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Outcomes in language and social skills as seen in children with autism and developmental disabilities participating in equine assisted activities

Megan Koenigseder

University of Arkansas

#### Abstract

Individuals with developmental disabilities commonly present characteristics that include deficits in social and communicative abilities. A number of intervention strategies have been implemented, but none have proven to be most effective. A somewhat novel approach known as equine assisted activities and therapies (EAAT) involves the utilization of horses during intervention and has shown to be effective in areas concerning quality of life, social functioning, self-regulation, adaptive behaviors, motor control, and motivation.

The purpose of the current study is to examine the effects of EAA on social skills and expressive language in 2-4 children diagnosed with developmental disability. Participants engaged in 6 weeks of EAA at Equestrian Bridges, a local not-for-profit organization. Sessions were one hour and occurred once a week. Prior to the first session, participants' guardians completed the Social Skills Improvement System (SSIS) and the Behavior Rating Inventory of Executive Function (BRIEF) questionnaires. A conversational language sample was elicited from each of the participants. Each session consisted of time spent learning a new vocabulary word, greeting and brushing miniature horses, leading the horses while engaging in activities, and reviewing the vocabulary word of the day. The final 3 sessions also included horseback riding. Following the last session, participants' guardians completed the SSIS and BRIEF questionnaires again, and a second conversational language sample was elicited. Results suggested EAA may contribute to increased social skills, fewer problem behaviors, and improved executive function. Gains in expressive language were also noted, such as increased length and ease of conversation.

#### Acknowledgements

First and most importantly, to my Savior: Thank You for the opportunities and the people You have strategically placed in my life. You have blessed me greatly. To You be the glory and credit for this accomplishment and for all others.

To my wonderful parents: I would not be here without your influence and hard work. Thank you for encouraging me through the stress and supporting me no matter what. You two are the best of the best, and I am so thankful and honored to be your daughter.

To all my awesome friends: Thank you for putting up with my stressed-out self and for making me laugh at just the right moment. You all are the highlight of my college experience, and I could never thank you enough.

To Jessie, Shanna, and everyone at Equestrian Bridges: Thank you for allowing me to volunteer and to conduct my research with your program, and thank you for bearing with me through all of the questions. I thoroughly enjoyed every moment I spent at the barn getting to know you all and the horses.

To my mentor, Dr. Frazier: Thank you for your willingness to take me on as a mentee amidst all of your other responsibilities. I would have been lost without your guidance and advice.

To Dr. Lisa Bowers: Thank you for treating me like one of your own mentees whenever I had a question for you. You were always happy to help me in any way and at any time, and I am so grateful.

To Dr. Andy Bowers: Thank you for teaching me the foundations of research and for assisting me in writing my proposal. Your suggestions and edits were always very helpful, and I so appreciate your input.

Lastly, to the best advisor I know, Mr. Aslin: Thank you for encouraging me to apply to the Honors College and follow through with the work. You always put me at ease when I came into your office freaking out, and I am so grateful for this.

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# Outcomes in language and social skills as seen in children with autism and developmental disabilities participating in equine assisted activities

#### Introduction

The Centers for Disease Control and Prevention (CDC) defines developmental disability as a group of conditions due to a deficit in a physical, behavioral, language, or learning domain (Centers for Disease Control and Prevention, 2015). Due to the heterogeneity of expression in developmental disabilities, a variety of educational and therapeutic intervention approaches have been implemented, but no single intervention has proven to be most effective (Majnemer, 1998). As such, it is as yet unclear what constitutes the most effective treatment for any given individual diagnosed with developmental disability.

A somewhat novel intervention strategy for children with developmental disabilities and other diagnoses such as autism spectrum disorder (ASD) is known as equine assisted activities and therapies (EAAT) (Lanning, Baier, Ivey-Hatz, Krenek, & Tubbs, 2014; Smith-Osborne & Selby, 2010). EAAT includes aspects of both equine assisted activities (EAA) and equine assisted therapies (EAT). EAA constitutes any intervention that involves activities with a horse, such as grooming, walking, and riding, while EAT is simply the utilization of equine movement in therapy. While the research on the effects of EAAT is limited, a number of recent studies have provided positive evidence for increases in quality of life, social functioning, self-regulation, adaptive behaviors, motor control, and motivation (Bass, Duchowny, & Llabre, 2009; Gabriels et al., 2012; Lanning et al., 2014; Taylor et al., 2009). However, many of those studies lacked a randomized control group or differed in the procedure used for treatment, suggesting that treatment efficacy has not yet been established. Nonetheless, as a result of these positive

implications, local programs have emerged throughout the United States, many without specified protocols for measuring participant outcomes. Equestrian Bridges, a not-for-profit organization in Northwest Arkansas that utilizes EAA for children with ASD and other disorders, is one example of a local program without a protocol for measuring social or language outcomes. The goal of Equestrian Bridges is "to empower children and youth of varying abilities using the horse to facilitate social and communication skills" (Equestrian Bridges, 2012). During social skills sessions, children with disabilities are partnered with volunteers who participate alongside the children during the activities. Therapists working with the program create activities intended to build the foundation for higher-level academic and communication skills such as joint attention, sharing, turn-taking, listening, emotional regulation, and flexibility, all of which are behaviors that may need to be addressed in children with ASD and other developmental disorders.

