

An investigation into the efficacy of therapy dogs on reading performance in 6-7 year old children

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There is scientific evidence that the presence of a therapy dog can positively impact on the performance of cognitive tasks (e.g. Gee et al., 2010). The aim of this study was to examine the effects of a therapy dog on reading performance. Twelve children in second grade, aged 6 to 7 years old, were randomly assigned to two groups in a cross-over design. Six boys and six girls read a text in the presence of a dog and, in another session, a similar text in the presence of a human confederate. Several parameters of the reading performance and human-dog interaction were assessed. In our study a therapy dog rather than a friendly female student improved the reading performance of children in three out of four task parameters: correct word recognitions, correct recognitions of punctuation marks, and correct line breaks. There was no significant influence of the dog on reading time. The four reading parameters did not show significant correlations with the total length of eye or body contact with the dog.

Results in this study are consistent with previous research that documented a positive impact on the performance of cognitive tasks in preschoolers due to the presence of a therapy dog (e.g. Gee et al., 2012). Our results add two new aspects. Firstly, data indicate that the presence of a dog can also be beneficial for older children. Secondly, the promotion of performance also applies to reading.

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Acknowledgements: Our thanks go to the children who took part in this research. We thank the school staff for their support. We would like to thank Anja Rothe for her assistance and her wonderful dog for their exemplary performance as a therapy dog team in this study. Thanks must also go to two anonymous reviewers for their constructive comments, which helped us to improve the manuscript. Andrea Beetz was financially supported by Mars Petcare Germany.

Theoretical background

Over the past thirty years, research exploring human-animal interaction suggests that many benefits are associated with providing children with regular opportunities

for supervised interaction with a friendly, calm, and trained animal (Julius, Beetz, Kotrschal, Turner, & Uvnäs-Moberg, 2012; Nimer & Lundahl, 2007). Dogs in particular seem to offer benefits to children. Research has often demonstrated positive physiological (Beetz et

al., 2011; Beetz, Uvnäs-Moberg, Julius, & Kotrschal, 2012) as well as emotional, social, and psychological effects of human-animal interaction (e.g., Tissen, Hergovich, & Spiel, 2007; Walters, Esteves, & Stokes, 2008; Kotrschal & Ortbauer, 2003; Gee, Harris, & Johnson, 2007). There is much evidence that talking to a friendly animal is associated with lower cardiovascular responses than talking to another person (Lynch, 1985), indicating less stress. In children who are asked to read aloud, the presence of a companion animal has the potential to reduce blood pressure (Friedmann, Katcher, Thomas, Lynch, & Messent, 1983). Persons performing an arithmetic task have also shown a greater increase in blood pressure in the presence of their friends or even spouses than in the presence of their pets (Allen, Blascovich, Tomaka, & Kelsey, 1991; Allen, Blascovich, & Mendes, 2002).

There is also some evidence that the presence of a dog can improve the cognitive performance of children. For example, a study by Gee and colleagues (Gee, Church, & Altobelli, 2010) examined how therapy dogs might affect accuracy in a match-to-sample task in 12 children aged 3 - 5 years old. The children were asked to choose a picture of an object that goes with another. The presence of a real dog resulted in fewer irrelevant choices than either a stuffed toy dog or a human confederate. The researchers claimed that the inclusion of a therapy dog may have helped to lower stress in the children because of their reduced fear of criticism from a non-judgmental source and may have increased the focus on task demands. In further studies, Gee and colleagues showed that preschool children also had higher speed and accuracy in motor skill tasks (Gee, Harris, & Johnson, 2007), showed better adherence to instructions in a motor skill task (Gee, Sherlock, Bennett, & Harris, 2009), required fewer instructional prompts to perform a memory task (Gee, Crist, & Carr, 2010), had better object recognition performance (Gee, Belcher, DeJesus, & Riley, 2012) and were better at categorizing animate objects in the presence of a dog (Gee, Gould, Swanson, &

Wagner, 2012.).

In summary, research exploring animal-assisted interventions (AAI) suggests that companion animals, dogs in particular, may provide a non-threatening and socially supportive atmosphere for children when performing a task (Friesen, 2010). This in turn will promote better performance and learning (Friesen & Delisle, 2012).

To our knowledge, there is no clear empirical evidence that the presence of a dog can improve reading performance in students. But initial data from pilot studies suggest that integrating dogs into reading programs does have positive effects on the motivation to read and reading performance (Beetz & Heyer, 2014). There is also some evidence that animal-assisted literacy learning sessions positively influence students' ongoing engagement in meaningful literacy activities, and thus potentially improves reading skills (Friesen, 2012).

