Experimental Trial Demonstrates Positive Effects of Equine Facilitated Learning on Child Social Competence

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Although equine facilitated programs have gained in popularity over the last decade, virtually nothing is known about the causal effects of equine facilitated interventions on human development and wellbeing. To address this gap in the literature, researchers conducted a randomized controlled trial to determine if an 11-week equine facilitated learning program enhanced 5th-8th grade children's social competence. Children were recruited for program participation through referral by school counselors and recruitment in schools and community agencies. Researchers then randomly assigned 64 physically and mentally able children to an experimental group or waitlisted control group. Children in the experimental group participated in an 11-week equine facilitated learning program designed to increase social competence through a series of once-weekly, 90-minute sessions of individual, team, and group-focused equine facilitated activities, whereas children in the control group did not until 16 weeks later. Parents of children in both groups provided ratings of child social competence at the beginning and again at the end of the 11-week program. Results indicated significant group differences in mean levels of child social competence at posttest (p = .020), suggesting a moderate positive effect of program participation (d = .61). Waitlisted children in the control group who completed the program at a later date demonstrated significantly higher posttest levels of social competence after program completion (p = .000), compared to their own pretest scores. Using a lagged dependent variable approach, program effects were robust (p = .026) when simultaneously considering children's pretest levels of social competence, age, gender, and referral status.

Keywords: child development, equine facilitated intervention, experimental trial, HAI, social competence

Although there is growing evidence that promotion of behavioral and social-emotional competence in children and youth is an effective strategy to prevent mental, emotional, and behavioral disorders in adulthood (O'Connell, Boat & Warner, 2009), identifying and expanding evidence-based prevention programs that promote these competencies in children and youth constitutes a significant challenge (Greenberg, Domitrovich & Bumbarger, 2000; Huang et al., 2005). One type of approach that has caught the attention of researchers and mental health professionals is equine facilitated learning, which combines the experience of equine human interaction with counseling-based processing skills to increase participants' awareness and control of their emotions, cognitions, and behaviors. Although equine facilitated programs have gained popularity over the last decade, virtually nothing is known about their causal effects on human development. To help alleviate this gap in the literature, researchers conducted a randomized controlled trial to determine the effects of an 11-week equine facilitated learning program on the social competence of 5th-8th grade children.

Although research on the broader field of equine assisted interventions is in its infancy, a small body of pioneering work has shown promising results. Findings suggest significant associations between involvement in equine assisted intervention and adjustment in various socio-emotional, cognitive, and behavioral domains, including depression (Bowers & MacDonald, 2001), positive behavior (Chandler, 2005), behavioral and mood disorders (Mann & Williams, 2002), self-esteem (Brown & Alexander, 1991; Gatty, 2001; Katcher & Wilkins, 1994), feelings of social acceptance and peer popularity (MacDonald & Cappo, 2003), interpersonal communication (MacDonald, 2004), sensitivity towards others (Vidrine, Owen-Smith & Faulkner, 2002), anger (Kaiser, Spence, Lavergne & Vanden Bosch,

2004), speech and language ability (Macauley & Gutierrez, 2004), as well as more global measures of functioning and adjustment (Schultz, Remick-Barlow & Robbins, 2007). Also, compared to more traditional classroom-based counseling activities, equine assisted interventions were more strongly associated with lower levels of internalizing and externalizing behavioral problem (Trotter, Chandler, Goodwin-Bond, & Casey, 2008). Other researchers, in a study on therapeutic riding targeting boys with emotional disturbances in a residential treatment program, found no improvement was seen in depression or anxiety (Greenwald, 2001). While current evidence regarding the efficacy of equine assisted approaches is promising indeed, more causal evidence is needed to demonstrate the effects of equine facilities programs.

Causal Pathways

Although there is not one specific human animal interaction theory that postulates how equine facilitated learning programs may affect child development, Bandura's social cognitive theory (1986) provides a nice framework (Kruger & Serpell, 2010; Serpell, 2000). According to this perspective, children learn by observing others, with the environment, behavior, and cognition all as important factors in influencing development. These three factors are not static or independent; rather, they are all reciprocal. For example, each behavior witnessed can change a person's way of thinking (cognition). Similarly, the environment one is raised in may influence later behavior.

