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Improving Adolescent Social Competence and Behavior: A Randomized Trial of an 11-Week Equine Facilitated Learning Prevention Program

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Abstract There is growing evidence that promoting social competence in youth is an effective strategy to prevent mental, emotional, and behavioral disorders in adulthood. Research suggests that programs delivered in collaboration with schools are particularly effective when they target social and emotional skill building, utilize an interactive instructional style, provide opportunities for youth participation and self-direction, and include explicit attempts to enhance youth social competence. A relatively new but popular approach that incorporates these characteristics is human animal interaction, which can be implemented in educational settings. We report the results from a randomized clinical trial examining the effects of an 11-week equine facilitated learning (EFL) program on the social competence and behavior of 5th–8th grade children. Children ($N = 131$) were recruited through referral by school counselors and school-based recruitment and then screened for low social competence. Researchers randomly assigned children to an experimental ($n = 53$) or waitlisted control group ($n = 60$). Children in the experimental group participated in an 11-week EFL program consisting of once-weekly, 90-min sessions of individual and team-focused activities, whereas children in the control group

served as a wait-listed control and participated 16 weeks later. Parents of children in both groups rated child social competence at pretest and posttest. Three independent raters observed and reported children's positive and negative behavior using a validated checklist during each weekly session. Results indicated that program participation had a moderate treatment effect ($d = .55$) on social competence ($p = .02$) that was independent of pretest levels, age, gender, and referral status. Results showed that higher levels of program attendance predicted children's trajectories of observed positive ($\beta = .500$; $p = .003$) and negative behavior ($\beta = -.062$; $p < .001$) over the 11-week program.

Keywords After-school program · Randomized clinical trial · Child social competence · Observed child behavior

Introduction

Mental, emotional and behavioral disorders create a largely unrecognized public health burden of \$247 billion annually and deeply impact the lives of one in five American families (O'Connell, Boat, & Warner, 2009). There is growing evidence that promoting behavioral and social-emotional competence in children and youth is an effective strategy to prevent mental, emotional, and behavioral disorders in adulthood (O'Connell et al., 2009). Studies suggest that delivering such prevention programs in collaboration

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with schools prevents the development of problems early on (Jensen & Dieterich, 2007), provides cost-effective services to many children in need (Hoagwood & Erwin, 1997), and fosters school connectedness, which is positively related to academic, behavioral, and social success in school (Blum & Libbey, 2004; McNeely, Nonnemaker, & Blum, 2002). A meta-analysis ($N = 165$) that examined effective program characteristics showed behaviorally-based, individually-focused interventions to be the most effective school-based programs (Wilson, Gottfredson, & Najakazs, 2001). The authors also found that such programs are particularly effective when they target at-risk populations. Other studies reported similar key features, including a focus on social and emotional skill building, an interactive instruction style, providing opportunities for youth participation and self-direction, and explicit attempts to enhance their social competence and connection to others (Greenberg et al., 2003).

One relatively new and increasingly popular approach that is thought to enhance and complement many of these characteristics incorporates human animal interaction (HAI) into therapeutic and educational settings (Nimer & Lundahl, 2007). Existing literature commonly refers to these approaches as Animal Assisted Interventions (AAI), and defines them as “any intervention that intentionally includes or incorporates animals as part of a therapeutic or ameliorative process or milieu” (Kruger & Serpell, 2010, p. 36). Specially trained professionals, paraprofessionals, and volunteers deliver AAIs—including Animal Assisted Therapy (AAT), Animal Assisted Activities (AAA), and various equine facilitated programs (EFP)—for a wide range of purposes in association with animals that meet specific criteria. Despite their increasing popularity and use, researchers have described AAIs as “a category of promising complementary practices that are still struggling to demonstrate their efficacy and validity” (Kruger & Serpell, 2010, p. 33). To address the lack of evidence-based research on the effects of HAI and AAI on child development, the National Institute of Child Health and Human Development (NICHD), in collaboration with the Waltham Centre for Pet Nutrition, convened several international conferences to review the current science (for a review see Esposito, McCardle, Maholmes, McCune, & Griffin, 2010; Griffin, McCune, Maholmes, & Hurley, 2010) and develop a research

agenda (Esposito, McCune, Griffin, & Maholmes, 2011). Along with a need to examine treatment effects of different types of AAIs in various populations (e.g., normal and at-risk), conference participants recommended the need for rigorously designed research using applied approaches, including randomized controlled clinical trials and use of mixed methods. Incorporating these themes, we report the results of a randomized controlled trial examining the effects of an equine facilitated learning (EFL) program on social competence and behavior of 5th through 8th grade children.

