

Does Reading Aloud to a Dog Improve Children's Reading Outcomes? An Academic Critique

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Abstract

Educators are increasingly seeking innovative interventions to improve children's reading skills through enhancing their reading enjoyment, motivation, and frequency. One such approach is through canine-assisted reading interventions in schools, which involve children reading aloud to therapy dogs and their handlers. The popularity of this approach is growing, with the development and delivery of numerous programmes and organisations worldwide. Given increasing interest in canine-assisted reading programmes in schools, there is a need to subject these interventions to scientific scrutiny, to evaluate the extent to which they are grounded in psychological theory, determine their efficacy for improving reading outcomes, and inform their implementation. In this critique, an overview of the theoretical underpinnings of reading aloud to dogs is first presented. Intervention effects are explained in terms of attachment theory, attentional control theory, and self-determination theory. The current critique also includes the first systematic review examining the effects of school-based canine-assisted interventions, compared to control conditions, on children's reading outcomes. Findings from nine controlled studies are discussed. Currently, there is mixed and limited evidence for the efficacy of school-based canine-assisted reading interventions, compared to control conditions, on children's reading skills, attainment, and attitude. Implications for practice and intervention implementation are considered.

Does Reading Aloud to a Dog Improve Children's Reading Outcomes? An Academic Critique

Literacy skills are widely acknowledged as being important for children's educational enjoyment and success (Clark & Douglas, 2011; Hanover Research, 2016) and future employment outcomes and social mobility (NIACE, 2016). Given that reading skills are associated with reading frequency and motivation (Clark & Douglas, 2011; Vu et al., 2021), educators are increasingly seeking innovative interventions to improve children's reading skills through enhancing their reading enjoyment, motivation, and frequency. One such approach is through canine-assisted reading interventions in schools, which typically involve children reading aloud to therapy dogs and their handlers.

Canine-assisted reading interventions are well-established in the US and include programmes such as Reading Education Assistance Dogs (R.E.A.D.; Intermountain Therapy Animals, n.d.), SitStayRead (2022), and BARK Reading Dogs (2018). Their popularity is also growing in the UK; a number of UK-based organisations have been developed to facilitate these interventions, such as The Bark and Read Foundation (2022), Paws and Read (2022), and Burns By Your Side (2022). Across these programmes, there are variations in how the intervention is implemented, including differences in session duration, frequency, overall intervention period, and delivery format (e.g., individual versus groups of children).

Despite some differences in implementation, core features appear to be shared across canine-assisted reading interventions. These include: the use of dogs selected for their calm temperament and obedience; handlers being present with dogs at all times; as much as possible, children reading to the same dog-handler pair across intervention sessions; and programmes being situated within a broader reading curriculum and designed to provide children with additional reading practice. Many UK organisations also adhere to the standards of practice developed by The Kennel Club Educational Trust (n.d.), which promote greater safety, credibility, and consistency in how interventions are implemented. These include: sessions lasting no longer than one hour; dogs

working for no longer than three hours per day; dogs being a minimum of 12 months of age; and schools carrying out risk assessments prior to implementation.

Purported benefits of canine-assisted reading interventions include improvements in reading confidence, motivation, self-esteem, and reading skills, and reductions in stress (e.g., Bark and Read Foundation, 2022). Additionally, many UK organisations are charities and provide services to schools free-of-charge; three organisations responded to emails confirming that visits are undertaken by volunteers and therefore there is no formal fee for this service (personal communication, September 29, 2022). Considering the global costs of poor literacy (Cree et al., 2022), canine-assisted reading programmes in schools may present a particularly accessible and cost-effective intervention for improving children's reading outcomes.

Given the growing interest in delivering canine-assisted reading programmes in schools, and claims around their efficacy, there is a need to subject these interventions to scientific scrutiny, to evaluate the extent to which they are grounded in psychological theory, determine their efficacy for improving reading outcomes, and inform their implementation. The current critique will first present an overview of the theoretical underpinnings of reading aloud to dogs. Next, findings from the first systematic review of controlled studies, examining the effects of school-based canine-assisted reading interventions on children's reading outcomes, will be reported. Finally, implications for practice and intervention implementation will be discussed.