While developmental and learning disabilities affect a wide range of behaviors, two of the most difficult domains to address are social skills and language. These two domains are critical to the ability to communicate successfully. For example, struggling to communicate or behave in a socially acceptable way may result in further difficulties across other domains (e.g., further language acquisition). Manifestations of social impairment include issues with reciprocal social interaction along with difficulty recognizing and expressing emotions (Bauminger, 2002). Children with learning disabilities have demonstrated deficits in areas such as self-concept, interpersonal skills, social adjustment, social competence, behavioral functioning, classroom behavior, communicative competence, social perception, social cognition, role taking, attributions, and social relationships (Kavale & Forness, 1996). Bass et al.,

(2009) provided evidence that EAA is associated with increased social skills in children with ASDs. That study assessed outcomes of therapeutic horseback riding on social functioning in thirty-four children with ASD. For 12 weeks, the children participated in one hour riding sessions, during which they took part in exercises, riding skills, and games while on horseback. A second group of wait-listed participants were used as a control. The Social Responsiveness Scale (SRS) and Sensory Profile (SP) were given to parents in both groups before and after the 12 weeks to evaluate social skills. Results suggested that compared to the control group, the EAA group made significant improvements in social functioning, specifically in the areas of sensory integration, directed attention, and social motivation. Thus, there is preliminary evidence to suggest that EAA can have a positive impact on social skills.

More recently, Lanning et al., (2014) provided further evidence that EAA can have a positive effect on social skills functioning in ASDs. In that study, quality of life assessments were used to determine the effects of EAA on behaviors of children ages 4-15 years with ASD. Thirteen children participated in hour long riding sessions that took place once a week for 9 weeks. During each session, the children received basic safety lessons, learned grooming skills, and engaged in riding activities. Within that same time period, a comparison group of twelve children participated in social circles – groups that targeted specific social skills through activities. At weeks one, three, six, and nine, participants from both groups completed the Pediatric Quality of Life 4.0 Generic Core Scales (PedsQL), meant to measure the health-related quality of life. The PedsQL was also administered to parents, who additionally completed the Child Health Questionnaire (CHQ), which measures 14 physical and psychosocial concepts.

Results for the EAA group revealed significant improvements in physical, emotional, and social functioning, especially within the first six weeks of EAA. Children who engaged in the social circles showed behavioral improvements as well, but not to the extent of the EAA participants. Thus, even when compared to an intervention targeting social skills, EAA is associated with significantly larger improvements in social skills functioning.

Along with enhanced social functioning, EAA has been associated with positive psychosocial outcomes. Smith-Osborne and Selby (2010) completed a literature review of 16 studies meeting the following criteria: meta-analyses, systematic reviews, qualitative or quantitative studies performed and reported in English within the past 25 years, and inclusion of findings on psychosocial effects of EAA for children or adolescents. Participants in these studies exhibited a range of diagnoses, including Attention Deficit Hyperactivity Disorder (ADHD), learning disabilities, cerebral palsy, and many more. The review reports that the research quality is mixed, but qualitative results for several studies reveal positive changes, such as decreased externalized behavior; improved verbal engagement; and improved behavior, communication, coping, and perceived self-efficacy. Ewing, MacDonald, Taylor, and Bowers (2007) conducted a study that examined the effects of an equine-facilitated learning program on 28 children between the ages of 10 and 13. The participants included children with a variety of diagnoses, including ADHD, ASD, and learning disability. Participants attended the program twice a week for nine weeks; each session lasted approximately two hours. Children were paired with a horse at the beginning of the program and worked with that horse for the remainder of the 9 weeks. Sessions included "circle time," when the participants would discuss

their goals for the day and the positive results of the session; lessons on caretaking and safety precautions, including saddling and cleaning stalls; and riding lessons. Both quantitative and qualitative measures were obtained using materials such as the Self-Perception Profile for Children, the Empathy Questionnaire, the Locus of Control Scale, the Children's Depression Inventory, the Children's Loneliness Questionnaire, and interviews and observations with teachers, riding instructors, and program volunteers. While the self-report measures did not reveal any statistically significant changes, qualitative results indicated positive changes, including improvements in social skills, self-care, and personal sharing. More than one participant with behavioral problems was able to reenter a mainstream classroom following his or her completion of the program.