Background

Part of a broader set of equine assisted interventions that include therapeutic riding,¹ hippotherapy,² and equine facilitated psychotherapy,³ EFL represents a unique set of practices that combine experiential learning and interaction with horses, ponies, miniature horses, donkeys, and mules with counseling-based processing skills to increase children’s awareness and control of their emotions, cognitions, and behaviors. An integral part of EFL is that its activities are based on our understanding of how horses think and learn, and how to use their natural behavior to interact with humans in a manner that enhances the safety, wellbeing and development of both horses and humans. According to the Professional Association of Therapeutic Horsemanship International (PATH, Intl.), EFL has experienced significant growth in popularity, as it is suitable for children with wide-ranging needs, risk

¹ Therapeutic riding is therapy or treatment that incorporates equine activities and/or the equine environment. Rehabilitative or habilitative goals are related to the patient’s needs and the medical professional’s standards of practice (PATHintl.org). Therapeutic riding has been used to contribute to the cognitive, physical, emotional, and social well-being of people with disabilities.

² Hippotherapy refers to physical, occupational or speech therapy treatment strategy that utilizes equine movement. This strategy is used as part of an integrated treatment program to achieve functional outcomes (PATHintl.org).

³ EAP is an experiential psychotherapy that involves a collaborative effort between a properly licensed mental health professional and an appropriately credentialed horse professional to incorporate horses in working with clients to address mutually established treatment goals and objectives (Fine & Beck, 2010).

factors or diagnoses, including emotional, behavioral or mental health issues, learning disabilities, hyperactivity disorders, autism, and substance abuse. Unfortunately, although the use of causal language present throughout the EFL literature may lead one to believe otherwise, a recent review on equine assisted interventions (Selby & Smith-Osborne, 2013) demonstrates that ‘true’ randomized trials investigating the effects of EFL are non-existent.

Evidence from correlational and descriptive studies on associations between EFL and child development are promising. When compared to traditional classroom-based counseling activities, equine assisted intervention was found to be more strongly associated with lower levels of internalizing and externalizing behavioral problems (Trotter, Chandler, Goodwin-Bond, & Casey, 2008). Similarly, a study investigating links between EFL, anxiety and self-esteem in children with emotional, behavioral or learning disabilities conducted by Holmes, Goodwin, Redhead, and Goymour (2012) found within-person decreases in trait anxiety when children interacted with real horses than with non-live model horses. Based on qualitative data obtained through interviews with foster care children, Burgeon (2011) described participation in equine assisted learning and therapy as altering participants’ perceptions of self-confidence, self-esteem, empathy and self-efficacy. Although most published studies feature statistically significant associations, links between participation and outcomes are not consistent. For example, Ewing and colleagues (2007) found that participation in a series of nine weekly EFL sessions in a sample of children with severe emotional disorders was not associated with within-person changes in levels of depression, internal locus of control, interpersonal empathy or self-esteem. In sum, while correlational and descriptive studies on EFL are promising, we concluded that a randomized controlled trial should be conducted to examine the effects of EFL before promoting its implementation in educational settings.

The Current Study

Our overall objective was to conduct a randomized controlled trial to determine the efficacy of an 11-week EFL program in improving the social competence and behavior of 5th through 8th grade children. Program

implementers and researchers collaborated closely with school administrators, school counselors and teachers to facilitate implementation after school. Our main outcome of interest was social competence, which is the ability 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. We selected this outcome because it is a central domain of child development that plays a critical role in later academic achievement, mental health, and overall wellbeing (Shonkoff & Phillips, 2000). 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, Domitrovic, & Bumbarger, 2000).

We hypothesized that children who participated in an 11-week equine facilitated learning program would have higher levels of social competence at posttest than those assigned to a waitlisted condition. We hypothesized 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. We also hypothesized that program participation would be associated with significant changes in observed positive and negative behavior during program sessions, and that we would find a significant association between degree of program participation (dose) and these objectives (response).

Method

The Program

Our university-based program was conducted at a Premier Accredited Center of the Professional Association of Therapeutic Horsemanship International (PATH, Intl.). The stated goal of the program is to enhance child social competence and behavior through an 11-week program of once-weekly, 90-min sessions of equine facilitated activities. Activities (Table 1) featured a combination of mounted and unmounted activities and horse-human interactions, including observation of equine behavior, engagement in equine management (e.g., grooming), in-hand horsemanship, some riding, and personal and group reflection

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 ^a
3	Communication: verbal and non-verbal	Leading horses, interpreting horse body language
4	Leadership: assertive and aggressive cues	Driving ^b 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 ^c horses
8	Enhancing self-regulation and relaxation	Horse massage ^d , 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

^a Pressure refers to signaling toward the horse (implied/indirect), pushing with fingers/hand, or leg until the desired behavior or the equine is fulfilled (i.e., moving away from the pressure)

