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Effects of Animal-Assisted Activities with Guinea Pigs in the Primary School Classroom

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Abstract

This study investigated the effects of a classroom-based animal-assisted activities (AAA) program with guinea pigs on the social functioning of primary school children. We hypothesized that participants in the experimental condition ($n = 64$), compared with a waitlist control group ($n = 64$), would demonstrate improvements in social functioning following the program. Parents and teachers used the Social Skills Rating System (SSRS) to evaluate the social skills and problem behaviors of 128 participating children (age range = 4.8 to 12.7 years) before and after an 8-week period. Teachers also rated academic competence at both time points. Children who participated in the AAA program demonstrated significantly greater improvements in social functioning than their control group peers, as defined by greater increases in social skills (teacher SSRS) and decreases in problem behaviors (parent and teacher SSRS). There were no significant differences between the groups in academic competence. AAA participants demonstrated significant increases in social skills and decreases in problem behaviors from pre- to post-program on the teacher version of the SSRS. Control group participants did not show significant changes on these measures. These findings suggest that an AAA program with guinea pigs may be a feasible addition to the primary school classroom in order to improve social functioning. Further component analysis will be necessary to determine whether the animal is the active ingredient in AAA programs of this nature.

Keywords

animal-assisted intervention; children; classroom pets; guinea pigs; social functioning

Companion animals are speculated to play an important role in the healthy emotional development of children (Melson and Fine 2006, p. 223). Pets are frequently found in homes with children and in school classrooms (Beck 2010, p. 43; Gee 2010, p. 117). Parents often report obtaining pets for the purpose of enhancing their child's socio-emotional development, most commonly to teach responsibility (Salmon and Salmon 1983, p. 256; American Pet Products Association 2009). Surveys indicate that teachers with classroom pets report a variety of perceived benefits, including: teaching humane values and captivating students' attention (Zasloff, Hart and DeArmond 1999); providing enjoyment, hands-on educational experiences, and enhancing psychological wellbeing (Rud and Beck

2000, 2003); and increasing empathy and socio-emotional development (Daly and Suggs 2010).

The field of Human–Animal Interaction (HAI) provides theoretical support for these perceived benefits by applying psychological theory to the interactions between children and animals. HAI social support theory suggests that animals can enhance social support both directly, as a source of comfort, and indirectly, as a facilitator of human interaction (McNicholas and Collis 2006, p. 54). Increased social engagement provides opportunities for social learning, which may enhance socio-emotional development (Melson 2001). HAI attachment theory suggests that animals may provide a source of comfort and safety for children, as transitional objects that can alleviate distress and may reduce problem behaviors (Triebenbacher 1998; Katcher 2002, pp. 193–194; Kruger and Serpell 2010, pp. 40–41). Finally, the biophilia hypothesis suggests that humans have a natural affiliation for, and attraction to, animals (Wilson 1984). For young children in particular, animals provide a perceptually captivating and often emotionally meaningful object of attention that may stimulate learning (Fawcett and Gullone 2001; Melson 2003). Yet despite a strong body of theoretical literature as well as parent and teacher perceptions of benefit, the effects of animal-assisted activities (AAA) on children have been largely neglected in empirical research (Beck and Katcher 2003; O'Haire 2010).

It has been suggested that the use of pets in classrooms may enhance social interactions (Esposito et al. 2011; O'Haire 2012). Several studies have focused on AAA in special education classrooms, yet minimal research has been undertaken in general education classrooms (Friesen 2010). A few studies have examined the impact of visiting dogs to mainstream classrooms. Results indicate that the presence of a dog is related to increased social cohesion and decreased aggression amongst 6–10-year-old children (Hergovich et al. 2002; Kotrschal and Ortbauer 2003; Tissen, Hergovich and Spiel 2007) as well as increased cognitive task performance amongst 3–5-year-old children (Gee, Church and Altobelli 2010; Gee, Crist and Carr 2010; Gee et al. 2012). These studies have been informative and promising regarding the effects of child–dog interactions in the classroom. However, dogs are not commonly found as classroom pets. Their behavior, care, and exercise needs are not conducive to extended time in the school classroom. Instead, the most common classroom pets tend to be small animals, which can live in cages, aquariums, or terrariums (Zasloff, Hart and DeArmond 1999; Rud and Beck 2003). In particular, guinea pigs have been recommended as one of the best classroom pets because they are small, sturdy, diurnal, relatively inexpensive and easy to care for, social, amicable to handle, and interact by vocalizing in response to feeding (Flom 2005; American Society for the Prevention of Cruelty to Animals 2008, pp. 13–14).