In addition to increases in social and psychosocial competence, EAA and EAT are associated with increases in expressive communication behavior. Gabriels et al. (2012) conducted a study that analyzed the impact of 10 weekly lessons of therapeutic horseback riding on 42 children with ASD as compared to a waitlist control group. Results suggested that children in the EAT group showed reductions in measures of irritability, lethargy, stereotypic behavior, and hyperactivity. In addition to a reduction in these behaviors, qualitative analysis of participant responses suggested that expressive language skills increased. In other words, although the study did not explicitly measure expressive language, parent report indicated that the children in the treatment group asked more questions, initiated conversation more often, used a more varied vocabulary, and used fewer words indicating negativity. However, because language was not targeted directly, it was unclear what aspect of EAT may have induced

increases in expressive language. One possibility is that interaction with horses, who are highly social animals, provides the individual with ASD immediate cause-and-effect feedback leading to an awareness of the impact of his or her social-communicative behavior (Grandin, 1997). Another possibility is that, as children interact with the horses, they are encouraged to verbalize instructions. The two explanations are not mutually exclusive and these two aspects of EAT likely interact. One weakness of the reported association between gains in expressive language and EAT in the Gabriels et al., study (2012) is that no quantitative measures of language be taken in order to demonstrate the feasibility of generalized language gains along with increases in social skills during EAT.

The purpose of this study is to examine the effects of EAA implemented at Equestrian Bridges on children diagnosed with a developmental disability, specifically in the areas of social skills and expressive language. The first aim of the study is to investigate whether children participating in Equestrian Bridges make gains in social skills over the course of 6 weeks using a pretest/posttest AB design. Social skills will be measured using two social skills questionnaires known to be valid and sensitive to changes over time, the Social Skills Improvement Scale (SSIS) and the Behavior Rating Inventory of Executive Function (BRIEF). The second aim of the proposal is to measure gains in expressive language from a pretest language sample and a posttest language sample. The expected outcome is that the participants will demonstrate significant improvements in both social skills and expressive language from pretest to posttest.

#### Methods

#### Participants

Four children from the Northwest Arkansas area originally participated in this study; all were English-speaking. Data from two of the participants were not included due to their absence at two or more of the six EAA sessions. Participant 1 was a seven-year-old male diagnosed with ADHD and Disinhibited Social Engagement Disorder (DSED). Participant 2 was a nine-year-old female diagnosed with developmental delays and learning disability. Neither child had previously participated in the program at Equestrian Bridges. Guardians of both participants were required to give written informed consent as approved by the University of Arkansas Institutional Review Board.

#### Measures

The Social Skills Improvement System (SSIS) is a questionnaire consisting of two parts: Social Skills and Problem Behaviors. Subscales are included within both parts; under social skills are communication, cooperation, assertion, responsibility, empathy, engagement, and selfcontrol. Subscales of problem behaviors include externalizing, bullying, hyperactivity/inattention, internalizing, and autism spectrum. The parent form consists of 79 statements regarding the child's behavior, including statements such as "Asks for help from adults" and "Acts lonely." Statements can be rated as not true (N), a little true (L), a lot true (A), or very true (V). Raters also determine the importance of each statement by circling N for not important, I for important, or C for critical. The Behavior Rating Inventory of Executive Function (BRIEF) is a questionnaire made up of statements that describe behaviors of children; it is meant to provide an understanding of a child's self-control and problem-solving skills by measuring aspects of executive function. Skills that are specifically measured include the child's ability to select appropriate goals for a task, plan and organize an approach to problem solving, initiate a plan, inhibit distractions, hold a goal and plan in mind, be flexible in trying a new approach when necessary, and check to see that the goal is achieved. The parent form contains 86 statements; examples include "Needs to be told to begin a task even when willing" and "Cannot find clothes, glasses, shoes, toys, books, pencils, etc." Raters determine whether each statement has been a problem for the child and circles N for never, S for sometimes, and O for often.

A conversational language sample was used to measure each participant's expressive language. Each language sample consisted of student-selected speech and story generation and was elicited by the same examiner every time. The story generation was elicited from a picture book created by the principal researcher. This book includes pictures that depict scenes from a typical Equestrian Bridges social skills session. The Systematic Analysis of Language Transcripts (SALT) was used to examine the participants' utterances (Miller & Iglesias, 2012).