R.E.A.D. (Reading Education Assistance Dogs) is a well-known animal-assisted literacy program and claims promising results (Jalongo, Astorino, & Bomboy, 2004). Martin (2001) conducted one of the initial studies of a program in which children read to dogs. Ten students, aged 5 - 9 years old, who were identified as high risk by the school and whose reading skills were below grade level, spent twenty minutes per week individually reading to dogs. After 15 months there were remarkable improvements in reading scores and some children began reading above their grade level. The findings showed that all students who participated in R.E.A.D for at least 13 months gained at least two grade levels. Some gained as many as four grade levels (Bueche, 2003).

Newlin (2003) conducted a study on the effects of animal-assisted reading with 15 second-grade students who were considered by their teachers and the school social worker to be at risk and consistently tested at least one grade level below their peers in reading. Each of these students read age-appropriate material to a canine companion for 20 minutes per week. The Accelerated Reader Test showed improvement

of reading skills by at least two grade levels over the school year. An increase of self-confidence was also noticed by teachers and parents.

However, studies by Martin (2001), Bueche (2003), and Newlin (2003) were not published in a scientific journal so the methodological approach of the research could not be clearly understood. But it seems they did not employ a control group nor condition, so it is impossible to evaluate whether the improvement was due to the dog's presence or the act of practicing reading.

In contrast, Smith (2010) investigated the impact of animal-assisted reading instruction on reading performance in a sample of 26 home-schooled students in third grade with an experimental pre- and post-test control group research design. The control group did not receive any treatment but was required to read aloud independently in an established location for 30 minutes once a week for 6 weeks. The animal-assisted reading sessions were conducted for 30 minutes once a week, during which the child in the experimental group read aloud to the dog while being monitored by a certified educational professional who was also the dog handler. The results confirmed that animal-assisted reading significantly improved the reading scores in a standardized reading test.

There are several possible explanations for the increased performance described above:

- Based on motivation research it is proposed that in the presence of a dog children gain more pleasure from the activity because a dog serves as an affectively hot stimulus and this results in strong implicit motives for achievement (Wohlfarth, Mutschler, Beetz, Kreuser, & Korsten-Reck, 2013). Dogs arouse implicit motives and lead to affective preferences and implicit behavioral impulses. Dogs, therefore, may represent catalysts and accelerators for the activation of implicit motives, which enhances motivation and further performance.
- Self-worth theory states that a lack of effort is likely to occur when negative feedback from a human supporter is given. Even if it is consciously understood that this is a suboptimal reaction, e.g. of a teacher, it poses a threat to a person's sense of self-esteem (Convington, 2009). Most frequently such negative feedback occurs after an experience of failure. Failure threatens self-estimates of ability and creates uncertainty about an individual's capability to perform well thereafter. If the subsequent performance turns out to be poor, then doubts concerning one's own ability are confirmed (Martin & Dowson, 2009). In contrast, dogs may be able to offer a unique form of support for children's learning and development in the school and classroom environment due to their non-judgmental, yet highly social, nature (Friesen, 2010).
- A third explanation is the stress-reduction effect of animals. It is likely that in the presence of a real dog the children felt less stressed and more relaxed while completing the reading task. Humans seem to have a predisposition to be attracted by the activities of other animals (Kellert, 1993). Numerous studies highlight the benefits of human-animal interaction in stressful situations. Animals may help children to cope with mildly stressful activities (e.g. a visit to a doctor or reading aloud) and also with a major, stressful experience such as hospitalization or public speaking. The physiological effects are measurable such as decreased blood pressure, heart rates, or cortisol levels (Beetz et al., 2011; Beetz et al., 2012; Bouchard, Landry, Belles-Isles, & Gagnon, 2004; Havener et al., 2001; Nagengast, Baun, Megel, & Leibowitz, 1997; Tsai, Friedmann, & Thomas, 2010).

Aims

The purpose of this study was to examine the effect of a therapy dog on reading performance. Specifically, we investigated whether a group of second-grade students aged 6 - 7 years old profited more from the presence of a therapy dog or a friendly person during a reading test. Based on findings of previous research, the presence of a therapy dog should promote better reading performance.

Methods

Design

Condition

Therapy Dog Condition: A herding dog mix (male, neutered, eight years of age) was involved in this study. The dog holds the German Kennel Club's Canine Good Citizen certificate and is also certified as a Therapy Dog according to the standards of the European Society for Animal Assisted Therapy. In the Dog Condition, the child was sitting on a cushion on the floor and was invited to read the text to the dog, who lay near the child. The child was allowed to touch or pet him during the exercise.