^b 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 and ahead of the equestrian

^c Desensitizing refers to exercises to condition the equine to ignore a stimulus or object, thus avoiding 'spooking' of certain gestures or objects

^d 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' him/her before riding

activities. The program was developed and piloted over a period of 3 years through a series of small sample ($N = 6$ –8) pilot studies on implementation that assessed program activities, outcome measurement, and estimation of within-person effects. A PATH, Intl. Registered Instructor, who attained secured certification status through demonstration of skills and knowledge in the areas of equine management, horsemanship, instruction, teaching methodology and

disabilities consistently supervised the program's implementation. The curriculum contained standardized lessons with weekly goals and step-by-step instructions and procedures for each activity. The program was implemented by a team of volunteer horse specialists and facilitators, who included certified instructors, students in human development, education, animal science, and counseling, as well as professional counseling psychologists. Program staff received training in the theoretical rationale of the program activities (see next section), principles of cognitive behavioral counseling and EFL, horse behavior, and child development through lectures, video and slide presentations, printed materials, and hands-on training with horses and child actors.

Participants were assigned to the same facilitation team for the entire 11-week program. A facilitation team included one equine, two child participants, an equine specialist, and a facilitator. Each day, a total of eight child participants—divided across four equine teams headed by four experienced equine specialists—participated. Lessons were designed to integrate individual, team and group activities, oscillating from activity to activity, and from setting to setting (e.g., from individual to team to group and vice versa). The majority of horsemanship activities (e.g., riding, leading, driving etc.) were conducted by participants individually, and they commonly took turns participating, observing and reflecting on the quality of their own and their teammate's human equine interaction. Participation in preparatory activities (e.g., grooming, tacking up and preparation of the arena) and challenge activities (e.g., mounted and unmounted obstacle courses) were conducted with the participants' regular teammate, whereas lesson instructions and reflection activities were most commonly conducted in a group setting. Staff conducted the program four times per week, serving a maximum of 32 children each week per 11-week program. Weekly sessions were conducted in the afternoon on weekdays and included transportation of participants from their schools to the program site and back immediately following their regular school day.

Theoretical Rationale Underlying Program Activities

Although there is no specific HAI theory that postulates how EFL activities may affect child social

competence and behavior, our study was informed by the positive youth development (PYD) perspective (Lerner, 2004). Based on developmental systems theories, this perspective posits that all youth possess strengths, and that different contexts can be directed in ways that will optimize these strengths to promote desired outcomes (Lerner, Almerigi, Theokas, & Lerner, 2005). Features of positive youth development, known as the “Five Cs” (competence, confidence, connection, character, and caring), are thought to be fostered when youths’ strengths are aligned with community-based, structured, out-of-school-time youth programs (Balsano, Phelps, Theokas, Lerner, & Lerner, 2009). In addition, this perspective considers the bi-directional influence between youth and their environment to be important. Furthermore, positive youth development considers three program characteristics to provide an ideal context to foster positive youth development. These ‘Big 3’ characteristics are (1) opportunities for participation and leadership, (2) an emphasis on developing life skills, and (3) fostering supportive youth-adult relationships (Eccles & Gootman, 2002; Lerner, 2004; Roth & Brooks-Gunn, 2003).

The characteristics of the EFL program under study and the theoretical rationale for the activities align with the ‘Five Cs’ and ‘Big 3’ as follows. First, working with equines provides multiple opportunities for participation. For example, at the beginning of each session, children participated—under the supervision of horse specialists—in catching, haltering, fetching, and grooming the horse, as well as assisting staff with saddling or tacking tasks on riding days. Similarly, participants assisted with set up—and cleanup—of the arena by setting up and removing obstacles, poles and cones at the beginning and end of each lesson.

This program fostered leadership by engaging participants in weekly variations of mounted and unmounted horsemanship activities. These activities were organized around weekly themes relevant to adolescents’ social settings (e.g., boundaries, respect, leadership) and aimed to strengthen participants’ non-verbal communication skills, self and social awareness, and confidence to facilitate participants’ success at eliciting positive, compliant responses from the horse. It is important to recognize that in order to elicit positive responses from the horse, participants had to recognize that they possess unique intrinsic and

physical attributes (e.g., being a prey animal, being a herd animal, being physically imposing) that required participants to control their behavior, emotional intent, cognitions and non-verbal communication (McGreevy & McLean, 2010). This program fostered participants’ skills by teaching participants to apply gradually increasing levels of direct and indirect pressure on the horse as a way of directing movement of the horse’s front and hind quarters, control which is synonymous with asserting leadership—in the eyes of the equine. An important component of these interactions was to teach participants subtle equine behavioral cues associated with compliance, along with the timely release of pressure as a reward for even the slightest try on behalf of the horse. In addition, participants were asked to reflect on their cognitions and emotional intent and their potential effect on the quality of human-equine interaction during these activities. In addition to enhancing the quality of this interaction, the activities enhanced human to human communication and relationship skills through the presence of a supportive adult facilitator. This facilitator modeled social competence and positive behavior and facilitated optimal communication between participants and their horses, as well as between the participants and their peers in dyadic and group contexts.