#### Procedure

Prior to intervention, guardians of the participants completed the SSIS and BRIEF questionnaires. Language samples from both participants were elicited in a quiet, isolated room where each child participated in natural conversation as well as story generation in order to

generate an acceptable number of utterances for analysis. All language samples were audiovisually recorded.

Participants then took part in one hour sessions of EAA once a week for six weeks at Equestrian Bridges. During the first five to ten minutes of each session, the children and volunteers engaged in "tribe time," a time when the director read through the rules and taught the children the word of the week, typically a social characteristic or skill such as "friendship" or "personal space." Participants, who were each matched with a miniature pony, then greeted and brushed their ponies. Next, the children and volunteers played group games, such as "red light green light," during which participants directed their ponies to walk by saying "Walk on," and stop by saying "Woah." The final five minutes of each session were spent in "tribe time," during which the rules and word of the week were reviewed. Weeks 4 through 6 were slightly different because the children took turns riding a quarter horse instead of leading their ponies, but the activities remained the same as during weeks 1 through 3. When a child was not riding the quarter horse, he was leading his miniature pony. For details on the activities completed during each session, see the appendix.

Immediately following the sixth session, guardians again completed the SSIS and BRIEF questionnaires. A second language sample from each participant was elicited, using the same procedures.

#### Analysis

Data gathered from both questionnaires was scored and visually inspected for differences from pretest to posttest. The SSIS questionnaire responses yielded raw scores for each participant, pre- and posttest, that were then converted to standard scores with a mean of 100 and standard deviation of 15. Raw scores from the BRIEF questionnaire were also converted to standard *T* scores with a mean of 50 and standard deviation of 10. The conversational language transcripts were analyzed for differences, specifically in measures such as mean length of utterance, number of different words, total number of words, number of mazes, and number of omitted words.

#### Results

#### Social Skills Improvement System (SSIS)

Standard scores (M=100; SD=15) were calculated for both participants, both pretest and posttest, in both social skills and problem behaviors. A social skills score below the mean indicates the participant is performing below average in social skills as compared to national norms for his or her age. A problem behaviors score above the mean indicates the participant is exhibiting a higher average of problem behaviors as compared to national norms for his or her age.

Pretest measures for Participant 1 revealed overall standard scores of 81 in social skills and 137 in problem behaviors. These scores along with the standard deviation ranges within which they fall are depicted in Figure 1. Further analysis of the subscales revealed Participant 1 was performing below average in areas of communication, cooperation, responsibility, and selfcontrol; he was exhibiting above average behavior levels in externalizing, hyperactivity/inattention, internalizing, and autism spectrum. Posttest measures yielded a standard score of 83 in social skills and 123 in problem behaviors. These scores along with the

standard deviation ranges within which they fall are depicted in Figure 2. Subscale behavior

levels remained the same.

		Social Skills	Problem Behaviors	**Academic Competence	]
		+	_	-	160 +4SD
	Well-above	±	± 1	±	145 +3SD
	Average	$\pm$	<u> </u>		
-	Altaria				130 +2SD
	Above Average	+	-	L	
- F	-				115 +1SD
	Avorago	—		-	
	Average	+			100 mean
L		+		+	85_150
	Below	+	-	+	00-100
-	Average	T			70 -2SD
		±		±	
	Average	+		+	55 -3SD
		$\mp$	<b>—</b>	$\mp$	40_450
					1 40 -400
Standard S	Score	81	137		
Confidence	e Interval	75 - 87	130 - 144		
Percentile	Rank	10	97		
Raw Score		76	47		

Figure 1: Participant 1 Pretest Results

	Social Skills	Problem Behaviors	**Academic Competence	]
	_			160 +4SD
Well-abc	ve	_	-	145 +3SD
		_		
Above				130 +2SD
Averag		<b>Ⅰ</b>	—	
				115 +1SD
Averag				100 mean
Delevi				85 -1SD
Averag	• 1	<b>—</b>	-	
				70 -2SD
Well-belo	w	_	<u> </u>	55-3SD
Averag		-	-	00-000
				40 -4SD
Standard Score	83	123		
Confidence Interva	l 77 - 89	116 - 130		
Percentile Rank	12	91		
Raw Score	78	35		

Figure 2: Participant 1 Posttest Results

Participant 2 earned a pretest standard score of 78 in social skills and 132 in problem behaviors. These scores along with the standard deviation ranges within which they fall are depicted in Figure 3. Subscale behavior levels showed Participant 2 to be performing below average in communication, responsibility, and engagement, and above average in externalizing, hyperactivity/inattention, and autism spectrum. Posttest analysis revealed standard scores of 68 in social skills and 130 in problem behaviors. These scores along with the standard deviation ranges within which they fall are depicted in Figure 4.