This theory has implications for equine facilitated learning because equines possess several intrinsic and physical attributes that strongly influence the cognitions and environments of those interacting with them (McGreevy & McLean, 2010). For example, horses and mules are prey animals, characterized by a highly attuned awareness of their physical

surroundings and a strong, instinctual inclination for a fight-or-flight response. This characteristic necessitates that program participants become more self-aware of their behavior, thoughts, emotional intent, and verbal and non-verbal communication to ensure their personal safety, and to enhance their ability to communicate with the equine. By interacting with equines in the context of horsemanship activities, children learn to provide and recognize non-verbal communication cues to their equine partner (e.g., pressure, release, posture, intent, physiological arousal), which may provide frequent opportunity to reflect on the meaning of their own behavior and intent. Since equines provide immediate, meaningful feedback - pinning ears, swishing tail, licking lips, blinking - children simultaneously gain experience in observing and interpreting non-verbal cues. As children – with the help from program facilitators - attempt to manage and direct their own behavior to evoke desirable responses from the horse (e.g., licking lips, blinking, resting foot), rather than less desirable responses (e.g., swishing tail, pinning ears, tuning out), reciprocal interactions between the child's behavior and cognitions take on an important role. Using human equine interactions as an analogy, program facilitators encourage children to reflect on their behavior, thoughts, feelings and communication skills and apply these to communication and collaboration with a *human* partner. Practicing of pro-social behaviors, reflecting on thoughts and feelings, and feedback – from the equine and facilitator - may thus improve self and social awareness, personal responsibility, goal-directed behavior, and communication skills.

Social role-activity theory (Brickel, 1982) also provides a useful perspective to explain effects of horse-human interactions on child development. Role theory proposes that when an individual assumes a new positive role (e.g. team leader), positive behavioral change may result (Lemon, Bengston & Peterson, 1972).

This relates nicely to equine facilitated activities, as participants are encouraged to take on a leadership role to facilitate positive interactions with equines, which rely heavily on the equine's instinctual expectations about the natural hierarchy of herd dynamics, leading them to oscillate between seeking and/ or assuming leadership, or accepting it from others (Budiansky, 1997).

During in-hand horsemanship activities, children are encouraged to engage in behaviors that assert leadership to the equine by moving the horse's body in a purposeful way through the use of progressive shaping techniques, or "…gradually increasing a behavior/pressure to elicit a specific behavior from the equine" (McGreevy & McLean, 2007, p. 114), and negative reinforcement to reward compliant responses from the horse. During these interactions children are frequently reminded by program facilitators who self-management, fostering a give-and-take relationship, quick decision making, and optimistic thinking are important skills that facilitate successful communication and thus completion of each task. Through these interactions with the horse, children thus learn to provide and interpret clear, non-verbal cues. In sum, equine characteristics may have a significant influence on the nature of interactions between participants and horses in ways that promote children's social and behavioral competencies through the practice of pro-social behavior, as well as reflection on participants' cognitions, behaviors, emotion and intent.

Description of Current Study and Hypotheses

The overall objective of the current study was to conduct a randomized controlled trial to determine the efficacy of an 11 week, equine facilitated learning program in improving the social competence of 5th-8th grade children. Social competence is the ability of the child to successfully interact with other children and

adults in a way that demonstrates an awareness of and ability to manage emotions in an age- and contextually appropriate manner. Social competence is comprised of social, emotional, and cognitive skills and behaviors that enhance social adaptation such as social awareness, self-awareness, goal-directed behavior, relationship skills, personal responsibility, and control of behavior. The main research question was: Does participation in an 11-week equine facilitated learning program increase children's social competence and/or components thereof?

The following hypotheses guided our analyses. The first hypothesis stated that children randomly assigned to participate in an 11-week equine facilitated learning program would have higher levels of social competence at posttest, compared to children assigned to a waitlisted condition. The second hypothesis stated that children in the waitlisted group would demonstrate significant within-person gains in social competence after program participation (i.e., *after* the experimental group completed the program). The third hypothesis stated that the positive effects of program participation on posttest levels of child social competence would be independent of children's pretest levels of social competence, gender, age, and referral status.

Social competence was the main outcome of interest to program designers and researchers, because it is considered a central domain of child development that plays a critical role in later academic achievement, mental health, and overall wellbeing (Shonkoff & Phillips, 2000). Lower social competence is positively associated with the development of anti-social behavior (Sørlie, Hagen, & Ogden, 2008), conduct problems and depression (Rockhill, Vander Stoep, McCauley, & Katon, 2009), substance use (Griffin, Epstein, Botvin, & Spoth, 2001) and lower academic competence and performance (Wentzel, 1991; Sørlie & Nordhal, 1998). Children with lower social

competence are also more likely to experience difficulty regulating negative emotion and arousal, which can interfere with initiating and maintaining positive peer interactions, leading to peer rejection (Dodge & Somberg, 1987). Relationship problems with peers and adults, difficulty with emotion regulation, attention, behavior, and challenges with learning and achievement contribute to the development of mental health issues and poor child wellbeing. As such, enhancing child social competencies that support the development of self-regulation, academic skills, and peer social skills is considered a suitable target for preventive intervention programs (Greenberg, Domitrovich, & Bumbarger, 2000).