The present study therefore extends previous research on visiting dogs by examining the impact of guinea pigs as resident classroom pets for the duration of one school term, compared with a waitlist control condition. To the best of our knowledge, it is the first controlled study of a classroom-based AAA program with a small animal. The purpose of the study was to examine the impact of the program as a whole (rather than the specific role of the animal) compared with the school classroom as usual. Based on existing HAI research, it was hypothesized that the AAA program with guinea pigs in the classroom would be associated with increased social functioning, defined by increases in social skills and decreases in problem behaviors, as well as increases in academic competence.

Methods

Participants

Participants included 128 typically-developing children (71 male; 57 female) aged 4.8 to 12.7 years ($M = 8.6$; $SD = 2.3$) in kindergarten (preparatory year) through seventh grade, from 41 general education classrooms spread across 15 schools in Brisbane, Australia. Classrooms were selected based on their inclusion of a child with Autism Spectrum Disorder (ASD), in order to evaluate the AAA program for children with ASD alongside their typically-developing peers in an inclusive, general education classroom setting. In each classroom, two typically-developing children were randomly assigned to participate with the child with ASD, in order to provide a peer base for the program. One typically-developing participant moved interstate in the middle of the study, making the total sample size $n = 127$. Results for children with ASD ($n = 64$) are reported elsewhere (O'Haire et al. in press). Inclusion criteria for typically-developing children were: (a) full-time enrollment in a regular education classroom; (b) consent from the child's school principal, classroom teacher, and parent/guardian to participate in the program; and (c) no prior parent-reported history of animal abuse or animal phobia. The background variables for the sample are shown in Table 1.

The minimum education level required to teach primary school in Queensland, Australia is either a Bachelor's Degree in education or a non-Bachelor's Degree followed by a Diploma or Postgraduate Degree in education. The highest degree attained for teachers in the current sample included a Bachelor's Degree (53.3%), Postgraduate Degree (24.4%), and Diploma (22.2%). Approximately two-thirds of participants (69.2%) and teachers (66.7%) reported having at least one companion animal present in their home, which is comparable to the national average in Australia of 64% of households owning pets. No teachers had any prior experience with, or training in, AAA.

Animal participants included 82 guinea pigs ranging in age from seven to eight weeks at the start of the program. Guinea pigs were chosen because they have been reported as one of the best choices for young children and classroom pets because they are diurnal, relatively easy to handle and care for, generally like to be held, and seldom bite (American Society for the Prevention of Cruelty to Animals 2008, pp. 13–14). Due to their social nature, each classroom was provided with two guinea pigs. All pairs were the same sex to prevent breeding. Each pair of guinea pigs was housed in a large, two-level cage with soft, dry bedding, a hiding house refuge, and constant access to a fresh supply of food and water. All guinea pigs were obtained at a young age in order to be socialized to children and the classroom environment. The average time the children spent in the classroom was between 4 and 5 hours per day, allowing the guinea pigs sufficient "down time" without the presence of children. Children were only permitted to handle the animals under the supervision of the classroom teacher or program facilitator.

This study was approved by the Human Ethics Committee and the Animal Ethics Committee of The University of Queensland, Australia. Additional approval was received from the Queensland Government Department of Education, Training, and Employment and Brisbane Catholic Education to approach local state and private primary schools for participation.

