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“Rabbit Rescuers”: A School-Based Animal Welfare Education Intervention for Young Children

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ABSTRACT

This study evaluated the effectiveness of a Scottish SPCA animal welfare education intervention, “Rabbit Rescuers,” on 5- to 7-year-old children’s belief in animal minds, rabbit welfare knowledge, attitudes toward cruelty, and attachment to pets. “Rabbit Rescuers” was a one-week intervention comprising daily 15-min rabbit welfare activities delivered in school by classroom teachers. The activities were designed to be age-appropriate and covered key elements of rabbits’ behavior and cognitive abilities, welfare needs (including diet, housing, and natural behaviors), and rabbit care including safe handling and health care (role play as vets). A mixed-method longitudinal design was employed comparing three intervention conditions: mechanical rabbits; soft toy rabbits; and control (education as usual). A sample of 123 children from two age groups (Primary 1 [5- to 6-year-olds] and Primary 2 [6- to 7-year-olds]; 65 boys and 58 girls) in one school participated in the study and were interviewed individually before and after the intervention. Multiple mixed-factor ANOVAs showed that children in the intervention groups improved significantly more than control children in terms of rabbit welfare knowledge, understanding of rabbits as sentient, and attachment to pets. There was also a reduction in attitudes that rabbit cruelty is acceptable among the intervention groups at post-test. The intervention was effective for children regardless of their age. Importantly, the intervention had a stronger impact for children interacting with the interactive mechanical rabbits compared with those who interacted with the soft toy rabbits for all the variables, except for attachment to pets. The findings show that animal welfare education can be effective for young children and that age-appropriate activities support children’s knowledge acquisition and attitude change relating to animal welfare. Importantly, the results highlight that mechanical or robotic animals might be highly effective animal welfare education resources.

KEYWORDS

Animal welfare; children; cruelty prevention; human–animal interaction; humane education; rabbits

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Rabbits are the third most common companion animal in the UK, with around one million of them kept as pets (People's Dispensary for Sick Animals (PDSA), 2020). However, they often experience unintentional cruelty and neglect (e.g., Oxley, 2013; Schepers et al., 2009). Martin (2012) found that the majority of pet rabbits are not living happy and healthy lives in the UK, and the PDSA (2020) report that 26% of the rabbits live in hutches that are too small, 18% are fed muesli-type food, 47% live without a companion rabbit, 14% receive no preventative health care, and 56% of owners report wishing to change at least one of their rabbit's behaviors. Rooney et al. (2014), in a large survey of UK rabbit owners, showed that less than one-quarter of pet rabbits were given continual access to exercise areas, only 42% lived with a companion rabbit, 61% were reported not to be calm when handled by their owner, and the majority were not fed the recommended amount of hay. Low fiber intake has been implicated in the development of digestive and dental disease in pet rabbits (Bennegadi et al., 2001; Crossley, 2003).

This negative treatment of pet rabbits is, in part, due to a lack of knowledge of rabbit welfare needs and an understanding that rabbits are sentient with their own behavioral repertoire. Edgar and Mullan (2011) found that at the time of purchasing a pet rabbit many customers have very limited knowledge of rabbit welfare needs, particularly their dietary and social needs. Furthermore, rabbit owners' knowledge was a significant predictor of intended husbandry of their pet rabbits. Around 24% of rabbit owners report having been bitten by their pet at least once (Normando & Gelli, 2011), indicating a lack of knowledge of how to appropriately handle rabbits (Bradbury & Dickens, 2016). Rioja-Lang et al. (2019), in a Delphi study of animal welfare experts, confirmed these rabbit welfare issues and attributed them, at least in part, to a lack of owner knowledge of rabbit care and behavior.

Thus, pet rabbits in the UK are affected by numerous welfare issues as a consequence of lack of knowledge of rabbit welfare needs. Importantly, many rabbits are children's pets. Children's knowledge of animals' welfare needs (Aguirre & Orihuela, 2010; Burich & Williams, 2020), their attachment to pets (Hawkins et al., 2017a; Muldoon, Williams & Currie, 2019; Muldoon, Williams, Lawrence, et al., 2019), their understanding of animal sentience and animal cognition (Hawkins & Williams, 2016; Menor-Campos et al., 2018) and their attitudes toward animals (Menor-Campos et al., 2019) all influence their interactions with animals, including pet care. As animal cruelty is found even among young children (Hawkins et al., 2017; Wauthier et al., 2020), it is important to intervene early (Miller, 2001).

There is a growing body of research on animal welfare education interventions for children. These interventions aim to promote positive interactions between children and animals by addressing children's knowledge, attitudes, and behavior. An evaluation of the Scottish Society for the Prevention of Cruelty to Animals' (Scottish SPCA) "Prevention Through Education" program with 1,217 7–13-year-old Scottish schoolchildren (Hawkins et al., 2017b) demonstrated improvements in animal welfare knowledge and understanding of animal minds. Furthermore, digital animal welfare games specifically on pet welfare (Hawkins et al., 2020) and farm animal welfare (Hawkins et al., 2019) reveal that interactive activities can enhance changes in welfare knowledge and attitudes toward animal cruelty. Mariti et al. (2011) found a classroom-based intervention for 9- to 11-year-olds led to greater knowledge of animal welfare, reduced fear of pets, improved perceptions of

animals and a sense of responsibility toward them. An animal welfare intervention with Mexican 8- to 10-year-olds (Lakestani et al., 2015) resulted in increased knowledge of farm animals and positive attitudinal change. Furthermore, Jamieson et al. (2012) found that a chicken welfare educational event for 13- and 14-year-olds led to increased knowledge about chickens and higher endorsements of positive behaviors toward chickens. Recently, a UK study of a canine welfare education intervention for 7- to 11-year-olds showed learning gains following two Dogs Trust (dog charity) workshops about dogs and dog care (Baatz et al., 2020). However, there is a need for more research to evaluate the efficacy of animal welfare education interventions, especially for young children (Arbour et al., 2009; Miller, 2001).