Study Procedures

The study was approved by the University Committee on Research Involving Human Subjects. Equine welfare of horses in the program was monitored by the university’s Institutional Animal Care and Use Committee (IACUC) regulations and campus veterinarian. Program staff recruited program participants through referrals by school counselors, distribution of flyers and advertisements, and informational meetings in schools. Children referred by school counselors 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.

We determined two criteria for program participation: (1) parents and children had to be able to communicate effectively in English and (2) the child did not have a serious physical or mental disability. For this selective prevention program we recruited normal children as well as those with lower levels of social competence or those at risk of academic failure.

Parents and children received information from the research team about the study, its screening, assessment, and assignment procedures as well as the process of adult consent and child assent. With the aim of conducting a selected prevention program while maximizing the utilization of available program slots, interested parents were paid \$5 to complete a standardized measure of child social competence (see measures section for description). This measure was used to rank order children from low to high levels of social competence and to recruit approximately equal numbers of boys and girls per grade. Study participants were randomly assigned to either a treatment group or waitlisted control group. Children assigned to the treatment group started program participation 2 weeks later, whereas those assigned to the waitlisted control group were offered program participation in the following program, which started 16 weeks later. Parents of both groups provided ratings of child social competence again at posttest (i.e., at the end of the 11-week program). Two program facilitators and a research assistant provided ratings of each child's positive and negative behavior at the end of each weekly session.

Sample Recruitment, Screening and Assignment

Program staff recruited a total of 131 interested children and their families from ten different schools in two rural university towns, of whom 113 children were selected ($n_{\text{boys}} = 41$; $n_{\text{girls}} = 72$; $n_{\text{referred}} = 16$; $M_{\text{age}} = 11.35$ years) for random assignment to the experimental ($n = 53$) or waitlisted control ($n = 60$) condition. Participants were predominantly White (81.6 %), and of non-Latino or non-Hispanic ethnicity (88.8 %), with the remaining children reporting across racial categories that included more than one race (8 %), Asian (3.2 %), and American Indian or Alaska Native (1.6 %), or unknown race (5.6 %). There were no significant differences across groups between participants' age ($t(111) = -.53$, *ns*), gender ($t(111) = -.30$, *ns*), referral status ($t(111) = 1.35$, *ns*), or pretest social competence ($t(111) = -1.02$, *ns*). Sample enrollment, selection, randomization, follow up and analyses counts are described in a flow diagram (Fig. 1). Of those participants originally assigned, 95 children were analyzed at posttest ($n_{\text{boys}} = 36$; $n_{\text{girls}} = 58$; $n_{\text{referred}} = 13$; $M_{\text{age}} = 11.34$ years; $M_{\text{social competence}} = 42.95$). There were no significant

group differences by age ($t(111) = -.11$, *ns*), gender ($t(111) = .99$, *ns*), referral status ($t(111) = -.22$, *ns*), or social competence ($t(111) = -.10$, *ns*), between those who completed the study and those who were lost to attrition.