Instruments

The Social Skills Rating System (SSRS) was used to quantify children's social functioning at pre-test and post-test. The SSRS is a standardized, multi-rater assessment of social behaviors at school (teacher-report) and at home (parent-report). It consists of an elementary-level, 55-item parent questionnaire and a 57-item teacher questionnaire (Gresham and Elliott 1990). It is divided into two broad behavioral domains: 1) Social Skills

(subscales include Cooperation, Assertion, and Self-Control, as well as Responsibility in the parent-version) and 2) Problem Behaviors (subscales include Externalizing, Internalizing, and Hyperactivity). The teacher version also includes an Academic Competence rating. Each of the three domains (Social Skills, Problem Behaviors, and Academic Competence) can be used separately or in combination. The SSRS demonstrates good reliability, with coefficient alpha reliabilities for each domain ranging from 0.84 to 0.95. It also has good construct and convergent validity, with correlations between 0.50 to 0.75 to similar measures (e.g., Social Behavior Assessment, Child Behavior Checklist, Scale of Social Competence and School Adjustment; Gresham and Elliott 1990).

Items within the behavioral domains (Social Skills and Problem Behaviors) are rated on a 3-point Likert scale of their frequency (0 = never, 1 = sometimes, 2 = very often), and Academic Competence items are rated on a 5-point scale that corresponds to percentage clusters (1 = lowest 10%, 5 = highest 10%) within the child's classroom. Total Social Skills scores range from 0 to 80 (parent version) and 0 to 60 (teacher version), with higher scores indicating a greater frequency of socially skilled behaviors. Total Problem Behaviors scores range from 0 to 36 (both parent and teacher versions), with higher scores indicating a greater frequency of problem behaviors. Total Academic Competence scores range from 1 to 45, with higher scores indicating a greater level of academic competence compared with other students within the same classroom. Aggregate scores for each of the three domains (Social Skills, Problem Behaviors, and Academic Competence) were used in statistical analyses.

Participant demographic data were also collected, as reported in Table 1. Teachers in the AAA condition were asked to report on their desire to participate in the program, on a 7-point Likert scale (1 = "no desire at all"; 7 = "very strong desire").

Procedure

Prior to the start of the study, parents of all 128 participating children completed the SSRS Social Skills and Problem Behaviors scales for their children. Teachers concurrently completed the same SSRS scales as well as the Academic Competence rating for participating children. Half of participants ($n = 64$) were assigned to participate in the AAA condition and the other half ($n = 64$) was placed on a waitlist control group to receive the program at the end of the study. Participants were assigned to groups at the school level, in order to prevent potential effects of accessing animals in neighboring classrooms. Both the AAA program and the waitlist control lasted eight weeks. After the 8-week period, parents and teachers completed the same assessments a second time. They were instructed to consider only the current behavior of the children when completing the forms, to minimize carry-over effects from pre-test to post-test.

Animal-Assisted Activities (AAA) Program—For participants in the AAA program, a pair of guinea pigs lived in the classroom during the school week (Monday through Friday) throughout the 8-week program. Each class was provided with animal housing as well as a box of animal care supplies, including fresh bedding, food, soft brushes for grooming, towels for handling and floor time, cage cleaning supplies, and an informational booklet about guinea pigs and their care. Guinea pig food consisted of a high-quality guinea pig pellet, hay, and an assortment of fresh vegetables and fruit (e.g., carrots, celery, apples) provided on a weekly basis. During the school week, participants were given responsibility to feed, water and care for the guinea pigs each day under the supervision of the classroom teacher and/or the program facilitator. On weekends, guinea pigs were cared for by eligible families with suitable transportation who signed a statement agreeing to adhere to a set of guidelines for proper guinea pig care (including appropriate housing, food, cage cleanliness, temperature, and supervised handling). Each family was provided with a booklet on the care

of guinea pigs, all necessary supplies for weekend care (including housing, food, bedding, and cleaning supplies), and contact information for the researchers and local veterinarian.