Method

The Program

The program under study was PATH to Success[1] conducted at a Premier Accredited Center of the Professional Association of Therapeutic Horsemanship, International[2] (PATH, Intl.) in a university setting. The stated goal of the program under study is to enhance child social competence through an 11-week session of once-weekly, 90-minute lessons of individual, team, and group-focused equine facilitated activities. The program was designed, implemented, and consistently supervised by a PATH, Intl. certified instructor in equine assisted mental health, and a doctoral level therapist. The curriculum contained standardized lessons with weekly goals and step-by-step instructions and procedures for each activity, which were piloted for 3 years before this study on its effects was conducted. The program was implemented by a team of volunteer horse

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[1] PATH to Success was designed by Sue Jacobson, coordinator of People-Pet Partnership at the College of Veterinary Medicine and Dr. Phyllis Erdman, Associate Dean of the College of Education, both at Washington State University.
[2] The professional association was known as the North American Riding for the Handicapped Association (NARHA) until its renaming in the Spring of 2011.

specialists and facilitators, that included PATH certified instructors, undergraduate students in child-development, education, and animal science, professional counseling psychologists, and graduate-level counseling students. Program staff received extensive training through printed lessons, a handbook, hands-on program training with horses and child actors, as well as training in theoretical rationale of the program, principles of cognitive behavioral counseling, and child development through video and slide presentations. Weekly activities - based on principles of equitation science and natural horsemanship (McGreevy, 2007; McGreevy & McLean, 2007; 2010) - featured a combination of mounted and un-mounted activities and horse-human interactions, including observation of equine behavior, engagement in equine management (e.g., grooming), in-hand horsemanship activities, some riding, and personal and group reflection activities. A description of weekly program objectives and a selection of sample activities are described in Table 1.

Table 1
Outline of Lesson Objectives by Week

Week	Lesson Objective	Sample Activity
1	Basic safety: Meet horses and staff	Observing horse behavior and herd dynamics
2	Respect: Self, others and horses	Moving horses using 4 phases of direct or indirect pressure[3]
3	Communication: Verbal and non-verbal	Leading horses, interpreting horse body language
4	Leadership: Assertive and aggressive cues	Driving[4] activity using body language and phases
5	Trust: Coping with perceptions of stress	Riding and leading
6	Boundaries	Driving activity using indirect pressure
7	Overcoming challenges and building confidence	Desensitizing[5] horses
8	Enhancing self-regulation and relaxation	Horse massage[6], riding
9	Prepare for parents/visitors day	Incorporating horsemanship skills for team challenge
10	Parents/visitors day	Participants 'teach' parents horsemanship skills
11	Program wrap up	Obstacle course, riding and reflection

[3] Pressure refers to a directly physical or implied signal to the horse with fingers/hand, or leg until the desired behavior or the equine is fulfilled (e.g., moving away from the pressure).

[4] Driving refers to signaling the horse to move forward by pointing toward the desired space, and applying pressure behind the equine's shoulder to 'drive' them forward of the equestrian.

[5] Desensitizing refers to exercises to condition the equine to ignore a stimulus or object, thus avoiding 'spooking.'

[6] Horse Massage refers to an exercise taught to participants in which they stroke the horse with slow, rhythmic strokes down the equines' body to 'relax' the equine before riding.

Children in the experimental group were assigned to the same facilitation team for the entire 11-week session that included one equine, two child participants, an equine specialist, and facilitator. Each day, a total of eight child participants - divided across four equine teams headed by four experienced equines – participated. The program was conducted four times a week, serving 32 children each week per 11-week session. The weekly lessons were conducted in the afternoons on weekdays and included transportation of participants from school to the program site and back immediately following their regular school day. Children who were waitlisted participated after children in the experimental group completed the program.

Procedures

The study was approved by the University Committee on Research Involving Human Subjects at Washington State University. Equine welfare of horses in the program was carefully monitored under the university's Institutional Animal Care and Use Committee (IACUC) regulations and campus veterinarian. In addition, equines were evaluated daily by a PATH, Intl. certified instructor for physical, mental, and emotional well-being before, during and after each session. Although equine participation in the program never elicited such behavior, program policy required that equines would be immediately released from program participation if they were to display stress behavior to ensure their wellbeing. In addition, any inappropriate or potentially harmful behavior of humans interacting with equines required immediate intervention to prevent undue distress by the equine.

Program participants were recruited by program staff through referral by school counselors[7], distribution of flyers and advertisements, and information meetings in schools and the community. Criteria for program participation were that 1) parents and children had to be able to communicate effectively in English, 2) the child did not have a serious physical or mental disability and 3) the child had to attend the 5th through – 8th grade. Recruitment for the study occurred at the informational meetings, during which parents and children received information from the research team about the study, its screening, assessment, and assignment procedures as well as information about the process of consent and assent[8]. Interested parents were asked to complete a standardized measure of child social competence for screening and sample selection purposes, for which they were paid five dollars (see measures section for description of social competence measure). Children in each grade were subsequently rank-ordered by their social competence score with the aim of recruiting approximately equal numbers of boys and girls per grade, as well as selecting children with relatively lower social competence scores. Participation in the study was voluntary and children could attend the program without enrolling in the study.