Theoretical Underpinnings

The field of canine-assisted reading does not appear to have identified psychological theories, or developed a unified theory, to explain how reading to dogs may confer beneficial reading outcomes in children. However, descriptions of interventions typically assert that benefits come from dogs offering unconditional acceptance and creating a safe, non-judgemental space for children to practice reading without the fear of making mistakes (e.g., Shaw, 2013). Benefits are also commonly attributed to the stress-moderating effects of a dog's calm presence (e.g., Hall et al.,

2016). Based on these descriptions, intervention effects could be explained by attachment theory, attentional control theory (ACT), and self-determination theory (SDT).

Attachment theory states that humans are born with an innate attachment system, which drive us, from birth, to seek physical proximity to, and emotional connection with, others (Bowlby, 1969). Not all attachments are to other humans. Jalongo (2018), in their review of the literature on the human-canine bond from the perspective of attachment theory, argues that the bond between a child and dog is a unique form of attachment, potentially stronger than the bond formed with any other type of companion animal. This has been attributed to the parallel evolutionary process of domestication between humans and dogs (Benítez-Burraco et al., 2021). In support of this attachment relationship, interacting with dogs has been found to produce the hormone oxytocin (Beetz et al., 2012; Handlin et al., 2011), known for its central role in attachment formation (Sharma et al., 2020).

From the perspective of attachment theory, reading aloud to a dog may improve children's reading outcomes by providing the opportunity for them to connect with the reading dog. Research has shown that attachment experiences in school are associated with improved attainment, emotion regulation, and approach to challenges (Bergin & Bergin, 2009). The way in which canine-assisted reading interventions are typically implemented increases the potential for children to bond with their reading dogs; for example, dogs are selected for prosocial traits and children are paired with the same dog for the duration of the intervention.

According to ACT (Eysenck et al., 2007), anxiety impairs attentional control and increases distractibility by disrupting the balance between the top-down, goal-directed attentional system and the bottom-up, stimulus-driven attentional system, resulting in the dominance of the bottom-up system. Top-down control is necessary for attentional focus during cognitively demanding tasks. Therefore, children who experience reading as being cognitively demanding and anxiety-inducing

are likely to be distracted by their experience of anxiety and interpretations of 'threat' in their environment (e.g., peers' and teachers' judgements), impairing their reading performance.

Research has shown that interacting with dogs decreases human cortisol levels, heart rate, and self-reported anxiety (Beetz et al., 2012). Compared to reading aloud to an adult, children who read aloud to an adult when a dog was also present experienced reductions in their heart rate and blood pressure (Friedmann et al., 1983). Such findings suggest that the presence of a therapy dog may mitigate the stressful experience of reading aloud for children so that they are more able to engage their top-down attentional system and focus on practising reading. Therefore, in addition to increasing connection and attachment, reading to dogs may confer benefits through anxiety reduction.

SDT (Ryan & Deci, 2000) proposes that motivation to engage in an activity arises from fulfilling our fundamental psychological needs of competence (i.e., having the necessary skills, sense of efficacy and mastery over tasks), autonomy (i.e., feeling in control of our goals and actions), and relatedness (i.e., feeling like we belong and are socially connected). Reading aloud to a dog may support children's motivation to read by increasing their sense of competence, autonomy, and relatedness. Children may experience competence through having more opportunities to focus on practising their reading skills (e.g., accuracy, fluency) and gain a sense of mastery over reading. Autonomy can be fostered by, for example, encouraging children to choose their reading material (e.g., in line with their interests, reading level) and ensuring their assent to take part in the intervention is obtained. Research has described the shift from children reading to adults to children reading to, and 'teaching', dogs as an empowering experience which builds their sense of autonomy and reading motivation (Friesen, 2009). Finally, research highlights how canine-assisted interventions can improve children's sense of relatedness; interacting with dogs has been shown to improve the quality of children's peer relationships (Sorin et al., 2015), social communication

behaviours with peers (Germone et al., 2019), and social inclusion in the classroom (Hergovich et al., 2002).

Impact and Effectiveness

A systematic review of the literature on the effects of canine-assisted reading interventions in educational settings found that across studies, there were generally positive effects on children's reading outcomes (Hall et al., 2016). Most of the evidence in this review came from low quality studies (56% were expert opinion pieces, 27% were case series, cohort, or case control studies) and Hall et al. highlighted the need for more scientifically rigorous research, including the use of control comparison groups, in order to make stronger claims regarding the specificity of effects to the intervention.