“Rabbit Rescuers” is an educational intervention developed by the Scottish SPCA for 5- to 7-year-old Scottish schoolchildren. It aims to teach children about rabbit welfare needs through interactive activities involving toy rabbits (either soft toys or mechanical toys that move and make noises) to increase children’s knowledge of rabbit’s welfare needs and rabbit sentience, increase attachment to pets, and decrease attitudes that cruelty to rabbits is acceptable. A secondary aim was to explore the value of interactive toys as educational tools for animal welfare education; specifically, to investigate how the interactivity of the toy animal aided knowledge acquisition and attitude change. Previous research shows that children are more motivated to engage with pet toys when they are interactive (Stanton et al., 2008). Furthermore, animal welfare education research suggests that more interactive activities might be more effective in producing not only knowledge change but also change in attitudes. Thus, the three conditions (mechanical rabbits, soft toy rabbits, no-intervention control) would test whether the higher interactivity of the mechanical toy rabbits would be most effective in promoting children’s learning. Live rabbits were not included in the intervention owing to concerns for their welfare, and Scottish SPCA policy is not to include live animals in their school-based education program. The evaluation research was conducted independently of the Scottish SPCA.

Research Questions

- (1) How effective is “Rabbit Rescuers” for improving knowledge of rabbit welfare needs, understanding of rabbit sentience, attitudes toward rabbit cruelty, and attachment to pets?
- (2) Does the interactivity of the toy rabbits influence the effectiveness of the intervention?
- (3) Is the effectiveness of “Rabbit Rescuers” influenced by children’s age?

Methods

Ethical approval for the research was granted by the Clinical and Health Psychology Ethics Committee, University of Edinburgh. The study also gained ethical approval from Midlothian Local Authority who granted research access to schools.

Design

A mixed factorial design with three factors was used to evaluate the intervention. One variable was the phase of testing (time), a repeated-measure factor with two levels: pre-test (week before the intervention) and post-test (week after the intervention). The between-subject variables were the condition participants were assigned to (intervention with soft toy rabbits, intervention with mechanical rabbits, no-intervention control group) and the age group of participants (Primary 1 [5–6-year-olds] or Primary 2 [6–7-year-olds]). For ease of international comparison, we report the year groups in terms of ages throughout. The dependent variables were participants' scores on: knowledge of rabbit welfare needs, rabbit sentience, attitudes toward rabbit cruelty, and attachment to pets.

Participants

Participants were 123 schoolchildren (65 boys and 58 girls) from a Scottish primary school. Parental consent was initially requested of parents of 130 children; only one child did not receive parental consent to participate. Four children were absent from school either at pre- or post-test and two children did not assent to participate, resulting in 123 children. Children were aged between 5- and 7-years-old ($M = 5.83$, $SD = 0.65$) and were sampled from six classes of two year-groups (three classes from Primary 1, ages 5–6 years, and three classes from Primary 2, ages 6–7 years). The sample included 63 5–6-year-olds and 60 6–7-year-olds. Children's classes were semi-randomly assigned to one of the three conditions (two classes per condition; one from Primary 1 (5–6-year-olds) and one from Primary 2 (6–7-year-olds)): 41 in the soft toy rabbit condition, 42 in the mechanical rabbit, and 40 in the no-intervention control group. Children in all conditions were interviewed pre- and post-intervention (see Results for a detailed breakdown of sample characteristics).

Materials

"Rabbit Rescuers" Intervention: The intervention consisted of five structured 15- to 30-min interactive activities administered each day of a school week by class teachers. Each intervention class was provided with the intervention task equipment, intended learning outcomes, and teacher instructions (see Table 1). The pack for each intervention class included two toy rabbits (either two mechanical rabbits or two soft toy rabbits). The mechanical rabbits were low-cost fur-covered toys that hopped and made noises, thereby facilitating greater interaction with the children, whereas the soft fur toy rabbits were inert but could be handled. The external appearance and size of the mechanical and soft toy rabbits was similar, but they differed in that the mechanical toy had a solid internal structure and actions (movement and sound). The main themes of the intervention were rabbit welfare needs (e.g., appropriate diet and cage requirements), appropriate rabbit care, becoming responsible owners, and understanding rabbits' sentience and natural behaviors (see Table 1). Following completion of the evaluation, teachers were asked to complete a feedback form on the intervention including: fidelity of delivery, feedback on activities and materials, age-appropriateness and curriculum fit. Responses

Table 1. [Rabbit Rescuers] intervention activities, equipment, and learning outcomes.