Human Condition: The human confederate was a 25 year old, female college student. In the Human Condition, the confederate and the child were sitting on a cushion on the floor. The confederate sat close to the child and invited the child to read the text to her. She verbally praised the child for his or her reading performance.

It has to be noted that the 25 year old female college student was present during both conditions: with her dog as the dog handler during the Dog Condition and as the confederate without her dog in the Human Condition. She only interacted actively with the children during the Human Condition. In the Dog Condition she only introduced the dog to the children.

Researcher: In both conditions, there was also a 23 year old female college student

present as a researcher. She brought the children to the "reading room," observed, and documented the human-dog interaction on a documentation sheet developed for this study. At the end of each reading session she also praised the child for his or her reading performance while bringing them back to the classroom, regardless of accuracy.

Participants

All 24 children aged 6 to 7 years old attended a second-grade class of a school located in an area with upper middle class people. All pupils were born in Germany, and German was their primary language. According to the class teacher no child had significant difficulty with language or reading.

None of the students met our exclusion criteria, such as an allergy to the coat of dogs or fear of dogs. We concluded that no fear of dogs was present according to the following criteria:

- When asked they did not verbally report a fear of dogs.
- The children showed no signs of fear while interacting voluntarily with the dog during his second visit.
- All 24 children wanted to participate in the study.

Children were given an age-appropriate information sheet and volunteered verbally to participate in the study.

The study was approved by the school's management and the School Council and was conducted in accordance with the ethical principles of the Declaration of Helsinki. Initially, parents were verbally informed at a parents evening where some of them came out against video recording of the reading sessions. Video recording was therefore not incorporated in the study design. In a second step, parents were given an information sheet and subsequently provided written consent.

Of the 24 children in the class, 12 children (6 boys and 6 girls; age in years: $Min = 6$, $Max = 7$, $M = 6.58$, $SD = 0.51$) were randomly selected for actual participation. There was no statistically significant difference in age between the two groups.

Procedure

The research team, consisting of the researcher and the human confederate/dog handler, made three visits to the classroom prior to the experiment. First the research team introduced themselves to the children without the dog. They gave an introduction to the study and to the interaction rules with the dog. Students’ experiences with, and fears towards, dogs were fully addressed in this visit.

During the second and third visits the dog was introduced to the children by the dog handler, so the children were familiar with him and did not consider his presence to be a novelty. First the research team talked about the dog and dog behavior. All questions about the dog and his behavior were answered. Then the children interacted on a voluntary basis with the therapy dog during the third visit in small groups of three to four children.

After the third visit all 24 children wanted to participate in the experiment. 12 children were then randomly assigned to two groups in a cross-over design. Group 1 (three boys and three girls) first read Text 1 in the Dog

Condition and, in another session, Text 2 in the Human Condition. Group 2 read Text 1 in the Human Condition and then Text 2 in the Dog Condition (see Figure 1).

Data collection days were Tuesday and Thursday. Reading performance was assessed in a separate session for each child. Each session was spaced at least one week apart.

The experiment took place in a quiet room known to the child. The room is regularly used as a “reading room” for a project called “Reading Mentors.”

Instruments

Assessment of reading performance: Two texts appropriate for children aged five to seven were selected from a book (“Paula and the Sunday Dog”). In a pilot study, students on a course for German language teachers judged the qualitative and quantitative compositions (number of words, punctuation marks, and line breaks) of the two texts. Also, six children read the text to assess minimum reading time. The results show that the compositions of the two texts and the reading times were nearly identical, and that the reading skills required

Figure 1: Study design

24 children aged 6-7	Randomly assigned to	Group 1 three boys three girls	Dog Condition (A) Text 1	Human Condition (B) Text 2
		Group 2 three boys three girls	Human Condition (B) Text 1	Dog Condition (A) Text 2

Note: Of the 24 children in the class, 12 children were randomly selected for actual participation.

Table 1: Main Characteristics of the Two Texts

Text Characteristics	Text 1	Text 2
Number of words	552	556
Number of punctuation marks	112	91
Number of line breaks	79	84
Time to read (estimated minimum in seconds)	960	970

were similar for both texts. Table 1 summarizes the characteristics of the two texts.

The reading performance of each child was audiotaped, because some parents did not give permission for video recordings. A student, who was blind to the condition of the participant, assessed the reading performance. Full blinding, however, could not be guaranteed because in three cases there were some sounds of the dog on the tape.