On the first day of the program, the program facilitator (MEO) conducted a 15-minute introductory lesson about guinea pigs with the whole class. Lesson topics included the proper care, diet, housing, and treatment of the animals. A demonstration on careful handling of the animals was provided with strong emphasis on the requirement for teacher permission and supervision of handling. The students were informed that the guinea pigs would be their classroom pets for approximately one school term (8 weeks) and that they would be entrusted with the task of naming the animals.

Following the introductory lesson, the program facilitator visited the classroom twice a week (16 times total) to a) check the welfare of the guinea pigs, and b) conduct AAA sessions with the selected group, including one child with ASD and two typically-developing children in each class. Each session lasted 20 minutes and was conducted within regular school hours. Attendance of sessions was not mandatory, however, all participants elected to take part in sessions when they were present at school. Due to school absences, participants missed approximately one session on average over the course of the 8-week program (attendance rate $M = 95.0\%$, $SD = 8.2\%$).

All sessions followed a constructivist teaching technique, whereby the facilitator guided the topics based on the interests and requests of the students. Participants were prompted up to two times within the first 5–10 minutes of the session to ascertain activity preferences through either verbal responses or touching picture-activity cards. Discrepancies among participant preferences were resolved either through group discussion or subsequently a randomized drawing from preferred picture-activity cards. Activities were categorized and recorded by the percent of sessions in which they occurred, including: feeding (preparing vegetables, feeding by hand, designing experiments to assess food preferences; $M = 78.0\%$, $SD = 17.6\%$), grooming (brushing, clipping nails, and bathing; $M = 25.2\%$, $SD = 16.2\%$), cage cleaning ($M = 29.7\%$, $SD = 17.6\%$), construction (of toys, housing additions, mazes, etc.; $M = 25.8\%$, $SD = 19.6\%$), health monitoring (recording weight, temperament, and physical characteristics; $M = 25.0\%$, $SD = 21.2\%$), visual art (taking photographs or drawing pictures of guinea pigs; $M = 30.9\%$, $SD = 19.6\%$), and circle time (seated with guinea pigs roaming free in the middle; $M = 58.3\%$, $SD = 19.0\%$). Participants also had access to children's literature on guinea pigs, including an informational book about guinea pig care and a fictional story about a child's pet guinea pig. All sessions included physical contact with the guinea pigs in some form, whether through holding, petting, grooming, or feeding.

The role of the program facilitator during the sessions was to ensure both child and animal welfare, as well as to provide information and resources as needed. There were no targeted therapeutic goals (which are characteristic of animal-assisted therapy), but instead all sessions were open-ended to allow natural interactions between the children and animals through AAA.

Statistical Analysis

All statistical analyses were conducted using the Statistical Package for the Social Sciences (SPSS) Version 19 (Chicago, IL, USA). The dependent variable, social functioning, was operationalized as a composite of the three SSRS domains: Social Skills, Problem Behaviors, and Academic Competence. The hypothesis, that the AAA program would be associated with increases in social functioning compared with the waitlist control, was evaluated by comparing changes from before to after the 8-week study period between experimental and control group participants in each domain. Due to the nested design of the

study, where participants were nested within classrooms nested within schools, specialized analyses were employed.

Prior to analysis, descriptive statistics, including the Kolmogorov-Smirnov test, were used to examine the normality of each SSRS domain: Social Skills (parent- and teacher-report), Problem Behaviors (parent- and teacher-report), and Academic Competence (teacher-report only). All domains were normally distributed except for teacher-reported Social Skills and Problem Behaviors. However, normality was assumed for the purposes of analysis based on the Central Limit Theorem, which states that F -tests are robust against non-normal data when the sample size in each group is larger than 30 (Carlin and Doyle 2000; Wackerly, Mendenhall III and Schaeffer 2008, pp. 346–389). The sample size in each group was 64, which met this criterion. Next, the homogeneity of variances assumption was evaluated using Levene's test for between-subjects factors and F_{\max} for within-subjects factors.