	Social Skills	Problem Behaviors	**Academic Competence	
	-	-		160 +4SD
Well-above Average	$\blacksquare$	$\pm$	$\pm$	145 +3SD
	$\square$	-	$\square$	120 . 250
Above	—			130 +25D
Average				-115 +1SD
Average	$\pm$			100 moon
, tronugo				100 mean
Below				85 -1SD
Average	-		+	70 280
				10-230
Average		<u>+</u>		55 -3SD
			_	40 -4SD
Standard Score	78	132		
Confidence Interval	72 - 84	125 - 139		
Percentile Rank	7	96		
Raw Score	72	43		

Figure 3: Participant 2 Pretest Results

		Social Skills	Problem Behaviors	**Academic Competence	
[					160 +4SD
	Average	±		±	145 +3SD
		-	<u>t</u>		120 +250
	Above Average	+	-	-	130 +230
ſ				-	-115 +1SD
	Average	+		+	100 mean
		T		<u> </u>	85 -1SD
	Below Average	+		+	70 250
			±		10-230
	Well-below Average	-	-		55 -3SD
		Ŧ		Ŧ	40 -4SD
Standard	Score	68	130		
Confidenc	e Interval	62 - 74	123 - 137		
Percentile	Rank	2	95		
Raw Score	e	60	41		

Figure 4: Participant 2 Posttest Results

#### Behavior Rating Inventory of Executive Function (BRIEF)

Analysis of the BRIEF yielded *T* scores (M=50; SD=10) for 8 scales meant to measure aspects of executive function: Inhibit, Shift, Emotional Control, Initiate, Working Memory, Plan/Organize, Organization of Materials, and Monitor. *T* scores were calculated for the scale reflecting overall executive functioning, called the Global Executive Composite (GEC), and two summary scales, the Metacognition Index (MI) and the Behavioral Rating Index (BRI). The MI included *T* scores from 5 scales: Initiate, Working Memory, Plan/Organize, Organization of Materials, and Monitor; the BRI included *T* scores from 3 scales: Inhibit, Shift, and Emotional Control. Higher *T* scores suggest higher levels of dysfunction.

Pre- and posttest *T* scores and percentile ranks are shown for both participants in Table 1 and Table 2. Figures 5 and 6 reflect these results in line graphs.

Index/Scale	<b>Pretest</b> <i>T</i> Score (Percentile)	<b>Posttest</b> <i>T</i> Score (Percentile)
Inhibit	<b>78 (≥ 99)</b>	80 (≥ 99)
Shift	67 (94)	67 (94)
Emotional Control	<b>78 (≥ 99)</b>	83 (≥ 99)
Behavioral Regulation Index (BRI)	79 (≥ 99)	82 (≥ 99)
Initiate	80 (≥ 99)	61 (89)
Working Memory	78 (98)	60 (86)
Plan/Organize	67 (93)	59 (84)
Organization of Materials	56 (76)	59 (83)
Monitor	76 (≥ 99)	70 (≥ 99)
Metacognition Index (MI)	74 (97)	63 (86)
Global Executive Composite (GEC)	78 (≥ 99)	72 (97)

Table 1: Participant 1 Results from the BRIEF Questionnaire

Index/Scale	<b>Pretest</b> <i>T</i> Score (Percentile)	<b>Posttest</b> <i>T</i> Score (Percentile)
Inhibit	82 (98)	67 (94)
Shift	80 (≥99)	65 (93)
Emotional Control	69 (93)	62 (88)
Behavioral Regulation Index (BRI)	80 (98)	67 (92)
Initiate	65 (91)	68 (95)
Working Memory	72 (97)	74 (98)
Plan/Organize	71 (96)	67 (94)
Organization of Materials	66 (94)	66 (94)
Monitor	72 (≥ 99)	64 (89)
Metacognition Index (MI)	72 (98)	70 (97)
Global Executive Composite (GEC)	76 (98)	70 (94)

Table 2: Participant 2 Results from the BRIEF Questionnaire



• = pretest; = = posttest Figure 5: Participant 1 Results from the BRIEF Questionnaire



Figure 6: Participant 2 Results from the BRIEF Questionnaire

#### Conversational Language Sample

Each language sample was transcribed and analyzed using SALT. The items specifically examined were total number of utterances, mean length of utterance (MLU) in words, MLU in morphemes, number of different words, number of total words, type-token ratio, number of mazes, and number of omitted words.

To control for length of the language samples, the first 80 utterances of each sample for Participant 1 were analyzed, and the first 83 utterances of each sample for Participant 2 were analyzed. Pre- and posttest results for both participants are displayed below in Tables 3 and 4.