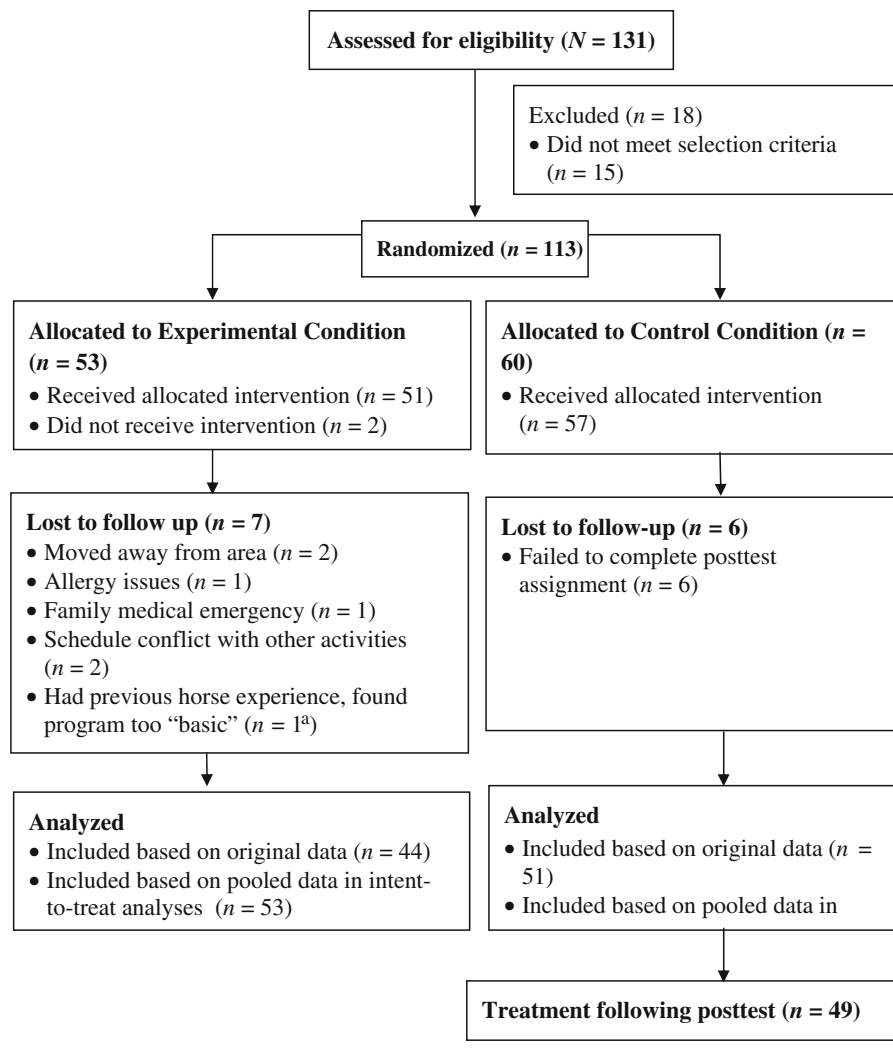
Measures

Child Social Competence

As part of the screening and pretest measurement, parents completed the parent report form of the Devereux Student Strength Assessment (DESSA; LeBuffe, Shapiro, & Naglieri, 2009), a behavior rating scale assessing the social-emotional competencies that serve as protective factors for children in kindergarten through eighth grade. The measure contains 72 items across 8 subscales asking respondents to indicate how often various child behaviors occurred over the past 4 weeks based on a 5-point Likert scale ranging from 0 (*never*) to 4 (*very frequently*) from which a composite score was calculated. In our sample, the 8 subscales featured high levels of internal consistency including Optimistic Thinking ($\alpha = .87$), Self-Management ($\alpha = .86$), Goal-Directed Behavior ($\alpha = .89$), Self-Awareness ($\alpha = .82$), Social-Awareness ($\alpha = .81$), Personal Responsibility ($\alpha = .87$), Decision Making ($\alpha = .91$), and Relationship Skills ($\alpha = .93$). Raw scores were converted to T-scores using DESSA coding procedure. 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, including the BERS-2 (Epstein, 2004) and the Behavior Assessment System for Children-2 (BASC-2; Reynolds & Kamphaus, 2004). Completion of the DESSA by parents occurred at pretest ($\alpha_1 = .98$) and posttest ($\alpha_2 = .98$)

Child Behavior

At the end of each 90-min session, each participant's positive and negative behaviors were rated using the Animal Assisted Therapy—Psychosocial Session Form (AAT-PSF; Chandler, 2005). Each child's



^aParticipant withdrew after 4 weeks of participation but completed posttest assessments

Fig. 1 Flow diagram describing sample enrollment, selection, randomization, follow up and analyses

behavior was rated by two program facilitators who worked with the child each week and by a third independent rater, a research assistant not engaged in the facilitation of horse-human interaction. This resulted in an average of 26 behavioral reports per child. Raters indicated the extent to which children engaged in 25 positive behaviors (e.g., following direction, accepting feedback, sharing, making eye contact, appropriately assertive) and 18 negative behaviors (e.g., argumentative, fidgeting, withdrawn, hyperactive, resistant) on a 6-point Likert scale ranging from 0 (*none*) to 5 (*very high*). At the end of

each weekly session, summed scores for each participants' positive and negative behaviors were averaged across observers, whose ratings were positively associated as evidenced by a high intra-class correlation ($r = .83, p < .001$), resulting in a score of positive and negative behavior for each participant for each week.