Selected study participants were randomly assigned to a treatment group or wait-listed control group. Children assigned to the experimental group started program participation 2 weeks later, whereas children assigned to the waitlisted control group were

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[7] Children referred by school counselors were children who were receiving school counseling services for academic and/or behavioral adjustment issues, or those whose parents had consulted with school counseling staff about the presence of stress in the home.

[8] Using a slide presentation, parents were given information about the consent and assent process, along with hard copies of both forms, and a typed script of the assent procedures, which described study procedures and children's rights using developmentally appropriate language (i.e., children 11 and younger, children 12 and older). The Principal Investigator (PI) assented all child participants in person.

offered program participation in the following session – 16 weeks later. Parents of both groups provided ratings of child social competence again at the posttest (i.e., at the end of the 11-week program). Parents of waitlisted children were asked to report on their child's social competence a third time, after their child completed their 11-week session.

Sample Recruitment, Screening and Assignment

In the first year of this two-year study, program staff recruited a total of 78 interested children and their families from 10 different schools in a rural university town in the Pacific Northwest area of the United States. Sixty-four children were selected (N $_{boys}$ = 37; N $_{girls}$ = 27; M $_{age}$ = 10.93 yrs) for study participation and random assignment to an experimental group (N = 33) or waitlisted control condition (N = 31). There were no significant differences between participants' age (*p* = .988), gender (*p* = .143), referral status (*p* = .300), grade level (*p* = .874), or pretest social competence (*p* =.599) by group status (e.g., between experimental or waitlisted). Sample characteristics are reported in Table 2.

Table 2
Sample Descriptive and T-Tests Comparing Group Differences

	Assigned (N = 64) M (SD)	Treated (N = 54) M (SD)
Social Competence		
Age	10.95 (1.06)	10.93 (1.08)
Male	26	25
Female	38	29
Referred	10	8
Grade		
5th	30	26
6th	21	18
7th	5	3
8th	8	7

Sample enrollment, selection, randomization, follow up and analyses counts are described in a flow diagram (Figure 1). A total of 54 participants completed data collection at pretest and posttest. Attrition in the experimental group was due to two active withdrawals immediately following assignment, one participant moving out of the area after 6 weeks of program participation, and one active withdrawal in week four due to allergy issues. Attrition in the control group occurred due to active withdrawal by three participants following random assignment, and three passive withdrawals as evidenced by failure to complete the posttest assessment. Of all children originally assigned to the waitlist control condition, a total of 20 eventually participated in the active program, which was conducted 4 weeks after children in the experimental group completed the program. There were no significant group differences (comparing waitlisted or experimental group) by age (*p* = .637), referral status (*p* = .581), grade level (*p* = .639), social competence (*p* = .548), or gender (*p* = .089) between participants who completed the study and those who withdrew.

Figure 1

Flow Diagram describing sample enrollment, selection, randomization, follow up and analyses

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                    │  Assessed for eligibility (N = 78)   │
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                    │        Randomized (N = 64)           │
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│ Allocated to Experimental        │   │ Allocated to Control Condition    │
│ Condition (N = 33)               │   │ (N = 31)                          │
│ • Received allocated             │   │ • Received allocated intervention │
│   intervention (N = 31)          │   │   (N=28)                          │
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│ Lost to follow-up                │   │ Lost to follow-up                 │
│ • Moved away from area (N = 1)   │   │ • Failure to complete post-test   │
│ • Allergy issues (N = 1)         │   │   assignment   (N=3)              │
└──────────────────────────────────┘   └──────────────────────────────────┘
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│ Analyzed                         │   │ Analyzed                          │
│ • Included based on original     │   │ • Included based on original data │
│   data (N = 29)                  │   │   (N = 25)                        │
│ • Included based on pooled data  │   │ • Included based on pooled data in│
│   in intent-to-treat analyses    │   │   intent-to-treat analyses (N=31) │
│   (N = 33)                       │   │                                   │
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Measures

As part of the screening and pre-test measurement process, parents were asked to complete the parent report form of the Devereux Student Strength Assessment (DESSA), a measure of child social competence (LeBuffe, Shapiro & Naglieri, 2009). The DESSA is a behavior rating scale that assesses the social-emotional competencies that serve as protective factors for children in kindergarten through eighth grade. In keeping with the prevention perspective of the program designers, an assessment tool was chosen that was strength-based and did not assess risk factors or maladaptive behaviors. The measure contains 72-items asking respondents to indicate how often various child behaviors occurred based on a 5 point Likert scale ranging from 0 (*never*), 1 (*rarely*), 2 (*occasionally*), 3 (*frequently*), to 4 (*very frequently*) over the past 4 weeks. The DESSA features a social competence composite score derived from 8 subscales. Examples of items and subscales include Optimistic Thinking ($\alpha = .87$; e.g., *How often did the child say good things about the future?*), Self-Management ($\alpha = .86$; e.g., *How often did the child focus on a task despite a problem or distraction?*), Goal-Directed Behavior ($\alpha = .89$; e.g., *How often did the child keep trying when unsuccessful?*), Self-Awareness ($\alpha = .82$; e.g., *How often did the child show an awareness of his/her personal strengths?*), Social-Awareness ($\alpha = .81$; e.g., *How often did the child respect another person's opinion?*), Personal Responsibility ($\alpha = .87$; e.g., *How often did the child prepare for school, activities, or upcoming events?*), Decision Making ($\alpha = .91$; e.g., *How often did the child accept responsibility for what she/he did?*), and Relationship Skills ($\alpha = .93$; e.g., *How often did the child greet a person in polite way?*). DESSA (LeBuffe, Shapiro & Naglieri, 2009) raw scores were converted to T-scores using the DESSA coding procedure.