Analysis Measures	Pretest	Posttest
Total Number of Utterances	80	80
MLU in Words	5.04	4.57*
MLU in Morphemes	5.57	5.23
Number of Different Words	130*	119**
Number of Total Words	383	352*
Type Token Ratio	.34*	.34*
Number of Mazes	25	29
Number of Omitted Words	3	4*

\* 1 standard deviation from database mean

\*\* 2 standard deviations from database mean

 Table 3: Participant 1 Language Sample Analysis Controlled for Length

Analysis Measures	Pretest	Posttest
Total Number of Utterances	84*	83
MLU in Words	3.57*	3.62*
MLU in Morphemes	4.42*	4.25*
Number of Different Words	117*	115*
Number of Total Words	296*	286*
Type Token Ratio	.4	.4
Number of Mazes	31	24
Number of Omitted Words	2	2

\* 1 standard deviation from database mean

\*\* 2 standard deviations from database mean

Table 4: Participant 2 Language Sample Analysis Controlled for Length

Prior to controlling for length, Participant 1 produced more utterances during his second language sample than his first. Contrastingly, Participant 2 produced fewer utterances during her second language sample than her first but still demonstrated some improvement. Tables 5 and 6 display the pre- and posttest results for the full language samples of both participants.

Analysis Measures	Pretest	Posttest
Total Number of Utterances	80	125
MLU in Words	5.04	4.40
MLU in Morphemes	5.57	5.01
Number of Different Words	130	148
Number of Total Words	383	537
Type Token Ratio	.34	.28
Number of Mazes	25	37
Number of Omitted Words	3	4

Table 5: Participant 1 Full Language Sample Analysis

Analysis Measures	Pretest	Posttest
Total Number of Utterances	169	115
MLU in Words	3.29	3.83
MLU in Morphemes	3.90	4.43
Number of Different Words	186	146
Number of Total Words	536	425
Type Token Ratio	.35	.34
Number of Mazes	60	36
Number of Omitted Words	4	3

Table 6: Participant 2 Full Language Sample Analysis

#### Discussion

The current study was meant to examine the effects of EAA on children with autism or developmental disability. The specific aims were 1) to measure any gains in social skills from pretest to posttest and 2) to investigate possible gains in expressive language. Though results were fairly obscure, some progress was made from the initial baseline measures, suggesting EAA can have positive implications for children with disabilities.

Results from the SSIS indicate that both participants were exhibiting fewer problem behaviors following EAA. This change in Participant 1 caused his score to move within 2 standard deviations of the mean rather than over 2 standard deviations. Participant 1 also progressed in social skills as measured by the SSIS; though this progression was minimal, it brought Participant 1 much closer to being within 1 standard deviation of the mean.

The BRIEF results proved interesting. Participant 1 improved in multiple index areas, including Initiating, Working Memory, Planning/Organizing, and Monitoring. The decrease in his

overall Global Executive Composite score indicates he was experiencing fewer issues in executive functioning following EAA, and his Metacognition Index decreased enough from pretest to posttest to be within normal limits. Participant 2 decreased in her overall Global Executive Composite score enough to fall within 2 standard deviations of the mean rather than above; the same occurred for her Behavioral Rating Index score. Her Metacognition Index score did drop from pretest to posttest, but not by much. Improvements were made by Participant 2 in the specific index areas of Inhibition, Shifting, Emotional Control, Planning/Organizing, and Monitoring. The improvements made by both participants could have multiple explanations. Each child engaging in EAA at Equestrian Bridges led a miniature horse for the majority of the time each session. While this gives the child a sense of control, it is different from walking a dog because the horse is larger and stronger. Often this factor causes children to approach the horse with caution and even respect; for this reason, a child may inhibit certain impulses that he or she would normally allow. Initiating and monitoring may be affected because the horses wait for the appropriate command from the child and respond when it is given. The child must learn to say "walk on" when he or she desires to walk with the horse; if the command is not used to initiate movement, the horse will not walk. Such a tangible response can demonstrate to the child his or her ability to make an impact by communicating and initiating. During many EAA activities, the horse/child team must work with the other groups to stay together in formation and timing. These types of activities force a child to monitor not only his or her own actions, but the horse's as well. If the horse is not moving when it should be, the child must become aware of this (monitoring) and remember how to initiate the appropriate movement.