The reading performance in the two texts was assessed and calculated as follows:

- **Literal reading:** We assessed all reading errors. Percentiles of literal reading (correct words) were calculated as follows: $\text{number of correct words} / \text{number of all words} \times 100$.
- **Content comprehension:** The recognition of punctuation marks was correct if the child set clear pauses or changed his voice. Percentiles were calculated as follows: $\text{number of correct marks} / \text{number of all marks} \times 100$. Line breaks were accepted as accurate if line breaks were succeeded without pause or there was no shifting into a different line. Percentiles were calculated as follows: $\text{number of correct line breaks} \times 100 / \text{number of all line breaks}$.
- **Reading time:** Assessed as seconds needed to read the text. A percentile rank for the time children required to read the text was calculated as follows: $\text{Expected minimum time to read} / \text{time to read in seconds} \times 100$.
- **Text comprehension:** Number of correct answers to six text-related orally presented standardized questions. Percentiles were calculated as follows: $\text{number of correct answers} / 6 \times 100$.

Behavior observation: Time of attentiveness to the human confederate and time of body contact with the dog were assessed using a stop watch. The researcher observed and documented the human-dog interaction on a documentation sheet developed for this study. Physical contact was the time of contact of the

child with the dog, such as petting and touching. Time of attentiveness was assessed through facing his counterpart.

Statistical analysis

Data were analyzed with SPSS 21.00. The analyses of the cross-over trial was carried out using the approach of Wellek and Blettner (2012), which is based on previous work by Brown (1980).

According to the Kolmogorov Smirnov Test and visual inspection of the distribution, the performance values for literal reading, punctuation marks, line breaks, and reading time show that these variables were normally distributed. Analysis of these variables were therefore performed parametrically with the t-tests for independent samples.

Text comprehension was not normally distributed. It shows a pronounced ceiling effect. In the Dog Condition eight children gave correct answers to all six questions, four children answered five questions correctly. In the Human Condition nine children gave correct answers to all six questions, three answered five questions correctly. These results indicate that there were too few questions and the questions were too easy to answer. Hence, the variable text comprehension was omitted from further analysis.

Firstly, evaluations were performed with the t-test to determine differences in carry-over effects (i.e., inter-individual comparison of the sum of values from the Dog Condition plus that for the Human Condition for Group 1 with the corresponding sum for Group 2). Significant carry-over effects were determined based on an alpha level of 0.10.

Secondly, the difference scores were evaluated with the t-test to determine the effects of condition (i.e., inter-individual comparison of the absolute difference of values from Session 1 minus that for Session 2 for Group 1 and vice versa for Group 2).

Statistical significance was determined based on an alpha level of 0.05. To account for multiple testing, we adjusted the significance threshold for the number of tests performed

using the Bonferroni method with $p < 0.0125$ considered statistically significant. Effect size was estimated by Cohen’s d (Cohen, 1988). According to definitions of effect size, small, medium, and large effects for Cohen’s d are considered to be 0.2, 0.5, and 0.8 for “small,” “medium,” and “large.”

Correlations between reading performance and duration of reading with time of attentiveness and time of body contact were calculated via Pearson product-moment correlation coefficient (Pearson’s r).

Results

No children dropped out of the groups. Children performed very well in the reading test overall. Table 2 shows that the children read the words fairly correctly. For the accurate words parameter, we found a mean percentile of 96.45 in the Dog Condition ($SD = 0.797$) and 94.83 in the Human Condition ($SD = 1.67$). Children

performed lower for correct punctuation marks and line breaks. The mean percentile for punctuation marks was 82.84 in the Dog Condition ($SD = 7.60$) and 70.73 in the Human Condition ($SD = 8.76$), for line breaks 79.66 ($SD = 4.50$) and 71.93 ($SD = 7.97$) respectively. For time spent reading there was a mean percentile of 91.57 in the Dog Condition ($SD = 4.44$) and 92.93 in the Human Condition ($SD = 4.31$).

To determine differences in carry-over effects, a comparison was made between the sum of values from Dog Condition plus that for Human Condition and a t-test for independent samples. The comparisons of the sums of each performance variable show p-values greater than 0.10, which indicates that no carry-over effects have occurred (see Table 3).