T-scores were used as dependent variables to analyze group differences and estimate regression models. T-scores were also used to categorize children into 3 groups ranging from low to high (0-40 = *needs instruction,* 41-59 = *typical,* and 60-72 = *strength)* to enable interpretation of causal changes for intervention and prevention purposes. The DESSA has excellent internal reliability and shows significant, moderate-to-high correlations with widely used measures with good psychometric properties (LeBuffe, Shapiro & Naglieri, 2009), including the BERS–2 (Epstein, 2004) and the Behavior Assessment System for Children–2 (Reynolds & Kamphaus, 2004). Completion of the DESSA by parents occurred at the beginning ($\alpha_1 = .98$) and end ($\alpha_2 = .98$), of the first 11-week program, and parents of waitlisted children reported once more (posttest2) more at the end of the second 11-week program ($\alpha_3 = .98$).

Results

Descriptive analyses

Descriptive analyses on observed data revealed that overall pretest social competence levels of children in the study group were in the normal range (M = 41.41; SD = 10.16). The distribution in the sample suggests that the goal of recruiting children with relatively lower levels of social competence was met, as approximately half of the study sample was classified as needing instruction in social competence ($N_{needs\ instruction} = 30$, $N_{typical} = 31$, $N_{strengths} = 3$). A series of one-way ANOVAs revealed no statistically significant differences in pretest levels of child social competence between children in the control and experimental group composites scores ($M_{control} = 40.71$ (9.55), Min = 28, Max = 69; $M_{experimental} = 42.06$ (10.81), Min = 28, Max = 72) or any subscale scores (Table 3). Also, there was no evidence to suggest that the distribution of social competence classification groups (i.e., needing

instruction, typical or strength) was different $(p = .649)$ between the control ($N_{\text{needs instruction}} = 13$, $N_{\text{typical}} = 7$, $N_{\text{strengths}} = 1$) and experimental group control ($N_{\text{needs instruction}} = 17$, $N_{\text{typical}} = 14$, $N_{\text{strengths}} = 2$). There were significant differences in pretest child social competence by gender showing higher social competence scores for girls ($p = .010$; $M_{\text{boys}} = 37.63$ (9.03); $M_{\text{girls}} = 44.16$ (10.16)) and referral status ($p = .009$; $M_{\text{referred}} = 34.45$ (6.85); $M_{\text{unreferred}} = 43.08$ (10.14)), although boys and girls were equally likely to be referred ($p = .851$).

To determine whether participation in the program significantly affected child social competence we conducted a series of intent-to-treat analyses. This is a strategy for the analysis of randomized controlled trials that prevents overestimation of treatment effects by comparing participants in the groups to which they were originally randomly assigned, regardless of whether they subsequently withdrew or deviated from the protocol (Fisher et al., 1990). To accommodate this approach, missing data on posttest assessments on social competence (i.e., subscale and composite T-scores of child social competence measures at posttest) for 10 participants were thus imputed using five imputations according to multiple imputation procedures (Rubin, 1987; Rubin, 1996). Doing so retains the full sample for calculating intention-to-treat estimates and, under appropriate assumptions, should yield unbiased estimates of the intention to treat. The posttest results described in the next section thus reflect pooled estimates across five imputed datasets that were generated.

Hypothesis 1

To test the first hypothesis **-** participation in the program will improve child social competence - researchers conducted a one-way ANOVA comparing child T-scores on social competence measured at posttest between experimental and control group. The within-

subjects variable is the posttest, and the between-subjects variable constitutes the condition (control versus experimental group). Results support the first hypothesis (Table 3) by demonstrating a significant treatment effect of program participation as illustrated by significant group differences between experimental and control groups' social competence composite scores ($p = .020$). Based on calculations using pooled variances, this represents an effect size of $d = .61$, which is a moderate effect (Cohen, 1988). Researchers explored which aspects of social competence appeared most significantly improved by conducting a series of ANOVAs comparing T-scores on all subscales by treatment group. Using Tukey's method to correct for multiple comparisons, results revealed that self-awareness ($p = .000$) and self-management ($p = .001$) had most significantly - and positively - responded to the program participation (Table 3).