Analysis of the conversational language samples along with the examiner's observations indicated that the participants were able to engage in conversation for longer periods of time following the sessions as compared to before. In addition to this, both participants exhibited increased confident in discussing the picture book depicting an Equestrian Bridges session. When controlled for length, Participant 1 actually demonstrated a slight decrease in measures such as number of total words, number of different words, and MLU, although his type-token ratio remained exactly the same from pre- to posttest. Participant 2 showed minor improvement in that she had a slightly larger MLU in words and fewer mazes during the second controlled language sample than during the first. Like Participant 1, Participant 2 had a constant type-token ratio. Examination of the full language samples showed that Participant 1 increased from pre- to posttest in total number of utterances, total number of words, and number of different words. Participant 2 made improvements in MLU in words and MLU in morphemes; she also had a large decrease in the number of mazes produced throughout the conversation.

In addition to the quantitative measures, qualitative data was collected via parent response. Parents of both participants were given the option to comment on whether they had seen a change in their child since being involved at Equestrian Bridges. Both participants' parents chose to respond. The mother of Participant 1 stated she had "noticed a significant change" in her son. Further comments included "He talks about it [Equestrian Bridges] in detail and looks forward to it. I do think he retained information on boundaries, patience, taking turns, etc. I also see him transferring those things into daily activities. His teachers have noticed improvements as well. He's very happy with this therapy." The mother of Participant 2 reported

noticing that her daughter was "calmer and more alert of her surroundings; more respectful and not so disruptive." She also stated that "her tantrums and outbursts have occurred less frequently than normal." These comments suggest that in addition to the benefits of EAA observed during and immediately following therapy sessions, progress is generalizing to a variety of environments – even to the extent that one participant's teachers noticed improvement.

#### **Limitations and Future Directions**

While the current study sought to provide quantitative data on effects of EAA, there were several limitations that future studies should address. First, the study was originally intended to assess effects of EAA on children with autism. Only one of the four original participants was diagnosed on the spectrum, and her data had to be excluded due to absence at two or more sessions. Interpretation of the results was also made difficult due to the small sample size and lack of control group. Additionally, EAA sessions only occurred once a week for six weeks, a shorter amount of time than is usual for EAAT programs. While this shorter duration may have lessened the potential effects of maturation, it could have limited the amount of possible progression over a longer time period. As is encountered with many questionnaires, the SSIS and BRIEF measures may have been limited by the appropriateness of certain items. Participants' parents commented multiple times on certain items in each questionnaire that did not apply to their child's specific circumstance. This study was further limited because the program director for Equestrian Bridges had to leave unexpectedly after the fourth week of sessions. The final two weeks were led by a different instructor. Although

this second director had previous experience with social skills sessions, the change in leadership may have affected certain aspects of the last two sessions. Finally, both participants had different diagnoses, and neither was controlled for medications or simultaneous intervention. The ultimate question that remains – following this study and various others – is whether EAA is the reason for the changes observed in the participants.

Subsequent studies should include a larger sample size and implement a control group. In addition, it would be beneficial to include participants who have similar or matching diagnoses and, if possible, are not participating in any concurrent interventions. More sessions over a longer period of time could provide more evidence of progression, although control for maturation would need to be in place.

#### Conclusions

Though research in animal therapy is not uncommon, studies of equine therapy, especially regarding its relationship with social skills and communication, are scarce and inadequate and warrants further investigation. Despite its limitations, the current study showed positive implications for social skills outcomes in children with developmental disabilities participating in EAA. In particular, the results indicated positive effects for improving social skills, decreasing problem behaviors, and improving executive function in areas such as inhibition, metacognition, and monitoring.

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# Appendix

# Weekly Session Activities

Week 1

Week 1	
15 minutes	Volunteers high-five children as they walk to the learning station
	Tribe Time in the learning station
	Word of the Week: Friendship
	Read the tribe skills (safety rules)
	Children and volunteers filled out "friend files" to get to know each other (profile to fill out with facts about self)
	Worked together to choose a team name
10 minutes	Meet the miniature horses in the arena
	Work together to pair up children and horses
	Children and volunteers untie their mini; bring them to the line-up cone
25 minutes	Weekly Activity: "Obstacle Course"
	Child/volunteer/mini groups take turns leading everyone through the obstacle course while playing "red-light green-light"
	Tie minis back in their spots
5 minutes	Tribe Time in the learning station
	Review word of the week and tribe skills

10 minutes	Volunteers high-five children as they walk to the learning station
	Tribe Time in the learning station
	Word of the Week: Communication (verbal and nonverbal)

	Read the tribe skills (safety rules)
15 minutes	Greet minis in the arena with the horseman's handshake
	Groom minis with brushes, paying special attention to their ears and stance – signs of nonverbal communication
	Friendly feather game (long feather, rub down mini's back and in friendly zone) paying special attention to nonverbal communication
	Untie, lead to line-up cone
25 minutes	Weekly Activity: "Simon Says"
	Lead minis to the red barrel at the front of the arena
	Choose a child/volunteer/mini group to be "Simon"
	Simon faces the other three groups and gives two commands: one verbal, one nonverbal (in whatever order)
	The group performs the command and must say whether it was verbal or nonverbal communication
	Simon chooses a new Simon, and the groups lead their minis to the barrel at the other end of the arena
	Process repeats until every child has been Simon
	Tie minis back in their spots
10 minutes	Tribe Time in the learning station
	Review word of the week and tribe skills