To determine the effects of condition, the differences of the Dog Condition minus that of the Human Condition for Group 1 were compared with the corresponding differences

Table 2: Median Percentile Scores for the Reading Parameters

Reading Parameters	<u>Dog Condition</u>				<u>Human Condition</u>			
	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>SD</i>
Accurate words	95.14	97.46	96.45	0.79	91.12	96.76	94.83	1.67
Punctuation marks	71.43	98.90	82.84	7.60	57.14	85.71	70.73	8.76
Line breaks	73.42	87.34	79.66	4.50	59.52	84.52	71.93	7.97
Time to read	83.70	98.16	91.57	4.44	87.43	99.07	92.93	4.31

Note: Median percentile scores for Dog Condition (Group 1 + Group 2 with the dog; $n = 12$) and Human Condition (Group 1 + Group 2 with the human confederate; $n = 12$)

Table 3: Estimation of Carry-over Effect

Reading Parameters	<u>Sum Score Group 1</u> (Dog Condition + Human Condition)		<u>Sum score Group 2</u> (Human Condition + Dog Condition)		<i>t</i>	<i>p</i>
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>		
Correct words	191.88	1.85	190.69	2.53	0.954	0.377
Punctuation marks	156.35	12.09	150.81	12.13	0.792	0.447
Line breaks	150.19	14.87	152.99	7.62	-0.410	0.691
Time to read	182.35	3.16	186.65	9.06	-1.097	0.298

Note: Sum scores for Group 1 (Order1: Dog Condition + Human Condition; $n = 6$) and Group 2 (Order 2: Human Condition + Dog Condition; $n = 6$); $df = 10$

for Group 2. These difference scores were the subjected to an independent t-test (see Table 4). The three variables, which can be viewed as indicators of concentration, show significantly better results in the Dog Condition: correct word recognitions ($t(10) = 3.75, p = 0.004, d = 2.38$), correct recognitions of punctuation marks ($t(10) = 5.73, p = 0.000, d = 3.63$) and the correct line breaks ($t(10) = 4.35, p = 0.001, d = 2.76$).

All these variables were found to exceed convention for a large effect ($d = 0.80$).

The t-test revealed no significant influence of the factor condition on reading time ($t(10) = -0.84, p = 0.416, d = 0.53$), which could be interpreted as a speed parameter. But d-score showed a medium effect size.

For the four reading parameters, no significant associations (Pearson product-moment correlation coefficient) with time of body contact or of facing to the dog were found (see Table 5). But there was a medium negative correlation between time to read and body

contact to the dog ($r = -0.456, p = 0.13$): the longer the physical contact with the dog, the lower the reading time.

Discussion

The main finding of the present study was that, regarding reading performance, a real dog with a friendly female student rather than a friendly female student alone improved reading performance of children in three of the four task parameters. All three parameters could be seen as indicators of concentration. For reading time, which could be seen as an indicator of speed, there were no statistically significant differences. Thus, it could be concluded that a friendly dog may positively influence reading performance.

These results – that a dog enhances performance – are consistent with the results of the previous studies by Gee and colleagues (e.g. Gee, Belcher, DeJesus, & Riley, 2012; Gee, Church, & Altobelli, 2010; Gee, Crist, & Carr,

Table 4: Estimation of Condition Effects

<i>Reading Parameters</i>	<u>Difference score</u> <u>Group 1</u> (Dog Condition – Human Condition)		<u>Difference score</u> <u>Group 2</u> (Human Condition - Dog Condition)		<i>t</i>	<i>p</i>	<i>d</i>
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>			
Correct words	1.71	1.26	-1.50	1.67	3.75	0.004	2.38
Punctuation marks	2.87	4.61	-10.18	3.12	5.73	0.000	3.63
Line breaks	9.71	3.74	-5.73	7.83	4.35	0.001	2.76
Time to read	-0.15	6.56	2.56	4.35	-0.84	0.416	0.53

Note: Mean difference scores for Group 1 (Dog Condition minus Human Condition; $n = 6$) and Group 2 (Human Condition minus Dog Condition; $n = 6$); $df = 10$

Table 5: Correlations of Performance Variables with Time of Visual and Physical Contact

<i>Reading Parameters</i>	<u>Visual Contact</u>		<u>Physical Contact</u>	
	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>
Correct words	0.191	0.55	-0.236	0.46
Punctuation marks	0.069	0.83	0.228	0.47
Line breaks	0.065	0.84	-0.012	0.97
Time to read	-0.095	0.97	-0.456	0.13

Note: For each comparison $n = 12$ and $df = 10$

2010; Gee, Gould, Swanson, & Wagner, 2012). The results of the present study add two new aspects: Firstly, data indicate that not only preschoolers, as investigated by Gee and colleagues, profit from an animal-assisted intervention aiming at promoting cognitive performance, but also older children in elementary school. Secondly, the promotion of performance also applies to reading.

Baker and Wigfield (1999) point out that there are three essential dimensions for children's motivation for reading. The first dimension includes self-efficacy, the belief that one can be successful at reading, and the willingness to take on difficult reading material. When children lack a sense of self-efficacy, they are likely to avoid challenging reading activities. Dogs seemed to be ideal reading companions because they do not judge, laugh, or criticize, and they allow children to read at their own pace. AAI research has documented much evidence showing that animals may be able to offer a unique form of support for children's learning and development in the school and classroom environment due to the animals' non-judgmental, yet highly social, nature (Friesen, 2010).