	Activity	Equipment	Learning Outcomes
Day 1	“Liv’s Story” Story about a child learning about rabbits’ needs before rehoming two rabbits from a welfare charity.	Story book (developed for the intervention). Toy Rabbits. Pet Carrier. Rabbit needs picture chart.	Knowledge of rabbit welfare needs. Rabbit behavior. Appropriate handling. Knowledge of Scottish SPCA.
Day 2	“Happy/Sad Rabbit” Image based recognition task of rabbit welfare needs including positive (large hutch and run) and negative (fireworks) items, and images of welfare conditions (e.g., poor living environment)	Set of 21 large posters for class work with images of rabbit welfare needs and rabbit welfare conditions and response options of “happy” or “sad” for class discussion. Toy rabbits.	Knowledge of rabbit welfare needs. Knowledge of harm of compromised welfare. Understanding of responsible rabbit ownership.
Day 3	“Rabbit Run” This activity involved measuring out a hutch and run for rabbits, outlining them on the floor with ribbon, and placing all items required for rabbit welfare and toy rabbits within it.	Poster of drawing of hutch and run with all measurements. Welfare items: water bottle, food bowl, straw, hay, vegetables, etc. Toy Rabbits.	Knowledge of rabbit welfare needs. Understanding of responsible pet ownership. Demonstration of compassionate behavior towards rabbits.
Day 4	“Vet Check-up” Role play activity (veterinarian, veterinarian nurse, family) to consider rabbit health and simulate a visit to a veterinary surgery. Children complete health check-up following a checklist.	Veterinarian costume. Veterinarian nurse costume. Pet carrier. Syringe (no needle). Microchip reader. Toy rabbits. Veterinarian rabbit health check-up checklist.	Understanding of rabbit health needs. Understanding the roles of veterinary professionals.
Day 5	“Consolidation Session” Class discussion revisiting activities and main learning outcomes	No specific equipment.	Rabbit welfare needs. Appropriate handling. Responsible pet ownership.

indicated high intervention fidelity, and feedback was used to refine the intervention for national release.

Pre-Questionnaires and Post-Questionnaires: Pre- and post-interviews comprised the same scales, but pre-intervention interviews also included items on demographics (sex, age, date of birth) and pet ownership experience (“Do you like pets?”, “What pets have you got at home?”, “Do you have a pet that is your own?”, “Do you have a pet rabbit at home?”). Post-intervention interviews for children in intervention groups asked them to rate the following statements about “Rabbit Rescuers” on a 5-point Likert scale (from strongly disagree to strongly agree): “I liked Rabbit Rescuers,” “I enjoyed the activities,” “I learned a lot about rabbits,” “I like rabbits more now,” “I know how to look after rabbits now.” These data were used to inform refinements of the intervention activities and materials for national release.

Knowledge of Rabbit Welfare Needs: Knowledge of rabbit welfare needs was assessed by using five open-ended questions related to the five pets’ welfare needs (environment, diet, behavior, companionship, and health) indicated by the UK Animal Welfare Act (2006). Children were asked: “What do you know about rabbits?”, followed by the five questions (e.g., “What should you give a rabbit to eat and drink?”, “What should you give a rabbit to live in?”). A coding scheme was developed to classify answers as

correct or incorrect (e.g., “water” and “hay” were among correct answers for what to give a rabbit to eat). Responses were coded by assigning one point for each correct answer (there could be more than one correct answer) and zero points for each wrong or irrelevant answer. Higher scores indicated higher levels of rabbit welfare knowledge. Three researchers each coded 41 interviews individually and an additional 20 that were previously coded by each of the other two researchers (10 each). Inter-rater reliability was 92%.

Children’s Beliefs about Rabbit Sentience: The Children’s Beliefs about Animal Minds (Child-BAM) (Hawkins & Williams, 2016) measures children’s understanding of animals’ minds and sentience. It includes five items relating to emotional and cognitive capacities (clever/pain/happiness/sadness/fear) for different animals. In the present study, these questions were asked in relation to rabbits only. The standard question form was: “Do you think rabbits are/can feel ...?” Items were scored on a 5-point Likert scale (1 = “strongly disagree” to 5 = “strongly agree”). Higher scores indicated greater beliefs about rabbit sentience. The scale has been previously shown to have high internal consistency ($\alpha = 0.92$); and for this study it was good ($\alpha = 0.65$).

Children’s Attitudes Toward Rabbit Cruelty: Hawkins et al.’s (2020a) Children’s Attitudes toward Animal Cruelty (CAAC) was used in this study. The CAAC is an 11-item scale testing children’s views on intentional and unintentional animal cruelty, where children are asked: “How acceptable do you think it is to ...?” in relation to 11 behaviors. For the purpose of this study, the questions were asked in relation to rabbits specifically, rather than animals in general (e.g., “annoy a rabbit on purpose,” “forget to feed a rabbit”). Answers were scored on a 5-point Likert scale (1 = “not at all acceptable,” 2 = “not acceptable,” 3 = “not sure,” 4 = “acceptable,” 5 = “very acceptable”). Lower scores indicated more negative attitudes toward intentional and unintentional cruelty toward rabbits. The scale had good internal consistency ($\alpha = 0.80$).

Attachment to Pets (SAPS): The Short Attachment to Pets Scale (SAPS) for Children and Young People (Marsa-Sambola et al., 2016) measures children’s attachment to pets. It comprises one scale where children are asked: “Please tell us how you feel about your favourite pet animals.” This is followed by eight statements (e.g., “I talk to my pet quite a lot (or would if I had one)” and “my pet makes me feel happy (or would if I had one)”) for which answers were scored on a 5-point Likert scale (1 = “strongly disagree” to 5 = “strongly agree”). Higher scores signified higher attachment to pets. The scale had high internal consistency ($\alpha = 0.90$).

Procedure

The study comprised three phases run in three consecutive weeks: Pre-test data collection in week one, delivery of the intervention by the teachers in week two, and post-test data collection in week three. Parental information sheets and consent forms were completed before data collection and children were asked to give their written assent to participate.

Pre-Test: During week one, each child was interviewed individually. When all the children of one class were interviewed, interviewers proceeded with the next class. Interviews were carried-out in a classroom made available for the project. First, standardized information about the study was provided and a child-friendly assent form was completed.

Interviews lasted approximately 15 min for each child. Interview questions were read aloud and children were instructed to say their answers or to point to their answers on response cards provided. Children's responses were recorded in writing by the interviewer on a standardized form.