Since Hall et al.'s (2016) review, research in this field has continued to grow and includes a number of studies with control groups. The current paper includes the first systematic review examining the effects of school-based canine-assisted interventions, compared to control conditions, on children's reading outcomes. By limiting to controlled studies, the current review aimed to contribute to our understanding of the extent to which positive outcomes can be attributed to reading aloud to dogs.

Nine controlled studies were included in the current review. Appendix A presents the search strategy and study flow, Appendix B the data extraction table, and Appendix C the quality appraisal table.

Reading Skills

All nine studies included a measure of reading skill or attainment. The most common outcomes were overall reading performance or skill ($k = 7$), reading comprehension ($k = 2$), reading fluency ($k = 1$), reading rate ($k = 1$), reading accuracy ($k = 1$), and vocabulary ($k = 1$). Findings across these studies presented mixed evidence for the efficacy of canine-assisted reading interventions for improving reading skills.

Four studies reported positive effects. Smith (2009) found that compared to a teaching as usual (TAU) control group ($n = 98$), grade two students who received eight weeks of weekly individual canine-assisted reading intervention ($n = 152$) showed significant improvements in their overall reading skills. Paradise (2007) compared struggling first to fifth grade children who received an individual canine-assisted reading intervention ($n = 98$) with those in control groups ($n_s = 19$ and 46) and also found a significant between-group difference in overall reading performance improvement, favouring the intervention group. However, effects on standardised reading scores were non-significant. Le Roux et al.'s (2014) randomised controlled trial (RCT) found that compared to three control groups ($n_s = 24-26$), grade three children, identified as being poor readers, who received 10 weeks of weekly individual reading to a dog ($n = 27$) demonstrated significantly improved reading comprehension both post-intervention and at two-months follow-up. However, they did not find significant effects for reading rate or accuracy. Kirnan et al.'s (2016) study was the only one to examine the effects of a group-based canine-assisted reading intervention. They found that compared to TAU ($n = 152$), kindergarten children who read aloud to a dog in a small group on a weekly basis ($n = 169$) showed significantly greater standardised reading scores. However, between-group differences were non-significant for children in grades one to four.

Three studies did not find any effects on reading skills. Linder et al.'s (2018) RCT compared grade two children, with average reading ability, who received either six weekly sessions of reading aloud to a dog (with at least two teachers present in addition to the handler) ($n = 14$) or TAU ($n = 14$) and found a non-significant between-group difference in literacy skills development over the intervention period. Similarly, Booten (2011) found a non-significant between-group difference in standardised reading scores post-intervention when comparing grade five children who read aloud to a dog brought into their classroom at least three days per week ($n = 17$) to a TAU group ($n = 15$). Tamborello (2017) found that both fourth grade children who received 10 weeks of weekly

individual reading to a dog ($n = 5$) and those in the control group ($n = 3$) experienced non-significant changes in overall reading performance, vocabulary, comprehension, and reading level.

Finally, due to small sample sizes in each group, both Clune (2019) and Treat (2013) made between-group comparisons using descriptive statistics only. Clune compared grade three children with dyslexia who received 10 weeks of twice-weekly reading intervention delivered by a teacher with a therapy dog present ($n = 4$) to a group who received the same intervention without the presence of a dog ($n = 3$). Three of the four students in the intervention group showed pre-post percentile increases in reading fluency. One student in the control group showed a pre-post percentile increase in fluency. Treat compared fifth grade students with SEND who read aloud to a dog, with a teacher present, twice a week for five weeks ($n = 9$) to a group who read aloud to a teacher without the presence of a dog ($n = 8$) and found that mean reading fluency, accuracy, and comprehension increased in both groups, but gains were greater for intervention students.

Reading Attitude and Motivation

Only three studies included a measure of reading attitude or motivation. Outcomes included reading anxiety ($k = 1$), reading motivation ($k = 1$), attitude towards reading ($k = 1$), and reading self-efficacy ($k = 1$). Findings indicated a lack of evidence for the efficacy of canine-assisted reading interventions for improving reading attitude.

Linder et al.'s (2018) RCT was the only study which conducted inferential statistical analyses. They found a non-significant between-group difference in overall attitude towards reading over the intervention period. However, for children who received the intervention, they found a significant improvement in attitude towards academic reading (but not recreational reading) over time; this effect was non-significant in the TAU group.