All assumptions were met, therefore a nested-design 2×2 mixed-model analysis of variance (ANOVA) was conducted for each dependent variable. The between-subjects factor was Group (experimental vs. control), where the experimental group contained participants in the AAA program and the control group contained participants on the waitlist control. The within-subjects factor was Time (pre-test vs. post-test), where pre-test indicated assessments which took place prior to the 8-week study period and post-test indicated assessments that took place following the 8-week study period. The dependent variables were the five SSRS domain scores: SSRS Social Skills (teacher- and parent-report), SSRS Problem Behaviors (teacher- and parent-report), and Academic Competence (teacher-report only). For each significant between-subjects factor on the nested-design ANOVA, follow-up nested-design one-way ANOVAs were conducted. The SSRS domain scores were evaluated by comparing pre-test and post-test scores separately for each Group. In order to correct for multiple individual tests, a Bonferroni-adjusted alpha value of $p < 0.01$ was used for all tests, which were two-tailed (Tabachnick and Fidell 2012). The reported effect sizes are eta-squared (Cohen 1988).

Results

Across 128 participants, complete SSRS assessments at both pre-test and post-test were received from teachers for 99% ($n = 127$) of participants from parents for 77% ($n = 99$) of participants. Academic Competence was rated by teachers for all children over the age of four ($n = 126$) because the academic assessment was deemed inapplicable to children younger than age five.

A series of 2×2 nested-design ANOVAs (participants nested within classrooms nested within schools) were conducted with the between-subjects factor of Group (experimental vs. control) and the within-subjects factor of Time (pre-test vs. post-test). Dependent variables included teacher- and parent-reported SSRS Social Skills and SSRS Problem Behavior raw scores, as well as teacher-reported SSRS Academic Competence. Group means and standard deviations for each SSRS domain are reported in Table 2.

Results indicate that participants in the AAA condition showed significantly greater increases in SSRS Social Skills from pre-test to post-test, as reported by teachers ($F_{(89, 164)} = 2.60, p < 0.001, \eta^2 = 0.59$), and significantly greater decreases in SSRS Problem Behaviors, as reported by teachers ($F_{(89, 164)} = 3.09, p < 0.001, \eta^2 = 0.63$) and parents ($F_{(83, 123)} = 1.73, p = 0.003, \eta^2 = 0.54$), than control group participants. There were no significant changes between groups from pre- to post-test on parent-reported SSRS Social Skills ($F_{(83, 124)} = 1.34, p = 0.07$), or teacher-reported SSRS Academic Competence ($F_{(88, 163)} = 1.12, p = 0.267$). Therefore, teachers perceived that children in the AAA

program engaged in more socially skilled behaviors, and both teachers and parents perceived fewer problem behaviors after the 8-week trial period, compared with their control group peers (Table 2).

Significant interactions were followed up with nested-design one-way ANOVAs (participants nested within nested classrooms within schools) to examine where significant changes took place. For participants in the AAA condition, there were significant changes from pre-test to post-test on teacher-reported SSRS Social Skills ($F_{(57, 68)} = 3.51, p < 0.001, \eta^2_p = 0.75$), and SSRS Problem Behaviors ($F_{(57, 68)} = 3.51, p < 0.001, \eta^2_p = 0.75$), but not on parent-reported SSRS Social Skills ($F_{(51, 38)} = 1.23, p = 0.256$), SSRS Problem Behaviors ($F_{(51, 38)} = 1.57, p = 0.076$), or teacher-reported SSRS Academic Competence ($F_{(56, 67)} = 1.30, p = 0.153$). For participants in the control group, there were no significant changes from pre-test to post-test on any measure: SSRS Social Skills as reported by teachers ($F_{(31, 96)} = 1.37, p = 0.126$) and parents ($F_{(31, 86)} = 0.93, p = 0.577$), SSRS Problem Behaviors as reported by teachers ($F_{(31, 96)} = 1.68, p = 0.029$) and parents ($F_{(31, 85)} = 1.23, p = 0.230$), and SSRS Academic Competence ($F_{(31, 96)} = 0.73, p = 0.841$). Therefore, teachers perceived that students in the AAA group engaged in more socially skilled behaviors and less problem behaviors following the program than prior to it; however, teachers did not perceive substantial changes for control group participants (Table 2).

