue throughout the study via a dialogue between the researcher and research participant. Federal regulations require each participant receive a copy of the signed consent document.

Please note that any revision to previously approved materials must be approved by this office prior to initiation. Please use the appropriate revision forms for this procedure.

All SERIOUS and UNEXPECTED adverse events must be reported to this office. Please use the appropriate adverse event forms for this procedure. All sponsor reporting requirements should also be followed.

Please report all NON-COMPLIANCE issues or COMPLAINTS regarding this study to this office.

Please note that all research records must be retained for a minimum of three years.

Based on the risks, this project requires Continuing Review by this office on an annual basis. Please use the appropriate renewal forms for this procedure.
Thank you for your submission of Amendment/Modification materials for this research study. The University of Delaware IRB has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a study design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

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