Intervention Week: During each day of week two, classes assigned to the intervention condition participated in "Rabbit Rescuers." Allocation of school classes into conditions had been previously carried out by the school using a simple semi-randomization method. While any of the three classes in each age group was randomly assigned to one of the three intervention conditions, each of the conditions incorporated a class from each age group. Children in the no-intervention control group did not receive any intervention, continued with regular classes throughout the week (with no material on rabbits, rabbit welfare or animal welfare) and received the intervention after the study was completed.

Post-Test: Post-test data collection followed the procedure of pre-test. Children were interviewed in the same order as the pre-test. Children who participated in the interventions were asked additional questions on "Rabbit Rescuers" activities. At the end of the interviews, children were given a sticker as a reward and a certificate of participation.

Statistical Procedure

Before the main analyses, the data were checked for normality and assumption violations. As a consequence of this, the dependent variable "children's belief in animal minds" (BAM; pre- and post-) was transformed using reflect and logarithm transformation (log 10). To check whether the assignment of whole classes to conditions had resulted in an uneven distribution of demographics, preliminary Pearson's chi-square and Fisher exact test analyses were run to explore whether there was an association between the three conditions on the one hand, and gender, age group, pet ownership and pet type on the other. As some of the pet type categories presented with very low frequencies, they were combined into one category of "Other," resulting in five categories (dog, cat, rabbit, other, and more than one pet).

To explore the research questions, a mixed factor $2 \times 3 \times 2$ multivariate analysis of variance (MANOVA) was conducted with condition (soft toy rabbit, mechanical rabbit, control) and age group (5–6 and 6–7-year-olds) as between-subject factors, and time (phase of testing: pre- and post- tests) as a within-subject factor. Results were further explored with ANOVAs and simple effect analyses using Bonferroni adjustment. As we did not match groups according to previous levels of the dependent variables (rabbit welfare knowledge, BAM, attitudes to cruelty toward rabbits, or pet attachment), our focus for the analyses here was on the main effect of time and on interaction effects that include the factor time to assess changes in the intervention groups at post-test not exhibited by the control group (i.e., time*condition, time*condition*age group). Preliminary analyses of pet ownership as a co-variate in the MANOVA and subsequent ANOVAs were non-significant and showed that this factor did not influence the results. Consequently, the results are reported without the covariate to simplify the presentation.

Results

Sample Characteristics

Sample characteristics relating to age, gender, age group, and pet ownership separately for each condition are shown in [Table 2](#).

Frequency analyses revealed no significant association between the three conditions, and gender, age group, pet ownership, and pet type. This suggests that, despite the allocation of whole classes to each of the conditions, there was a similar distribution of each of these demographics across the three conditions.

Descriptive Statistics

Descriptive statistics of mean scores and standard deviations on each key variable at pre- and post-test for the three conditions and two age groups are shown in [Table 3](#).

MANOVA

There was a significant main effect of time, age group, and condition (see [Table 4](#) for MANOVA results). We found two-way interactions between time and condition, time and school, and condition and age group. There was no three-way interaction between time, condition, and age group. Follow-up univariate analyses for each dependent variable separately are presented below and in [Table 4](#).

Knowledge of Rabbit Welfare Needs (ANOVA)

We found significant main effects of time, age group, and condition for knowledge of welfare needs ([Table 4](#)). More specifically, children displayed significantly higher

Table 2. Sample characteristics presented for each condition.

		Soft Toy <i>n</i> (%)	Mechanical Toy <i>n</i> (%)	Control <i>n</i> (%)	Totals <i>n</i> (%)
Age (years)	Total*	6.15 (0.79)	5.62 (0.59)	5.73 (0.45)	5.83 (0.65)
	Age Group 5–6*	5.50 (0.51)	5.29 (0.46)	5.42 (0.53)	5.40 (0.49)
	Age Group 6–7*	6.76 (0.44)	6.06 (0.24)	6.00 (0)	6.28 (0.45)
Gender	Female	19 (15.4)	21 (17.1)	22 (17.9)	62 (50.4)
	Male	22 (17.9)	21 (17.1)	18 (14.6)	61 (49.6)
Age group (years)	5–6	20 (16.3)	24 (19.5)	19 (15.4)	63 (51.2)
	6–7	21 (17.1)	18(14.6)	21 (17.1)	60 (48.8)
Like of pets	Yes	40 (32.5)	42 (34.2)	40 (32.5)	122 (99.2)
	No	1 (0.8)	0 (0)	0 (0)	1 (0.8)
Family pet	Yes	27 (22.0)	25 (20.3)	27 (22.0)	79 (64.2)
	No	14 (11.4)	17 (13.8)	13 (10.6)	44 (35.8)
Type of pet	Dog	5 (6.3)	8 (10.1)	6 (7.6)	19 (24.1)
	Cat	6 (7.6)	9 (11.4)	5 (6.3)	20 (25.3)
	Rabbit	2 (2.5)	2 (2.5)	3 (3.8)	7 (8.9)
	Other	9 (11.40)	4 (5.1)	7 (8.9)	20 (25.3)
	> One pet	6 (6.6)	1 (1.3)	6 (7.6)	13(16.5)
	Total	28 (35.4)	24 (30.4)	27 (34.2)	79 (100)

Note: Values presented are means with standard deviation in parentheses. Family Pet refers to whether the family own a pet. Category “Other” in Type of Pet includes small mammals, fish, and other; rabbit ownership was retained as an independent category due to the focus of the study on rabbit welfare.

*Percentages are calculated from total sample.

Table 3. Means and standard deviations at pre- and post- test for each of the four dependent variables across conditions and school years.