The second dimension is a motivational factor, including intrinsic and extrinsic motivation, achievement goal orientation, and achievement. The children in our study liked the dog and enjoyed reading to him. In an unsystematic post-inquiry, the children said that the dog should come again and that they want to read to him again. According to motivation theory, we propose that implicit motives may be an important mode of action in improving reading performance. Using a push-pull metaphor, implicit motives "push," whereas explicit motives "pull" the individual. Implicit and explicit motives have distinct effects on behavior. On a proximal level distinction, aroused implicit motives lead to affective preferences ("I like this dog") and implicit behavioral impulses ("I would like to read to the dog"). Though children were motivated to do their best and read with a higher concentration in both conditions. We suggest

that a dog could act as a motivating factor to encourage children to read, because animals are natural incentives that address implicit motives and promote intrinsic motivation values (Wohlfarth et al., 2013).

The third dimension described by Baker and Wigfield (1999) addresses social purposes of reading, based on the engagement perspective's premise that reading is inherently a social activity and that social aspects of classrooms have an important impact on student achievement. Most studies investigating the effects of a dog in a classroom found that the social atmosphere changed in a positive way. The class often became more socially homogenous and behavioral extremes decreased (Kotrschal & Ortbauer, 2003; Tissen, Hergovich & Spiel, 2007; Anderson & Olson, 2006), also pupils show more positive attitude toward school and positive emotions related to learning (Beetz, 2013). This is in line with research from psychotherapy, which also shows that companion animals often create a warm, friendly, and empathic atmosphere (Prothmann, Bienert, & Ettrich, 2006).

We would like to propose a fourth explanation, which extends the explanations described above. There is growing scientific evidence that exposure to fear and states of anxiety can cause levels of stress that adversely affect performance in school. Stress, and cortisol released during stressful experiences, influence a wide range of cognitive functions (Schwabe & Wolf, 2012). It has been shown that dogs can reduce the stress reactions of children performing a stressful task (Beetz et al., 2011). Beetz and colleagues (2012) found that the more children stroked the dog during a stressful task, the less pronounced their stress reaction was. Yet, we did not find statistically significant correlations between task performance and eye or body contact with the dog. This may be due to the fact that we were not able to use videotapes for a precise analysis of interaction between the children and the dog. This measurement may have been prone to error due to the use of a stop watch and participating observation. However, it is

impossible to rule out that stress reduction via physical contact with the dog was not a factor influencing reading performance. Some authors suggest that even the mere presence of a calm animal may have stress-reducing and calming effects (Julius et al., 2012).

Although not statistically significant, it is worth noting that there was a medium negative correlation between body contact to the dog and reading time. The more the children were petting the dog the longer the reading time.

The other performance variables showed no significant correlations with visual or body contact to the therapy dog. The common assumption that the presence of a dog can be distracting for children during the execution of cognitive tasks appears to be false, but intensive interaction with a dog might reduce reading performance. Reading to a dog should take place in a relaxing atmosphere with little distraction caused by intensive petting.

Our findings support the theory that dogs can enhance reading performance, although the study does have a number of limitations. We have only two conditions: the Dog Condition in which the dog was present with a female student and the Human Condition in which only the female student was present. In both conditions there was also a female researcher present. In further studies there should be a condition without a human confederate in order to assess more fully the effects of the human involved.

No data concerning inter-rater reliability is available because reading performance was assessed from an audiotape by only one rater. Although the rater did not participate in the sessions or take part in the randomization process, in three cases in the Dog Condition she was aware of what session had been provided because there was some sound of the dog on the audiotapes. Thus she may have unintentionally biased the data. In further studies, study design should allow a complete blinding of the rater, and performance variables should be assessed by two raters to reduce any unintentional improvement of scores in the Dog Condition.

The text comprehension parameter showed a pronounced ceiling effect. Most children gave correct answers to all questions. This makes a differentiated assessment of text comprehension and short-term memory impossible. In further studies there should be more, and more detailed, questions concerning the text.

The body contact and eye contact to the dog parameters were assessed only via a self-designed observation sheet. We were not able to use videotapes for a precise analysis of interaction between the children and the dog. This measurement may have been prone to error due to the use of a stop watch and participating observation. In further studies, videotapes should be used to analyze interaction between the children and the dog in more detail.