Follow-up analyses were conducted in order to determine whether there were differences in outcomes between pet owners and non-owners. For participants in the AAA condition, a series of one-way ANOVAs for pet ownership (pet owners vs. non-owners) were conducted, with SSRS change scores (difference between pre-test and post-test) as the dependent variables. No significant main effects for pet ownership were found for any SSRS domain (all $F_{(42-55)} < 0.55$, all p s > 0.462), indicating that changes following the program were not contingent upon prior experiences with companion animals in the home.

There was also no correlation between teachers' initial level of desire to participate and teacher-reported SSRS domain change scores from pre-test to post-test for SSRS Social Skills (Spearman's $r_{(61)} = -0.04, p = 0.751$), SSRS Problem Behaviors ($r_{(61)} = 0.03, p = 0.803$), or SSRS Academic Competence ($r_{(59)} = 0.04, p = 0.784$). Therefore, a teacher's positive feelings toward participating in the program did not appear to positively bias his or her ratings of specific behavioral outcomes following the program. Following the AAA program, half of teachers (50.0%) chose to adopt the guinea pigs to keep in their classroom, and the remaining guinea pigs were adopted by families of children who participated in the program. There were no significant differences in any teacher-reported outcomes between teachers who chose to adopt the animals and those who did not (all $F_{(59-61)} < 1.04$, all p s > 0.078). Thus, children whose teachers decided to keep the animals did not appear to fare better in testing on the SSRS.

Discussion

This study evaluated the effects of an 8-week classroom-based AAA program with guinea pigs compared with a waitlist control. Results indicated that both parents and teachers reported greater improvements in social functioning in the AAA condition compared with the control condition, as defined by greater increases in social skills and reductions in problem behaviors. For AAA participants, teacher reports indicated significant increases in social skills and decreases in problem behaviors from pre-test to post-test. No corresponding changes were seen in control group participants. Half of teachers elected to adopt the guinea pigs following the AAA program, in order to maintain the perceived benefits of having an animal in their classroom. These findings suggest that an AAA program in the primary

school classroom may be a feasible way to improve teacher perceptions of social functioning, compared with current classroom practices.

It is important to note that these results demonstrate the efficacy of the program as a whole, but not necessarily the specific influence of the animals themselves. However, the results are consistent with previous research on animals in the classroom. For example, improvements in social skills following the AAA program support previous research, which demonstrates that the presence of a visiting dog in the school classroom is associated with increased social cohesion (Hergovich et al. 2002; Kortschal and Ortbauer 2003). They also support qualitative survey data from teachers, which indicate that teachers report classroom pets to be associated with increased psychological well-being (Rud and Beck 2000, 2003) and enhanced socio-emotional development (Daly and Suggs 2010). Previous research involving animals in social situations has demonstrated that the presence of an animal can make a situation or person appear less threatening (Lockwood 1983, pp. 70–71; Friedmann and Lockwood 1991). Animals have often been called “social lubricants,” in that they facilitate social interactions between the people around them. For example, people are more likely to initiate friendly conversation with a stranger if an animal is present (McNicholas and Collis 2000). This effect has been demonstrated with a number of animals, including smaller animals such as rabbits and less mobile animals such as turtles (Hunt, Hart and Gomulkiewicz 2001). It is possible that the presence of the guinea pigs made the classroom environment and its participants feel more calm and secure, thereby opening opportunities for increased social engagement and socio-emotional development.