Hypothesis 2

Next, we tested the second hypothesis which stated that program participation by waitlisted control group children will increase their levels of social competence. Using t-tests, we compared social competence scores of waitlisted children obtained *after* they completed the 11-week session to their own pretest scores obtained during program screening. We found that waitlisted children in the control group who completed the program at a later date demonstrated significantly higher posttest levels of social competence ($M = 43.71$; $SD = 11.07$) after program completion compared to their own pretest scores ($p = .000$).

Hypothesis 3

Testing the third hypothesis- positive effects of program participation on posttest levels of child social competence are independent of

Table 3

Experimental Effects of Equine Facilitated Learning Program on Child Social Competence

Pretest	Control M T-scores (SD)	Experimental M T-scores (SD)	ANOVA p-value
Social Competence COMP	40.71 (9.55)	42.06 (10.81)	.599
Personal Responsibility	42.31 (8.90)	48.52 (9.12)	.441
Optimistic Thinking	43.54 (11.07)	47.72 (11.23)	.957
Goal Directed Behavior	37.85 (8.77)	43.64 (8.60)	.572
Social Awareness	43.88 (11.40)	48.00 (10.13)	.873
Decision Making	42.85 (10.99)	50.00 (10.60)	.864
Relationship Skills	43.92 (11.00)	49.25 (10.27)	.830
Self Awareness	41.92 (10.40)	50.65 (9.07)	.823
Self Management	41.65 (11.75)	51.07 (9.10)	.168
Posttest	**Control** T-Scores	**Experimental** T-Scores	**ANOVA** p-values
Social Competence COMP	41.45 (10.71)	47.85 (10.41)	.020*
Personal Responsibility	42.72 (8.60)	48.34 (8.87)	.009**
Optimistic Thinking	43.59 (10.50)	47.14 (11.30)	.317
Goal-Directed Behavior	37.89 (8.38)	43.39 (8.15)	.005**
Social Awareness	44.28 (11.70)	48.30 (10.31)	.227
Decision Making	43.93 (10.70)	49.38 (10.01)	.039*
Relationship Skills	43.84 (10.39)	48.99 (9.90)	.041*
Self Awareness	42.13 (11.04)	50.98 (8.87)	.001**
Self Management	42.33 (11.56)	51.35 (8.84)	.000***

Note. $*p< .05. **p<.01. ***p < .001$

children's pretest levels of social competence, gender, age, and referral status - required us to isolate unbiased estimates of the influence of program participation on child social competence using a longitudinal lagged regression approach. Child social competence at posttest was expressed as a function of program participation and child social competence at pretest. The same measure used to estimate child social competence at posttest was included as an additional Time-1 covariate in the model to reduce omitted (unmeasured), time-invariant differences in children that were present at the beginning of the program (Cain, 1975). To reduce the threat that measured individual differences in program effects on child social competence at posttest were related to social competence levels at pretest, important factors potentially related to social competence at both time points (e.g., gender, age, referral status) were also included in the model as covariates. Analyses were conducted using the observed data (Table 4, Model 1) and using imputed data for missing posttest variables, resulting in pooled estimates (Table 4, Model 2).

Results support the third hypothesis by showing that models derived from observed and

Table 4

Lagged Dependent Variable Model Predicting Posttest Social Competence

Variable	Unstandardized B	SE	Beta	p-value
Model 1 (Original Data)				
Constant	25.39	12.85		.054
Whether Experimental	4.84	.220	2.015	.021*
Social Competence Time 1	.686	.108	.666	.000***
Child Gender	-.111	2.15	-.041	.673
Child Age	-1.00	.959	-1.00	.301
Whether Referred	-2.22	3.00	-.073	.463
Model 2 (Imputed Data/Pooled Estimates)				
Constant	27.594	12.55		.030
Whether Experimental	4.97	2.15	2.31	.026*
Social Competence Time 1	.662	.103	6.43	.000***
Child Gender	-1.38	2.07	-.666	.507
Child Age	-1.08	.933	-1.16	.249
Whether Referred	-2.36	2.63	-.898	.370

Note. $*p < .05.$ $**p < .01.$ $***p < .001$

imputed data both show robust effects of program participation on posttest social competence scores. Based on imputed data and pooled estimates, results reveal a significant program effect on children's social competence ($\beta = 2.31$; $p = .026$). Results are independent of contributions of children's pretest levels of social competence, which are also positive and significant ($\beta = 6.43$; $p = .000$). There were no significant main effects of children's referral status, age, or gender when pretest levels of social competence were controlled. Although no hypotheses were stated regarding follow-up analyses to examine differences in program effects by group status of social competence, we found that children in the experimental group were much more likely to be reclassified from *needing instruction* to *typical* (Table 5) in response to program participation ($p = .014$) compared to children in the control group, the majority of whom remained classified as *needing instruction*.