	Soft toy rabbit				Mechanical rabbit				Control group			
	Pre-test		Post-test		Pre-test		Post-test		Pre-test		Post-test	
	AG 1	AG2	AG1	AG2	AG 1	AG2	AG1	AG2	AG 1	AG2	AG1	AG2
Welfare knowledge	4.10 (1.41)	5.05 (2.04)	6.25 (2.24)	8.76 (2.34)	3.67 (1.55)	5.83 (2.28)	6.71 (2.97)	9.83 (4.19)	4.84 (1.68)	4.38 (1.32)	4.84 (1.42)	4.95 (1.63)
Rabbit sentience	21.40 (3.14)	22.90 (2.59)	21.95 (3.12)	24.29 (1.35)	20.21 (3.60)	22.11 (2.74)	23.54 (2.77)	24.44 (1.20)	22.74 (3.02)	21.00 (3.16)	23.00 (2.94)	21.38 (4.61)
Attitudes toward cruelty	28.4 (6.81)	23.38 (4.07)	19.20 (5.01)	20.05 (5.33)	24.71 (5.08)	24.67 (5.25)	18.08 (6.44)	18.72 (5.80)	20.89 (7.50)	20.86 (4.21)	20.89 (7.72)	18.86 (4.28)
Attachment to pets	36.15 (6.40)	37.52 (4.49)	38.90 (4.96)	40.14 (4.73)	37.54 (5.33)	37.89 (5.60)	38.63 (6.75)	40.28 (4.93)	38.74 (5.40)	36.81 (5.02)	39.32 (5.42)	38.43 (5.16)

Note: Standard deviations are presented in parentheses. AG1 = 5–6 years; AG2 = 6–7 years. Whilst scores for “rabbit sentience” had been transformed with reverse and logarithm transformation for the analysis, the original means and standard deviations are presented here.

Table 4. Main and interaction effects for MANOVA and follow-up ANOVAs.

	Effects	<i>F</i>	<i>df</i>	Sig. Level	Wilk's Lambda	Effect size (η^2)	
MANOVA	Time	50.37	4, 114	< 0.001	0.361	0.639	
	AG	4.82	4, 114	< 0.001	0.855	0.145	
	Condition	3.12	8, 228	0.002	0.813	0.099	
	Time*Condition	8.04	8, 228	< 0.001	0.608	0.220	
	Time*AG	3.27	4, 114	0.014	0.897	0.103	
	Condition*AG	2.57	8, 228	0.012	0.844	0.081	
	Time*AG* Condition	ns	ns	ns	ns	ns	
ANOVAs							
	Welfare knowledge	Time	103.63	1, 117	< 0.001		0.470
		AG	17.51	2, 117	< 0.001		0.143
		Condition	9.76	2, 117	< 0.001		0.143
		Time*Condition	20.16	2, 117	< 0.001		0.256
		Time*AG	5.46	1, 117	0.021		0.045
		Condition*AG	6.12	2, 117	0.003		0.095
Time*AG* Condition		ns	ns	ns		ns	
Rabbit sentence	Time	46.91	1, 117	< 0.001		0.286	
	AG	ns	ns	ns		ns	
	Condition	ns	ns	ns		ns	
	Time*Condition	9.25	2, 117	< 0.001		0.137	
	Time*AG	ns	ns	ns		ns	
	Condition*AG	ns	ns	ns		ns	
	Time*AG* Condition	ns	ns	ns		ns	
Attitudes to cruelty	Time	62.41	1, 117	< 0.001		0.348	
	AG	ns	ns	ns		ns	
	Condition	ns	ns	ns		ns	
	Time*Condition	9.37	2, 117	< 0.001		0.138	
	Time*AG	ns	ns	ns		ns	
	Condition*AG	ns	ns	ns		ns	
	Time*AG* Condition	4.07	2, 117	0.020		0.065	
Attachment to pets	Time	27.51	1, 117	< 0.001		0.190	
	School Year	ns	ns	ns		ns	
	Condition	ns	ns	ns		ns	
	Time*Condition	ns	ns	ns		ns	
	Time*AG	ns	ns	ns		ns	
	Condition*AG	ns	ns	ns		ns	
	Time*AG* Condition	ns	ns	ns		ns	

Note: Only significant results are presented here; ns = non-significant; AG = age groups.

knowledge of rabbit welfare needs at post-test compared with pre-test, and 6–7-year-olds displayed significantly higher welfare knowledge than 5–6-year-olds (see Table 2). With regards to significant differences between conditions, children in the soft and mechanical toy conditions reported higher welfare knowledge than children in the control condition ($p = 0.007$ and $p < 0.001$, respectively), with no difference between the former two. There was also a significant two-way interaction between time and condition, between time and age group, and between condition and age group. The three-way interaction between time, condition, and age group was not significant.

Simple effect analyses to follow-up the interaction between time and condition indicated significantly higher scores on welfare knowledge at post-test compared with pre-test for children in the soft toy condition ($F_{(1,120)} = 58.48$, $p < 0.001$, $\eta^2 = 0.328$) and in the mechanical toy condition ($F_{(1,120)} = 81.99$, $p < 0.001$, $\eta^2 = 0.406$), but not for the control group (Figure 1). The findings here are in line with our expectations that knowledge of rabbit welfare would increase from pre- to post-test for both intervention conditions. Additionally, follow-up analyses relating to the interaction between time and

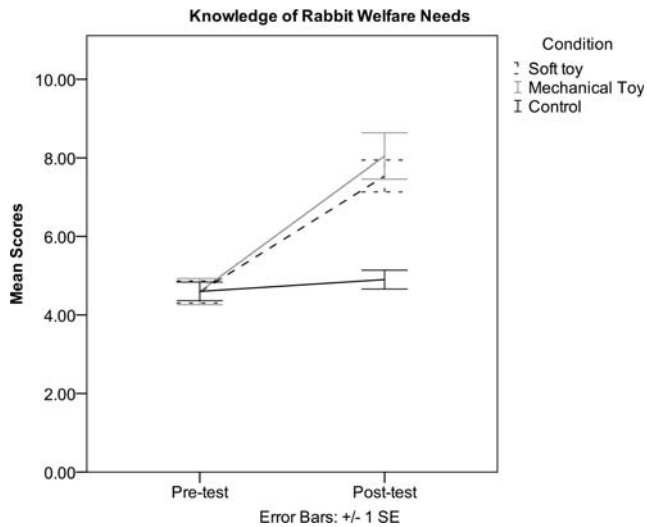


Figure 1. Changes in knowledge of rabbit welfare needs from pre- to post-test for each of the conditions.