Decreases in problem behaviors following the AAA program support previous studies on visiting dogs in the classroom, which have demonstrated that in the presence of a dog, children demonstrate decreases in aggression and hyperactivity (Hergovich et al. 2002; Kortschal and Ortbauer 2003; Tissen, Hergovich and Spiel 2007). They are also consistent with previous research demonstrating that in the presence of an animal, aggressive children behave more cooperatively, are less antagonistic, and display greater social competence (Katcher and Wilkins 2000, p. 171). Animals have often been labeled as attachment or transitional objects for children, which provide comfort and can reduce stress and anxiety (Triebenbacher 1998; Friedmann and Son 2009; Kruger and Serpell 2010, pp. 40–41). In the present study, reductions in problem behaviors may suggest that the animal's presence in the classroom provided a calming effect, which minimized children's impulses to act out. Further studies might elucidate this relationship by examining the stress reducing effect of animals as a potential mechanism for decreased problem behaviors and increased social functioning in the school classroom.

The current study found no significant changes in Academic Competence over the course of the intervention period, for either the experimental or the control group. One reason for this finding may be that the SSRS Academic Competence domain is a rating of a child's academic performance *relative* to the other members of the class. All children in experimental classrooms had access to the animals that lived in the classroom. Therefore, any changes in academic competence may have been similar for all individuals in the class, resulting in no changes relative to one's classmates. Previous research has documented positive correlations between young children's social skills and academic competence (Bursuch and Asher 1986; Wentzel 1991), as well as improved cognitive functioning in the presence of a dog in the classroom (Gee, Church and Altobelli 2010; Gee, Crist and Carr 2010; Gee et al. 2012). Therefore, it may be worthwhile to replicate the present study with a measure of academic competence that is not contingent upon comparison with other classmates, who also experience the animals' presence.

Limitations and Future Directions

The current study provides novel and promising findings, yet there are caveats to consider that may provide avenues for future research. The most salient limitation is the inability to determine whether the results were due to the animals themselves or other facets of the program (see Marino 2012). For instance, changes following the intervention for the experimental group may have been due to the presence of a new person regularly visiting the classroom rather than the AAA program. Although the waitlist design controls for changes due to the passing of time, it does not identify the “active ingredient” of the intervention, whether it be the animal or the focused attention of small-group activities on a weekly basis. Future studies might account for this limitation by including a control group that receives the same frequency and duration of sessions without the presence of the animal. The present study therefore provides evidence for effects of the overall program, but does not differentiate the specific components most responsible for reported outcomes.

Another limitation was the use of parents and teachers as raters of participants' behavior. They were not blind to the presence of the animal in the classroom and their ratings may have been influenced by awareness that children were involved in the program. It is notable that although both parent- and teacher-reports showed fewer problem behaviors for the experimental group than the control group, only teacher-reports showed greater social skills. Additionally, significant changes from pre-test to post-test in the experimental condition were *only* found in teacher-reports. Improvements on parent-reports of social functioning did not reach significance. This suggests that improvements from the program were perceived more by teachers than by parents. This may be due to the fact that teachers observed children's behavior at school, in the presence of the guinea pigs. Alternatively, it may indicate an expectancy bias such that teachers were more invested in the intervention, resulting in positive outcomes because they devoted time and effort in the animals. Where possible, future studies along these lines should use observers who are blind to experimental condition, in order to eliminate this potential bias (O'Haire et al. 2013).

A further limitation is that the current study did not assess the effects of the guinea pigs on children in the classroom who did not participate in the AAA sessions, but nevertheless were exposed to the animals on a daily basis. It would be worthwhile to investigate whether or not there were classroom-wide effects of having the animals present in the classroom. Further studies might also examine additional outcome variables such as empathy and animal-care knowledge. The program itself might also be modified to incorporate the animals into formal classroom learning and curriculum in order to more fully engage the whole class and assess the impact of animal presence on learning outcomes.

The AAA program in this study was somewhat unique, in that each group contained one child with ASD. The presence of a child with ASD may have influenced the group dynamic and outcomes of the experimental condition. It might be worthwhile in future studies to examine the impact of AAA on typically-developing children without the presence of a child with ASD. However, given the increasing number of children with ASD and other specialized needs in mainstream classrooms (Harrower and Dunlap 2001), this aim may not have practical value. Educational institutions may be more likely to devote resources to assisting students whose behaviors tend to thwart classroom productivity than typically-developing students. Therefore, a program which can accommodate both special needs and typically-developing children in a group-level design may be a more efficient means to improving the classroom environment and social functioning than individualized or segregated interventions. Further studies might focus on assessing changes in classroom productivity and the effects of the child with ASD on the whole class following AAA, as a means to gauge program effectiveness.