Table 5

Causal Change in Social Competence Category by Treatment Group

	Pretest		Posttest	
Group	Control	Experimental	Control	Experimental
Needs Instruction	13	17	17	7
Typical	17	14	12	20
Strength	1	2	2	6

Discussion

The current study employed a randomized controlled experimental trial to examine the causal effects of participation in an 11-week equine facilitated learning program on child social competence of 5th-8th grade children. This study responds to a call in the literature of human animal interaction to move the field of animal assisted intervention out of its 'fringe' status and establishing credibility by means of carefully controlled trials and valid efficacy studies (Kruger & Serpell, 2010). Results indicated support for our first hypothesis suggesting a moderate, positive effect ($d = .61$; $p = .020$) on the social competence of 5th-8th grade children in response to program participation. Positive effects were observed on various aspects of social competence, including improvements in children's self-awareness, self-management, personal responsibility, decision making, goal directed behavior, and relationship skills. In addition, children who were originally in the waitlisted control group showed similar gains in social competence after they completed the program, suggesting support for the second hypothesis, which predicted significant within-subject improvements for waitlisted children. Support for the third hypothesis demonstrated that treatment effects were independent of children's pretest social competence levels, referral status, gender, and age.

The results are important for the following reasons. First, the fact that participation in an equine facilitated program conducted as an after-school program effectively enhanced children's social competence is exciting, since research indicates that promotion of personal and social skills in after-school settings are also known to improve youths' feelings of self-confidence and self-esteem, school bonding (positive feelings and attitudes toward school), positive social behaviors, school grades, and achievement test scores (Durlak & Weissberg, 2007). As such,

equine facilitated learning may thus have produced multiple benefits that pertain to youths' personal, social, and academic lives. Second, these results represent a novel contribution to the literature on equine assisted intervention, as there is no prior work that has employed an experimental design to examine *causal* effects of equine facilitated learning programs on child social competence. Third, results echo findings from prior correlational, anecdotal, and case study evidence, which suggest significant positive associations between participation in equine facilitated programs and various aspects of adjustment and wellbeing (Bowers & MacDonald, 2001; Brown & Alexander, 1991; Chandler, 2005; Gatty, 2001; Kaiser et al., 2004; Katcher & Wilkins, 1994; Klontz, Bivens & Klontz, 2007; Macauley & Gutierrez, 2004: MacDonald, 2004; MacDonald & Cappo, 2003; Mann & Williams, 2002; Schultz, Remick-Barlow, & Robbins, 2007; Trotter, 2005; Trotter et al., 2008; Vidrine, Owen-Smith, & Faulkner, 2002). Fourth, the results give greater credence to the claim of therapeutic horsemanship professionals, participants, and parents who have reported and experienced significant positive effects of equine facilitated activities firsthand. Faced with skepticism about the efficacy of equine facilitated programs by potential funders and third party payers, therapeutic professionals and clients can now point to causal evidence. This may not only increase the public's confidence in equine programs' ability to positively affect child development, but also translate into increased structural support to increase accessibility to such programs. Equine facilitated learning programs may serve as viable alternatives to after-school programs focusing on athletic or academic achievement, to provide after - school opportunities to children with different interests and needs. Last, the results directly inform research questions for future research, particularly research focused on

understanding of the mechanisms that may underlie these positive effects.

Interpretation of Results

Although this study did not examine the pathways referred to in the introduction, we discuss several processes we think are important to consider in obtaining positive program effects. First, while we believe that equines possess key characteristics (e.g., prey animal, herd animal) that influence the behavior of humans interacting with them, we do not believe that equines' innate characteristics *alone* fostered gains in social competence. Program facilitators helped children recognize analogies between horse - human interactions to those between humans in various social contexts (e.g., school, family). For example, during one of the horse activities, children were taught to use gradually increasing amount of finger pressure on the horse - hair, skin, muscle, bone - as a way of 'asking' the horse to move its front or hind quarters. When the child started the activity using 'muscle' instead of 'hair', facilitators asked the child to reflect on whether he or she would use the analogous behavior - shove or push - to 'ask' another person to move out of the way, or if he or she may have used a different communication tool to express the request. By engaging children in practice and reflection within the context of a horsemanship activity, children may have been more open to reflect on their behavior during interactions with non-equine partners.

Second, embedded in lessons targeting children's goal-directed behavior and social skills were several activities designed to reduce 'stress.' The rationale for including such activities was that children who experience stress - through exposure to stressful life events or by perceiving common events as stressful - tend to have distorted perceptions of the degree of threat present in social situations. They also lack effective coping skills to manage their

internal distress. In addition to affecting peer relations, these tendencies lead children to be more susceptible to developing some form of psychopathology. Thus, social cognitions, especially regarding self-efficacy, personal agency, self-control, and cognitive distortion, as well as tools to help children regulate their physiological arousal and emotions, may have enhanced social competence through stress reduction. Examples of program activities that targeted stress reduction included silent grooming, rhythmic stroking of the horse, encouraging slow breathing, muscle relaxation and rhythmicity during mounted activity, as well as encouraging optimistic thinking, reflecting on emotions experienced during the lesson, and utilizing cognitive, behavioral, and physiological coping strategies towards adaptive self-management.