Cross-over designs are prone to carry-over effects. We could not detect carry-over effects. But it is argued that tests for carry-over are generally underpowered, even with an appreciable carry-over effect (Senn, 1988). It is therefore recommended instead that the washout period between sessions be sufficient to prevent carry-over effects. In our experiment we had almost seven days between the two sessions, thus it is unlikely that the cross-over sessions affected each other.

However a replication of this exploratory study with a larger sample size, randomized design, independent groups, and across various different age groups of children is required. For further insight into these aspects of AAI, future research also needs to include self-reported mood, measures of attractiveness of the dog, displayed affect, heart rate, blood pressure, and salivary cortisol.

Our findings, and the summary of AAI research, support and substantiate the practice of animal-assisted interventions and that a well-groomed trained dog has the potential to enhance performance and learning through self-efficacy, motivation, enjoyment, and reduction of stress and anxiety.

References

- Allen, K., Blascovich, J., Tomaka, J., & Kelsey, R. M. (1991). Presence of human friends and pet dogs as moderators of autonomic responses to stress in women. *Journal of Personality and Social Psychology*, *61*(4), 582–589.
- Allen, K., Blascovich, J., & Mendes, W. B. (2002). Cardiovascular reactivity and the presence of pets, friends, and spouses: the truth about cats and dogs. *Psychosomatic Medicine*, *64*(5), 727–739.
- Anderson, K. L., & Olson, M. R. (2006). The value of a dog in a classroom of children with severe emotional disorders. *Anthrozoös*, *19*(1), 35–49.
- Baker, L., & Wigfield, A. (1999). Dimensions of children's motivation for reading and their relations to reading activity and reading achievement. *Reading Research Quarterly*, *34*(4), 452–477.
- Beetz, A. (2013). Socio-emotional correlates of a schooldog-teacher-team in the classroom. *Frontiers of Psychology*, *4*. doi: 10.3389/fpsyg.2013.00886
- Beetz, A., Kotrschal, K., Turner, D., Hediger, K., Uvnäs-Moberg, K., & Julius, H. (2011). The effect of a real dog, toy dog and friendly person on insecurely attached children in a stressful task: An exploratory study. *Anthrozoös*, *24*(4), 349–368.
- Beetz, A., Uvnäs-Moberg, K., Julius, H., & Kotrschal, K. (2012). Psychosocial and psychophysiological effects of human-animal interactions: The possible role of oxytocin. *Frontiers in Psychology*, *3*. doi: 10.3389/fpsyg.2012.00352
- Bouchard, F., Landry, M., Belles-Isles, M., & Gagnon, J. (2004). A magical dream: A pilot project in animal-assisted therapy in pediatric oncology. *Canadian Oncology Nursing Journal*, *14*(4), 14–17.
- Brown Jr, B. W. (1980). The crossover experiment for clinical trials. *Biometrics*, *36*, 69–79.
- Bueche, S. (2003). Going to the dogs: Therapy dogs promote reading. *Reading Today*, *20*(4), 46.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Convington, M. V. (2009). Self-Worth-Theory: Retrospection and prospects. In K.R. Wenzel & A. Wigfield (eds.), *Handbook of motivation at school* (pp. 141–169). New York: Routledge.
- Friedmann, E., Katcher, A. H., Thomas, S. A., Lynch, J. J., & Messent, P. R. (1983). Social interaction and blood pressure: Influence of companion animals. *Journal of Nervous and Mental Disease*, *171*(8), 461–463.
- Friesen, L. (2010). Exploring animal-assisted programs with children in school and therapeutic contexts. *Early Childhood Education Journal*, *37*(4), 261–267.
- Friesen, L. (2012). Animal-assisted literacy learning as carnival: A Bakhtinian analysis. *The International Journal of Learning*, *18*(3), 305–324.
- Friesen, L., & Delisle, E. (2012). Animal-assisted literacy: A supportive environment for constrained and unconstrained learning. *Childhood Education International*, *88*(2), 102–107.
- Gee, N. R., Belcher, J., DeJesus, M., & Riley, W. (2012). The presence of a therapy dog results in improved object recognition performance in preschool children. *Anthrozoös*, *25*(3), 289–30.
- Gee, N. R., Church, M. T., & Altobelli, C. L. (2010). Preschoolers make fewer errors on an object categorization task in the presence of a dog. *Anthrozoös*, *23*(2), 223–230.
- Gee, N. R., Crist, E. N., & Carr, D. N. (2010). Preschool children require fewer instructional prompts to perform a memory task in the presence of a dog. *Anthrozoös*, *23*(2), 178–184.
- Gee, N. R., Gould, J. K., Swanson, C.C., & Wagner, A. K. (2012). Preschoolers