Results

Descriptive analyses showed that pretest social competence levels in the sample were in the normal range

Table 2 Group differences in mean levels of child social competence before and after participation in an 11-week EFL program

Pretest	Control $M_{T\text{-scores}}$ (SD)	Experimental $M_{T\text{-scores}}$ (SD)	$F(1,112)$	ANOVA p value
Social competence COMP	42.08 (9.66)	44.01 (10.52)	1.04	.31
Personal responsibility	43.57 (10.18)	45.34 (10.68)	.82	.37
Optimistic thinking	42.97 (9.83)	44.06 (11.03)	.31	.58
Goal directed behavior	40.70 (8.62)	41.79 (9.40)	.42	.52
Social awareness	43.12 (9.83)	44.21(10.51)	.33	.57
Decision making	44.57 (9.37)	45.81 (10.69)	.44	.51
Relationship skills	45.83 (9.22)	47.79 (11.82)	.98	.33
Self-awareness	42.35 (8.79)	43.81 (10.29)	.66	.42
Self-management	42.88 (10.75)	45.36 (9.93)	1.60	.21
Posttest	$M_{T\text{-Scores}}$ (SD)	$M_{T\text{-Scores}}$ (SD)	$F(1,94)$	p value
Social competence COMP	43.58 (10.36)	48.93 (9.33)	8.59	.01
Personal responsibility	45.68 (10.36)	49.58 (8.62)	4.77	.04
Optimistic thinking	44.65 (10.31)	47.36 (10.06)	2.15	.19
Goal directed behavior	40.96 (8.96)	44.73 (8.16)	5.68	.04
Social awareness	46.26 (10.45)	48.60 (10.45)	1.47	.25
Decision making	45.85 (10.50)	50.25 (9.07)	5.67	.02
Relationship skills	45.81 (9.98)	49.60 (9.77)	4.45	.07
Self-awareness	43.43 (9.68)	49.63 (9.43)	11.89	.001
Self-management	44.70 (11.24)	51.15 (8.81)	11.60	.003

($M = 42.99$, $SD = 10.07$). Based on comparisons of mean levels of pretest social competence in our sample to mean levels obtained in a ‘normal’ ($M = 48.20$, $SD = 10.01$) and ‘emotionally disturbed’ ($M = 37.10$, $SD = 7.90$) population sample (LeBuffe et al., 2009), it appears that our goal of recruiting children with relatively lower levels of social competence was met. Approximately half of the study sample was classified as needing instruction in social competence ($n_{\text{needs instruction}} = 47$, $n_{\text{typical}} = 58$, $n_{\text{strengths}} = 8$). A series of one-way ANOVAs showed no statistically significant differences in pretest levels of child social competence by experimental condition, $F(1, 112) = 1.04$, ns (Table 2). We did find significant differences in pretest levels of child social competence by child gender insofar as girls manifested higher social competence scores $F(1, 112) = 4.86$, $p = .03$, $M_{\text{boys}} = 40.27$ (9.67), $M_{\text{girls}} = 44.54$ (10.04), and lower levels for those referred by school counselors $F(1, 112) = 12.97$, $p < .001$, $M_{\text{referred}} = 35.00$ (6.46), $M_{\text{unreferred}} = 44.31$ (9.98), although boys and girls were equally likely to be referred $F(1, 112) = .44$, ns .

To determine whether participation in the program significantly affected child social competence we conducted a series of intent-to-treat analyses (Fisher et al., 1990). This is a strategy for the analysis of randomized controlled trials that prevents overestimation of treatment effects by comparing all the participants in the groups to which they were originally randomly assigned, regardless of whether they subsequently withdrew or deviated from the study protocol. To accommodate this approach, missing data on posttest assessments on social competence were imputed using five imputations (Rubin, 1987, 1996). The results described in the next section thus reflect pooled estimates across five imputed datasets.

Program Effects on Social Competence

Since a series of one-way ANOVAs did reveal statistically significant differences in mean levels of child social competence at posttest by treatment condition (Table 2), we next used a longitudinal lagged regression approach to predict posttest social competence scores, while including a pretest Time-1

Table 3 Lagged dependent variable models predicting post-test social competence and child behavior

Variable	Unstandardized B	SE	Beta	p value
<i>Model 1 (social competence)</i>				
Constant	29.66	9.29		.001
Experimental condition	4.18	1.74	.202	.02
Pretest social competence	.652	.079	.644	<.001
Child gender	−.831	1.58	−.044	.60
Child age	−.097	.060	−.112	.11
Whether referred	−.517	2.57	−.016	.84
<i>Model 2 (positive behavior)</i>				
Constant	−3.06	5.63		.59
Baseline positive behavior	−.066	.028	−.258	.02
Pretest social competence	.059	.035	.180	.10
Child gender	.797	.742	.116	.29
Child age	.017	.029	.060	.57
Whether referred	1.48	1.11	.148	.18
Attendance	.500	.161	.314	.003
<i>Model 3 (negative behavior)</i>				
Constant	1.311	1.14		.25
Baseline negative behavior	−.062	.011	−.512	<.001
Pretest social competence	.002	.008	.023	.80
Child gender	.186	.174	.099	.29
Child age	.000	.007	.004	.97
Whether referred	−.031	.253	−.011	.90
Attendance	−.153	.038	−.350	<.001