age group showed significantly higher rabbit welfare knowledge in 6–7-year-olds compared with 5–6-year-olds at both pre-test ($F_{(1,121)} = 7.67, p = 0.007, \eta^2 = 0.06$) and post-test ($F_{(1,121)} = 10.36, p = 0.002, \eta^2 = 0.07$), with a greater improvement in knowledge over time for 6–7-year-olds compared with 5–6-year-olds (see Table 3).

Children’s Beliefs About Rabbit Sentience (BAM; ANOVA)

We expected that children’s beliefs about rabbit sentience would increase from pre- to post-test for the children in the intervention conditions regardless of age. In line with this expectation, there was a significant main effect of time and a significant interaction between time and condition on sentience scores (Table 3). Sentience scores were significantly higher at post-test compared with pre-test for participants in the soft toy ($F_{(1,120)} = 7.39, p = 0.008, \eta^2 = 0.058$) and mechanical rabbit conditions ($F_{(1,120)} = 57.88, p < 0.001, \eta^2 = 0.325$), while no significant pre- to post-test differences were found for the control group (Figure 2). These results indicate that the intervention led to greater improvement in the mechanical rabbit compared with the soft toy conditions. There were no other significant main or interaction effects related to the factor time.

Children’s Attitudes Toward Rabbit Cruelty (ANOVA)

Acceptability of cruelty toward pet rabbits was expected to decrease following the intervention. We found a significant main effect of time, with children reporting lower acceptability of cruelty scores at post-test (Tables 3 and 4). We also found a significant interaction between time and condition, and a significant three-way interaction between time, condition, and age group. Follow-up analyses revealed that there was a significant difference between the three conditions at pre-test, with children in the soft

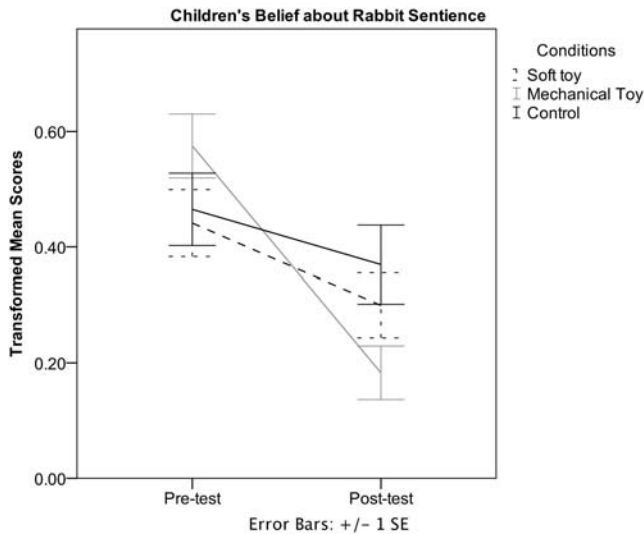


Figure 2. Changes in children's belief in rabbit sentience from pre- to post-test for each of the conditions. Due to reflect and logarithm transformation (\log_{10}) lower scores indicate higher knowledge.

and mechanical toy condition reporting significantly higher cruelty acceptability scores than children in the control condition ($p < 0.001$ and $p = 0.009$ respectively). In line with our prediction, cruelty acceptability scores significantly decreased at post-test for children in the soft toy condition, ($F_{(1, 120)} = 37.29$, $p < 0.001$, $\eta^2 = 0.237$) and in the mechanical rabbit condition ($F_{(1,120)} = 39.92$, $p < 0.001$, $\eta^2 = 0.25$), but not for those in the control group. As a consequence, at post-test, there was no significant difference between the three conditions anymore.

With regard to the three-way interaction, simple effect analyses showed that 5–6-year-olds in the soft toy condition reported significantly higher cruelty attitude scores at pre-test compared with 6–7-year-olds in the same condition ($F_{(1,117)} = 8.29$, $p = 0.005$, $\eta^2 = 0.066$). Nevertheless, this difference was not significant at post-test, with 5–6 year-olds in the soft toy condition showing a larger decrease in cruelty attitude scores compared with 6–7 year-olds (Figure 3). This indicates that the intervention involving soft toy rabbits had a particularly strong impact on cruelty attitudes for younger children. There were no other significant main or interaction effects.

Attachment to Pets (ANOVA)

It was expected that attachment to pets would increase for children who had taken part in the intervention. There was a significant main effect of time, with children reporting significantly higher pet attachment at post-test compared with pre-test (Table 4). None of the other main or interaction effects were significant. To explore our specific research questions and because the interaction between time and condition was significant at MANOVA level, simple effect analyses were used to test whether the difference in pet attachment over time was consistent across the three conditions. The analysis showed that attachment scores were significantly different from pre- to post-test for children in