Third, apart from equine facilitation, children may have benefitted from experiencing an optimal social niche that enabled them to improve on social skills important to success in other, more complex social settings. For example, large, unstructured peer group settings (e.g., recess) can be particularly difficult situations for children with poorer social competencies, who may have difficulty initiating and maintaining normative peer interactions. The smaller, more structured peer interaction setting may have provided an appropriate and positive learning environment as equine team members (horse specialists and facilitators) provided support to guide positive peer interactions, friendship development, and modeling of social competence. In addition, given that the sample was not exclusively targeting referred children, program participants experienced normative peers as pro-social models. Participation in the program may have provided less competent children with opportunities to interact with more competent social partners, leading to positive social interactions with peers. These serve as models

for subsequent interactions outside the context of the intervention. This small, structured format may have also counteracted the alienation experienced by children who are receiving special education services or targeted interventions that may make them vulnerable to labeling and the influence of less competent peers. In sum, we suggest that engaging in equine facilitated activities enhance social competence when conducted in an appropriate learning environment that provides optimal opportunities for promoting self-efficacy, performance accomplishment, and personal agency (Kruger & Serpell, 2010).

Strengths and Limitations

There are several strengths and limitations to consider when interpreting results of this study. The main limitation of the study is that the results are based on parents' perception of child social competence. While parents tend to be appropriate reporters of children's social competencies as they intimately *know* the child, they are, by definition, not blind to their child's treatment status. As such, it is possible that the results reflect parents' positive expectations about the efficacy of the program. This limitation would have been of less concern if teacher reports on child social competence had been included, assuming that researchers would have been more successful in keeping the child's treatment status blind to teachers. Teacher reports were not collected as several teachers expressed concern about the fact that measures were collected at the beginning of the school year, when teachers had not yet interacted much with the children.

Second, although participation in the intervention was offered to all 5th-8th grade students in the geographical area, students and parents had a choice to enroll their child in the program. As such, the study cannot address whether this equine facilitated intervention would be effective for children who may have been less willing to interact with horses, or whose parents were less supportive of their child's program participation. While we informally observed individual differences in the extent to which children - and parents - expressed enthusiasm about the efficacy of equine assisted activities, we did not measure or model these differences. Hence, this limitation needs to be considered when determining whether equine facilitated growth and learning programs can be used as universal prevention programs. Similarly, because of the relatively short-term nature of the intervention and lack of longitudinal data at this time, researchers could not ascertain whether the program was of sufficient duration or intensity to potentially alter developmental pathways of children at significant risk for developing mental health problems. Last, equine-facilitated activities involve a great deal of human-human interaction, which the participants in the control group did not receive. The design of the study would have benefitted from an additional control group to compare effects on social competence from the equine facilitated activities to the effects on social competence from interventions that do not involve interactions with equines.

One of the main strengths of this study and its findings is that the results are based on an experimental design, which allows researchers to make causal inferences. This constitutes a novel contribution to research on human-animal interaction and child development generally, and equine facilitated interventions specifically. Second, results yielded a moderate effect size that was statistically significant despite the small sample size and being based on a calculation method using pooled variances. In addition, results were robust when children's pretest levels of social competence were controlled, along with other potential confounding variables. Last, although the sample was relatively small, participants were drawn from ten public and private schools across two

different towns, and featured referred and non-referred children of various ages, somewhat alleviating concerns about the generalizability of the sample.

Conclusion

Given the causal design of this study, this study provides the broader field of therapeutic horsemanship professionals with scientific evidence that can be used to generate support for expanding innovative, evidence-based approaches through equine assisted activities. That said, observed program effects are specific to the program under study, which is an established, equine facilitated learning program with a structured curriculum and a team of experienced, PATH, Intl. certified instructors, horse specialists, therapists, and facilitators. Until more is known about the mechanisms underlying its observed effects, prevention scientists should pair enthusiasm with caution before encouraging scaling up equine facilitated programs in school and community settings to serve as targeted prevention programs. In fact, future research should attempt to elucidate which components of equine facilitated learning are central to program success. For example, is it grooming horses, riding horses, or being in the presence of horses or other children that drove program effects? Or, was it the cognitive-behavior learning processes practiced during natural horsemanship activities that uniquely enhanced children's social competencies? Similarly, to what extent does the equine component of this type of program infer benefits above and beyond evidence-based prevention focusing on human to human interaction? Last, future research should examine effects of equine assisted interventions on other developmental outcomes.

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