covariate in the model. The aim of this approach was to reduce omitted (unmeasured), time-invariant differences in children that were present at the beginning of the program (Cain, 1975). 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. As displayed in Table 3, the model explained a significant portion of variance in social competence at posttest, $R^2 = .539$, $F(1, 112) = 22.248$, $p < .001$, and a significant treatment effect ($d = .55$) on children's social competence, $\beta = .202$, $t(107) = 2.409$, $p = .02$, independent of contributions of children's pretest levels of social

competence, which were positive and significant, $\beta = .644$, $t(107) = 8.304$, $p < .001$. There were no significant main effects of children's referral status, age, or gender. In sum, results demonstrate that participation in the 11-week EFL program effectively increased children's social competence.

Associations Between Program Attendance and Behavioral Change

We conducted the following non-experimental analyses using behavioral reports of all participants who completed the 11-week program. This included children who were assigned to the experimental group, as well as those who were assigned to the waitlist control group and participated in the program 16 weeks later. Researchers first conducted a t test that compared the means of positive and negative behavior across the entire 11-week period, which indicated that on average, participants demonstrated significantly higher levels of positive than negative behavior ($M_{\text{pos}} = 81.49$; $SD = 14.32$; $M_{\text{neg}} = 9.49$; $SD = 6.31$). Based on paired-sample t tests that compared participant behaviors obtained during the first and last session, positive behavior increased significantly over the 11-week program period $t(78) = -11.287$, $p < .001$, $\Delta M_{\text{pos}} = 19.46$, whereas negative behaviors significantly decreased over this period $t(78) = 7.637$, $p < .001$, $\Delta M_{\text{neg}} = 6.06$. Based on bi-weekly paired-sample t tests, comparisons of means of positive and negative behaviors by session are presented in Table 4.

To test the hypothesis that attendance was associated with trajectories of positive and negative behavioral change over the course of the program, we next calculated two parameters representing each participant's individual behavioral trajectory of change over the 11-week period. Using multiple linear regression analyses, each child's scores of positive and negative behavior were regressed—predicted—by session number (i.e., 2 through 11) resulting in a series of regression coefficients representing a linear estimate of the *slope* value for each child's individual trajectory of positive ($M_{\text{slope}} = 1.84$; $SD = 1.56$; Min = -2.99 ; Max = 5.34) and negative behavior ($M_{\text{slope}} = -.57$; $SD = .85$; Min = $-.56$; Max = 2.24). Based on a series of one-way ANOVAs, there were no significant differences in trajectories of change in positive or negative behavior by gender, $F_{\text{positive}}(1, 99) = .948$, $p = .33$, $F_{\text{negative}}(1, 99) = .009$, $p = .93$; referral

Table 4 Mean levels of observed positive and negative participant behavior by week and significance level of bi-weekly change

Week	Positive change			Negative change		
	<i>M (SD)</i>	<i>t(df)</i>	(<i>p</i> value)	<i>M (SD)</i>	<i>t(df)</i>	(<i>p</i> value)
2	74.15 (13.13)			11.59 (7.71)		
3	74.73 (12.56)			10.64 (7.93)		
4	76.21 (16.56)	−1.52 (69)	.13	10.49 (7.76)	1.20 (69)	.23
5	82.96 (13.27)	−5.22 (75)	<.001	11.49 (9.42)	−.65 (75)	.52
6	78.21 (16.79)	−1.77 (69)	.08	10.14 (8.31)	1.26 (69)	.21
7	81.71 (12.41)	−1.26 (68)	.21	10.58 (8.18)	2.16 (68)	.04
8	82.97 (13.96)	−3.41 (71)	.001	9.29 (8.06)	2.01 (71)	.05
9	83.53 (11.04)	−1.39 (69)	.17	7.58 (6.96)	4.19 (69)	<.001
10	86.86 (14.59)	−2.06 (69)	.04	7.40 (6.45)	2.45 (69)	.02
11	93.57 (14.82)	−7.57 (74)	<.001	5.70 (6.24)	3.61 (74)	.001

status $F_{positive}(1, 99) = 1.520$, $p = .22$, $F_{negative}(1, 99) = .297$, $p = .59$, or pretest levels of social competence $F_{positive}(1, 99) = .488$, $p = .62$; $F_{negative}(1, 99) = .126$, $p = .88$.