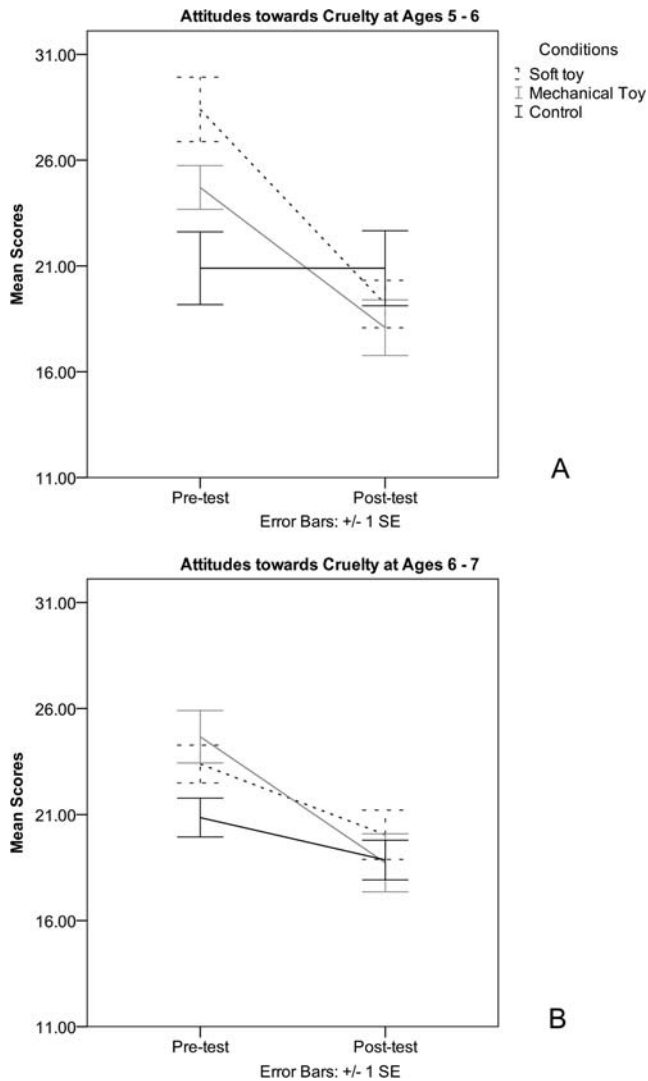


Figure 3. Three-way interaction between time, condition, and age group for children’s attitudes towards rabbit cruelty; A, age group 5 to 6 and B, age group 6 to 7.

the soft toy group ($F_{(1,120)} = 19.84, p < 0.001, \eta^2 = 0.142$) and for children in the mechanical rabbit group ($F_{(1,120)} = 7.62, p = 0.007, \eta^2 = 0.060$), but not for children in the control group (Table 3). Our results here indicate that the soft toy condition may have been more effective in increasing pet attachment scores than the mechanical rabbit condition.

Discussion

The aim of this study was to evaluate the effectiveness of “Rabbit Rescuers” for 5- to 7-year-old children. It was predicted that the intervention would be successful in improving children’s knowledge and attitudes and that children who had participated in the

intervention with the interactive mechanical toy rabbits would show greater improvements than children who had interacted with soft toy rabbits. The intervention was predicted to be effective for 5- to 7-year-olds. All predictions were supported; “Rabbit Rescuers” was effective in increasing children’s knowledge of rabbit welfare, understanding of rabbit sentience, and attachment to pets, as well as in decreasing attitudes that cruelty toward rabbits is acceptable. Furthermore, findings indicate greater changes in children in the mechanical rabbit condition for all the key variables, except for attachment. Below the findings for each key variable are discussed.

Knowledge of Rabbit Welfare Needs

“Rabbit Rescuers” was effective in teaching children about rabbits’ needs and behaviors. This is in line with previous research showing that animal welfare education interventions can be successful in increasing children’s knowledge of animals’ needs, humane treatment, and responsible ownership (Hawkins et al., 2017b; Hawkins et al., 2019; Hawkins et al., 2020; Jamieson et al., 2012; Lakestani et al., 2015; Mariti et al., 2011). This is an important finding, as knowledge about one’s pet greatly contributes to rabbit’s welfare (Edgar & Mullan, 2011). Moreover, lack of knowledge of appropriate animal treatment is likely to be related to unintentional cruelty, especially among children (Ascione, 2005; Hawkins et al., 2017). Rabbit owners’ limited knowledge about their pet’s welfare needs is reportedly common in the UK. This impacts rabbit welfare (PDSA, 2020) and leads to poorer rabbit–human interactions, including rabbit bites due to inappropriate handling (Bradbury & Dickens, 2016). Thus, “Rabbit Rescuers” might be a valuable way to promote adequate rabbit care, prevent unintentional cruelty/neglect, and reduce rabbit bites.

Children’s Beliefs About Rabbit Sentience

Hawkins et al. (2017b) reported that an animal welfare education program developed by the Scottish SPCA for 7- to 13-year-olds was successful in increasing children’s beliefs about animal minds (i.e., believing that animals are sentient and capable of feeling emotions). Likewise, “Rabbit Rescuers” is effective in increasing younger children’s beliefs that rabbits are clever and that they can feel happiness, sadness, pain, and fear. The increase in understanding of rabbit sentience in this study is due to sentience being highlighted in the intervention activities. Crucially, beliefs in animal sentience have been shown to be related to positive child–pet interactions and humane treatment of animals (Hawkins & Williams, 2016). Being able to acknowledge and recognize animals’ emotions is also linked to more positive attitudes toward animals (Knight et al., 2004) and could result in myriad positive outcomes for child–animal interactions.