Finally, although this study supports findings from previous research on dogs in the classroom, it did not contain a direct comparison between different types of animals. Future studies should systematically evaluate these differences in order to determine whether differences exist based on animal species, including dogs, guinea pigs, and other types of visiting and residential classroom pets. It may also be informative to compare a live animal with a stuffed animal or inanimate object, in order to determine whether effects are due to interacting with an animal or simply to the presence of a novel or engaging object. Novelty effects may be different for visiting classroom animals versus resident classroom animals. In the present study, the novelty of the guinea pigs may have declined over the 8-week study period, minimizing the impact of this factor. Further research into the mechanisms and factors that may contribute to increases in social functioning following child–animal interactions will be critical in order to design the most effective AAA for educational settings.

Conclusion

To the best of our knowledge, this is the first controlled study of an AAA program with guinea pigs in the school classroom. The results support our hypothesis that the program would be associated with increased social functioning compared with a waitlist control group. These findings suggest that including an AAA program in the school classroom may be an effective way to increase opportunities for positive child–animal interaction. Further studies will be necessary to determine whether the animal itself is the “active ingredient” in these types of programs. If so, it is noteworthy that the amount of time children spend interacting with animals is largely regulated by their school and home environments. The school setting is rapidly transitioning away from the natural environment outdoors into the highly technological and isolated environment indoors (Kahn and Kellert 2002). Including animals in primary school classrooms may be an ideal way to incorporate interaction with living creatures into an increasingly hectic, technology-driven world (Gee 2010, p. 137). Particularly for children without companion animals in the home, the classroom may provide a convenient arena for facilitating child–animal interactions.

In sum, the present study represents an innovative examination of the effects of HAI in a classroom setting on children’s social functioning. Although results are preliminary, they support the notion that including animals in the primary school classroom may be beneficial for young children’s social functioning and is worthy of further investigation.

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Table 1

Demographic variables for the animal-assisted activities (AAA) experimental group ($n = 64$) and the control group ($n = 64$).

Variable	Experimental Group	Control Group
<i>Gender</i>		
Male	41	30
Female	23	34
<i>Age (years)</i>		
Range	4.8–11.9	5.1–12.7
Mean (<i>SD</i>)	8.2 (2.1)	9.0 (2.4)
<i>School Year</i>		
Range	0–7	0–7
Mean (<i>SD</i>)	3.3 (2.1)	3.9 (2.6)
<i>Pet Ownership</i>		
Yes	37	44
No	21	15
Not reported	6	5

Table 2

Mean parent and teacher SSRS domain ratings at pre- and post-test.

Variable	Possible Range	n	Pre-Test M	Pre-Test SD	Post-Test M	Post-Test SD	F _{between}	F _{within}
<i>Teacher</i>								
Social Skills								
Experimental	0–60	63	43.94	12.51	45.98	10.87	2.02***	3.51***
Control		64	49.06	9.44	49.30	9.76		1.37
Problem Behaviors								
Experimental	0–36	63	7.92	8.33	7.57	8.66	2.96***	3.51***
Control		64	6.36	5.83	5.83	5.66		1.68
Academic Competence								
Experimental	1–45	61	30.16	8.06	30.90	8.18	0.96	
Control		64	33.59	7.83	33.75	8.39		
<i>Parent</i>								
Social Skills								
Experimental	0–80	44	56.13	9.38	59.86	9.86	1.50	1.23
Control		55	52.14	8.78	53.95	8.40		0.93
Problem Behaviors								
Experimental	0–36	44	12.39	6.61	11.09	5.89	1.68**	1.57
Control		55	9.81	4.87	9.17	4.70		1.23

Note: Bonferroni-adjusted alpha values of ** $p < 0.01$ and *** $p < 0.001$ are presented.