Next, using a linear regression approach, we used slope coefficients of positive and negative behavior as dependent variables and regressed on the number of sessions participants attended throughout the 11-week program. The model also included baseline levels of child observed behavior (week 2), pretest levels of social competence, referral status, gender and age. Models explained a significant portion of variance in positive $R^2 = .213$, $F(6, 92) = 3.873$, $p = .002$ and negative behaviors, $R^2 = .433$, $F(6, 92) = 10.943$, $p < .001$. Higher levels of attendance were associated with steeper trajectories of positive $\beta = .500$, $t(86) = 3.11$, $p = .003$ and negative behavioral change $\beta = -.153$, $t(86) = -4.024$, $p < .001$ (Table 3, model 2, 3). Results also suggested that these associations were independent of baseline levels of positive behavior, $\beta = -.066$, $t(86) = -2.393$, $p = .02$, and negative behavior, $\beta = -.062$, $t(86) = -5.704$, $p < .001$. In sum, results demonstrate that program attendance was significantly associated with adaptive behavioral change during EFL sessions.

Discussion

We employed a randomized controlled experimental trial to examine the effects of participation in an 11-week EFL program on social competence and

behavior of 5th–8th grade children. Results indicated a moderate positive effect ($d = .55$) on the social competence of 5th–8th grade children in response to program participation, including improvements in children's personal responsibility, decision making, goal-directed behavior, self-awareness, and self-management. Treatment effects were independent of children's pretest social competence levels, referral status, gender, and age. Results also showed that the extent to which positive behavior increased and negative behavior decreased during weekly program sessions was significantly associated with the number of sessions attended throughout the 11-week program.

These results are exciting for the following reasons. First, these findings represent the first randomized controlled trial conducted on the effects of equine facilitated learning, an animal assisted approach that has seen a significant increase in usage and popularity in educational settings. As such, these results nicely complement findings of the few randomized trials conducted on the effects of therapeutic riding, a related discipline. For example, Bass and colleagues (2009) demonstrated significant improvements in sensory seeking, sensory sensitivity, social motivation, and less inattention, distractibility, and sedentary behaviors in response to a 12-week therapeutic riding intervention for children with autism. Similarly, researchers found that children with autism participating in a ten-week therapeutic riding program demonstrated significant improvements in self-regulation (i.e., irritability, lethargy, stereotypic behavior and hyperactivity; Gabriels et al., 2012).

Second, the fact that participation in an equine facilitated program conducted as an after-school program effectively enhanced children's social competence and behavior is promising, as studies indicate that the 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). Provided that these results can be replicated, EFL may thus produce multiple benefits that pertain to youths' personal, social, and academic lives. In our opinion, further exploration of the efficacy of equine programming may be especially pertinent in rural communities like the one in which this study was conducted, as social and human capital needed to conduct equine programming (e.g., horses, riding facilities, school transportation, existing 4-H programming activities, volunteers) may be readily available there.

Strengths and Limitations

The main limitation of the study is that the causal findings are based on parents' perceptions of child social competence. While parents are appropriate reporters of children's social competence as they intimately know the child, they are 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 concern is somewhat alleviated, although not eliminated, by also examining adolescents' trajectories of behavior over the 11-week program period, as behavioral findings were based on reports by three independent raters, one of whom was a trained observer not involved in the implementation of EFL activities. Second, although the intervention was offered to all 5th through 8th grade students in the geographical area, parents had a choice to enroll their child in the program. As such, the study cannot address whether it would be effective for children who are less willing to interact with horses, or whose parents were less supportive of their child's participation. Similarly, although participants were drawn from ten public and private schools, and featured referred and non-referred children of various ages and genders, there are other concerns about the generalizability of the findings, which were obtained in a rural setting. Third, we could

not ascertain whether the program was of sufficient duration or intensity to potentially alter developmental pathways of children at significant risk for developing adjustment problems. Fourth, since the study did not include a cost-benefit analysis, it is unclear whether observed gains in social competence and behavior represent an economic benefit greater than the cost incurred related to program implementation for this population of children. It would have been particularly helpful to know whether similar results could have been obtained using smaller number of program staff by reducing the size of facilitation teams. Last, since EFL involves a significant amount of human-to-human interaction, the study design would have benefitted from an additional control group to compare effects of EFL to a program not involving interactions with equines. Similarly, since receiving *any* intervention may result in treatment effects, we cannot rule out that the findings represent a Hawthorne effect.

One of the main strengths of this study is that the results are based on a randomized controlled trial, which allows researchers to make causal inferences. Second, results yielded a moderate effect size that was statistically significant despite the small sample size.

Conclusion

This study makes a significant contribution to the existing literature on equine assisted intervention by conducting a randomized trial demonstrating significant effects of EFL on child social competence and behavior. As such, we hope that this work will stimulate further research on the effects of equine facilitated learning.

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