- categorize animate objects better in the presence of a dog. *Anthrozoös*, 25(2), 187-198.
- Gee, N. R., Harris, S. L., & Johnson, K. I. (2007). The role of therapy dogs in speed and accuracy to complete motor skills tasks for preschool children. *Anthrozoös*, 20(4), 375 - 386.
- Gee, N. R., Sherlock, T. R., Bennett, E. A., & Harris, S. I. (2009). Preschoolers' adherence to instructions as a function of the presence of a dog, and motor skills task. *Anthrozoös*, 22(3), 267 - 276.
- Havener, L., Gentes, L., Thaler, B., Megel, M. E., Baun, M. M., Driscoll, F. A., Beiraghi, S., & Agrawal, N. (2001). The effects of a companion animal on distress in children undergoing dental procedures. *Issues in Comprehensive Pediatric Nursing*, 24(2), 137-152.
- Beetz, A., & Heyer, M. (2014). *Leseförderung mit Hund – Grundlagen und Praxis*. München: Reinhardt Verlag.
- Jalongo, M., Astorino, T., & Bomboy, N. (2004). Canine visitors: The influence of therapy dogs on young children's learning and wellbeing in classrooms and hospitals. *Early Childhood Education Journal*, 32(1), 9–16.
- Julius, H., Beetz, A., Kotrschal, K., Turner, D., & Uvnäs-Moberg, K. (2012). *Attachment to pets*. New York: Hogrefe.
- Kellert, S. R. (1993). The biological basis for human values of nature. In S.R. Kellert & E.O. Wilson, *The biophilia hypothesis* (pp. 42-69). Washington: Island Press.
- Kotrschal, K., & Ortbauer, B. (2003). Behavioral effects of the presence of a dog in a classroom. *Anthrozoös*, 16, 147-159.
- Lynch, J. J. (1985). *The language of the heart*. New York: Basic Books.
- Martin, S. (2001). R.E.A.D. is a pawsitive program for kids of all ages. *Interactions*, 19(3), 10-11.
- Martin, A., & Dowson, M. (2009). Interpersonal relationships, motivation, engagement, and achievement: Yields for theory, current issues, and educational practice. *Review of Educational Research*, 79(1), 327-65.
- Nagengast, S. L., Baun, M. M., Megel, M., & Leibowitz, J. M. (1997). The effects of the presence of a companion animal on physiological arousal and behavioral distress in children during a physical examination. *Journal of Pediatric Nursing*, 12(6), 323-30.
- Newlin, R. B. (2003). Paws for reading: An innovative program uses dogs to help kids read better. *School Library Journal*, 49(6), 43.
- Nimer, J., & Lundahl, B. (2007). Animal-assisted therapy: A meta-analysis. *Anthrozoös*, 20(3), 225–238.
- Prothmann, A., Bienert, M., & Ettrich, C. (2006). Dogs in child psychotherapy: Effects on state of mind. *Anthrozoös*, 19(3), 265–277.
- Senn, S. J. (1988). Cross-over trials, carry-over effects and the art of self-delusion. *Statistics in Medicine*, 7(10), 1099-1101.
- Smith, K. A. (2010). Impact of animal assisted therapy reading instruction on reading performance of homeschooled students. *Journal of Elementary and Secondary Education*, 1(10).
- Schwabe, L., & Wolf, O. T. (2012). Stress modulates the engagement of multiple memory systems in classification learning. *The Journal of Neuroscience*, 32(32), 11042-11049.
- Tissen, I., Hergovich, A., & Spiel, C. (2007). School-based social training with and without dogs: Evaluation of their effectiveness. *Anthrozoös*, 20(4), 365-373.
- Tsai, C., Friedmann, E., & Thomas, S. A. (2010). The effect of animal-assisted therapy on stress responses in hospitalized children. *Anthrozoös*, 23(3), 245-258.
- Walters Esteves, S., & Stokes, T. (2008). Social effects of a dog's presence on children with disabilities. *Anthrozoös*, 21(1), 5–15.

- Wellek, S., & Blettner, M. (2012). On the proper use of the crossover design in clinical trials: Part 18 of a series on evaluation of scientific publications. *Deutsches Ärzteblatt International*, *109*(15), 276–281.
- Wohlfarth, R., Mutschler, B., Beetz, A., Kreuser, F., & Korsten-Reck, U. (2013). Dogs motivate obese children for physical activity: Key elements of a motivational theory of animal-assisted interventions. *Frontiers of Psychology*, *4*(796). doi: 10.3389/fpsyg.2013.00796