10 minutes	Volunteers high-five children as they walk to the learning station
	Tribe Time in the learning station
	Word of the Week: <i>Boundaries</i>

	Read the tribe skills (safety rules)
10 minutes	Volunteers high-five children as they walk to the learning station
	Tribe Time in the learning station
	Word of the Week: Boundaries
	Read the tribe skills (safety rules)
25 minutes	Weekly Activity: "Musical Hoops"
	Similar to musical chairs, but with hula hoops placed in the dirt in a circle around the arena
	As the music plays, the groups circle the hoops; when the music stops, the groups try to get to the nearest hoop; the group left out must go back and tie up their mini
	If two groups reach a hoop at the same time, verbal communication is used to determine who got there first
	When the groups are in the hoops, director gives instructions on what to put in the boundary (the hoop); for example, "put two of the mini's feet in the boundary"
	Tie minis back in their spots
15 minutes	Tribe Time in the learning station
	Review boundaries and discuss instances when it is okay and when it is inappropriate to violate another person's boundaries

15 minutes	Volunteers high-five children as they walk to the learning station
	Tribe Time in the learning station
	Word of the Week: Acceptance
	"String web" – pass the end of the yarn to another person and name a

	difference between you and that person but remind everyone you two are still friends ("this is my friend and I accept him/her even though he/she and I")
	Read the tribe skills (safety rules)
15 minutes	Greet minis in the arena with the horseman's handshake
	Groom minis with brushes
	Untie minis and lead them to line-up cone
	Use teamwork to choose which child will ride the big horse first
	Rider puts on helmet and mounts big horse while the other groups line up
25 minutes	Weekly Activity: "Acceptance Walk"
	Rider and other groups line up in a horizontal line, everyone holding the "acceptance string" (long piece of string)
	Rider determines when to go and when to stop; group must work together to keep the acceptance string in a straight line without letting anyone fall behind or get ahead
	The whole group walks down the arena, turns around, and comes back
	Rider dismounts, chooses the next rider, and goes to get his/her mini
	New rider mounts; process repeats until all children have had a turn
	Tie minis back in their spots
5 minutes	Tribe Time in the learning station
	Review word of the week and tribe skills

10 minutes	Volunteers high-five children as they walk to the learning station
	Tribe Time in the learning station

	Word of the Week: Teamwork
	Read the tribe skills (safety rules)
15 minutes	Greet minis in the arena with the horseman's handshake
	Groom minis with brushes
	Untie minis and lead them to line-up cone
	Use teamwork to choose which child will ride the big horse first
	Rider puts on helmet and mounts big horse while the other groups line up
25 minutes	Weekly Activity: "Obstacle Course" and "Show Practice"
	Rider leads the group through the obstacles in the arena in whatever route he/she chooses
	When he/she arrives back at the front of the arena, he/she picks one of the words learned over the past 5 weeks and recites the definition (practicing for the show that will happen the following week)
	Rider dismounts, chooses the next rider, and goes to get his/her mini
	New rider mounts; process repeats until all children have had a turn
	Tie minis back in their spots
	Meet in the front of the arena to review the show for next week
10 minutes	Tribe Time in the learning station
	Review word of the week and tribe skills

10 minutes	Volunteers high-five children as they walk to the learning station
	Tribe Time in the learning station
	Review all words learned in the past weeks

	Read the tribe skills (safety rules)
	Choose a paint color and sponge shape
15 minutes	Greet minis in the arena with the horseman's handshake
	Paint each mini with chosen sponge and paint color
	Tie a ribbon in the mane of each mini and the big horse
	Untie minis and lead them to line-up cone
	Use teamwork to choose which child will ride the big horse first
	Rider puts on helmet and mounts big horse while the other groups line up
	Parents/audience are called into the arena for the show
25 minutes	Weekly Activity: "Horse Show"
	Rider leads the groups through the obstacle course using his/her own chosen route
	Rider stops at the front of the arena and says the word and definition practiced the previous week to the audience
	Rider dismounts, chooses the next rider, and goes to get his/her mini
	New rider mounts; process repeats until all children have had a turn
10 minutes	All children/volunteer/mini groups line up in front of the audience
	Children are presented with trophies
	Parents/family can take pictures
	Tie minis back in their spots