Children’s Attitudes Toward Rabbit Cruelty

The current study also investigated the extent to which children considered various intentional and unintentional cruel behaviors toward rabbits to be acceptable. Children who participated in the intervention were more likely to judge these behaviors as

unacceptable at post-test, whereas no changes resulted for children in the control condition. Thus, “Rabbit Rescuers” had a positive impact on children’s attitudes toward cruelty. Previous studies have found animal welfare educational interventions to have an effect on children’s liking and perceptions of animals (Lakestani et al., 2015; Mariti et al., 2011). Yet, the change in attitudes following interventions is sometimes minimal (Jamieson et al., 2012), and there are a number of studies that have found an increase in children’s knowledge but not in positive attitudes (e.g., Hawkins et al., 2017b). Thus, it remains unclear whether there is a bi-directional influence of knowledge and attitudes (Jamieson et al., 2012). A potential explanation for children’s changes in attitudes toward cruelty in this study might be that attitudes are linked with beliefs in animal mind (see also Knight et al., 2004). As cruelty starts in childhood (Gullone & Robertson, 2008), tackling cruelty-related attitudes at early ages is essential for preventing animal cruelty (Miller, 2001).

Attachment to Pets

Attachment to pets was shown to significantly increase for children who took part in the intervention. Children’s attachment to pets is associated with several positive outcomes, such as compassion and caring behaviors toward animals (Hawkins et al., 2017a). Daly and Morton (2006) report that children who are highly attached to their pets have more positive attitudes toward pets and have higher empathy scores. High attachment to pets results in reciprocal benefits for child wellbeing and the welfare of the animals (McCune et al., 2014; Muldoon, Williams & Currie, 2019; Muldoon, Williams, Lawrence, et al., 2019). Interestingly, this study revealed a greater increase of pet attachment for children who had participated in soft toy rabbit intervention compared with those in the mechanical rabbit group. This finding is in line with Beetz et al. (2011) who found that, in the presence of both a living dog and a soft toy dog during a socially stressful situation, children are more likely to seek physical contact with the soft toy dog. Furthermore, people who own stuffed toy animals are more attached to companion animals than those who do not (Barlow et al., 2012). The underlying reasons for the link between attachment to companion animals and stuffed toys might reflect a desire for tactile contact (Barlow et al., 2012). Thus, the comfort and attachment derived from interacting with the soft toy rabbits might have led children to feel higher attachment toward real animals following this intervention.

Mechanical Versus Soft Toys

The interactive mechanical rabbit had more positive effects on children’s learning about rabbit welfare and sentience and on their attitudes toward cruelty, compared with a soft toy rabbit. When children play with mechanical toy animals that have interactive capabilities, they might attribute to these characteristics of living animals. Melson et al. (2005) observed children’s interactions with either a robotic dog, a stuffed dog, or a real dog and noted that, although they were likely to infer characteristics of both the robotic and stuffed dogs from living dogs (e.g., thinking that they could get sick), there was evidence that they perceive mechanical animal toys as more similar to real pets than stuffed

toys. Accordingly, children in the mechanical rabbit condition might have been more motivated to interact with the rabbits and learn about them, strengthening the success of the intervention.

Age Effects and Age-Appropriateness of the Intervention

“Rabbit Rescuers” was effective for all the children, regardless of their age group, although knowledge gains were higher among 6–7-year-olds. Animal welfare education interventions are usually designed for children older than 7 years and it is unclear at which age they are the most effective (Jamieson et al., 2012). This study shows that age-appropriate interventions can promote knowledge and attitude change among children as young as 5-years-old. Of note, the soft toy rabbits produced a greater decrease in cruelty acceptance for younger children, who might particularly value the tactile comfort associated with soft toys.

Limitations and Future Directions

The current study had some limitations. Firstly, the school that participated in the study volunteered to take part through the Scottish SPCA, showing an existing interest in the topic. This might mean that efforts to educate children about animal welfare were already occurring in the school before the intervention. However, an advantage of the study’s methodology is that socio-economic and school effects were controlled between the intervention conditions. Secondly, the sample included Scottish schoolchildren only; further research with broader demographic groups is required. Thirdly, we note that this intervention was delivered by school teachers and there may have been differences in their knowledge of rabbits and animal welfare, their dispositions toward animals, and their level of confidence in the topic. These factors may have affected how the teachers facilitated the intervention and whether implementation was consistent across teachers and classes. A fourth limitation is that no long-term follow-up was possible to test retention of gains and there was no assessment of longer-term behavioral changes. It is important that future research examines the effectiveness of animal welfare educational interventions on children of this age group over a longer period of time. As children cannot be solely responsible for pet care, and research indicates that parents take a primary role in caring for pets (Muldoon et al., 2015), further research to develop responsible animal care interventions for adults is also required. A further factor that could be explored is whether the effects of interventions focused on a specific animal, such as “Rabbit Rescuers,” are generalized to other species: for example, by decreasing children’s acceptability of cruelty toward animals in general. Future research should also explore whether the introduction of live rabbits would have enhanced the intervention effects further. While the mechanical rabbits did display some “life-like” qualities, there is no doubt that a wider range of information would have been generated from children interacting with and observing live rabbits, including how they behave, how they feel to touch, how they respond, and their likes and dislikes. We did not include live rabbits in this study for welfare reasons and because the aim was to create an intervention that could be put into practice easily, but there is a need for future studies to compare the learning

outcomes of interacting with live animals and animal simulants (toys, robots, and virtual animals). The Scottish SPCA have refined “Rabbit Rescuers” following this research for delivery to primary schools across Scotland as part of their “Animal WISE” program, reaching over 200,000 children annually. It has become a model for the development for further Scottish SPCA interventions focusing on other animals, including “Happy Hamsters.”

Conclusions

“Rabbit Rescuers” improved 5- to 7-year-old children’s knowledge of rabbit welfare and sentience, as well as their attitudes toward animal cruelty and their attachment to pets. The intervention was effective with children as young as 5 years old. Animal welfare education and cruelty prevention interventions involving interactive mechanical toy animals might be particularly effective for enhancing children’s knowledge of and attitudes toward animals.

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No potential conflict of interest was reported by the authors.

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