Due to small sample sizes, Clune (2019) and Treat (2013) both reported descriptives statistics only. In Clune's study, three out of four students in the intervention group showed pre-post percentile decreases in reading anxiety and all intervention students showed pre-post increases in

reading motivation. One student in the control group showed a pre-post percentile decrease in anxiety and two control students showed pre-post increases in motivation. Treat showed that overall pre-post improvement in mean self-efficacy in reading was greater for the intervention group than the control group.

Limitations Across Studies

Many of the included studies had small sample sizes or unequal allocation to groups and none included a sample size calculation. It is therefore not possible to determine whether null findings indicate lack of efficacy or are the result of studies being underpowered to detect significant interaction effects between intervention and control groups over time. A couple of studies with small sample sizes were only able to compare descriptive statistics between groups, which cannot tell us if differences are systematic and meaningful.

Null findings could also be attributed to how studies were designed and interventions implemented. Specifically, effects may have been diluted in studies which included practices considered at odds with the previously proposed theoretical underpinnings of canine-assisted reading interventions. These include studies: which recruited all children irrespective of reading ability rather than those identified as having reading difficulties (inconsistent with ACT; e.g., Linder et al., 2018; Tamborello, 2017); which involved the intervention being delivered to children in groups or as part of their class, rather than individually (inconsistent with attachment theory, ACT, and SDT; e.g., Booten, 2011; Kirnan et al., 2016); where children did not necessarily have all readings sessions with the same dog (inconsistent with attachment theory; e.g., Clune, 2019); and where multiple teachers were present in addition to dog-handler pairs (inconsistent with ACT and SDT; e.g., Linder et al., 2018). Future research may benefit from designing studies and interventions with underlying theory in mind.

An additional limitation pertains to the lack of clarity in reporting key participant demographic characteristics and details of intervention delivery. Very few studies provided

adequate demographic information, with aggregated age and/or gender commonly missing. Many also omitted important information regarding intervention implementation, including the number of sessions, session duration, intervention time period, and whether additional adults were present. Additionally, none reported details of how adverse events would be monitored, and whether any were reported. In order to build a robust evidence base for canine-assisted reading interventions, including what works, for whom, and the minimum 'dose' needed (i.e., length, duration, frequency), it is essential for future studies to clearly and explicitly report participant demographics, how the intervention was implemented, and details of adverse event monitoring.

Summary and Implications

The current systematic review indicated mixed and limited evidence for the efficacy of school-based canine-assisted reading interventions, compared to control conditions, on children's reading skills, attainment, and attitude. Due to methodological limitations and variation in intervention implementation across studies, it is not possible to determine whether these interventions are effective and whether any positive effects can be attributed to the specific process of reading aloud to a dog. Therefore, at present, there is little robust empirical research, using controlled designs, to support the implementation of canine-assisted reading interventions in schools. However, it is worth noting that these interventions are supported by having a plausible theoretical basis and in Hall et al.'s (2016) systematic review, which adopted broader inclusion criteria and included a range of study designs, including qualitative research, reading to dogs has been found to be positively received by children and have beneficial effects on a range of reading outcomes. Future research which improves on the methodological limitations of current studies may begin to build promising, preliminary evidence in support of canine-assisted reading interventions in schools.

Currently, the enthusiasm for this approach appears to be ahead of the evidence base, with limited robust empirical support to endorse the development and delivery of many canine-assisted

reading programmes and organisations worldwide. This is not unusual in educational research and practice; a recent systematic review indicated that schools appear to adopt interventions irrespective of whether they are evidence-based (Pegram et al., 2022). The authors reviewed the efficacy of interventions identified from a school cluster and found that 67% had no evidence, 30% had evidence of positive impact, and 3% had evidence indicating lack of efficacy.

Given the current limited evidence base for canine-assisted reading interventions from controlled studies, there are no strong empirically-informed recommendations for how this should be delivered in schools. However, schools considering implementing this intervention could take the following points into account. Existing controlled studies of canine-assisted reading interventions in schools have included primary-age children only. Almost all controlled studies of school-based canine-assisted reading interventions have been conducted in the US and none have been conducted in the UK. Therefore, it is not known how findings would apply to secondary-age children and a UK educational context. Careful planning may be needed to adapt US practices to fit UK school settings and curricula. Additionally, relevant underpinning psychological theory would support practices such as delivering the intervention individually and to children with reading difficulties and anxiety; ensuring children are paired with the same dog-handler team across intervention sessions; minimising the number of adults present; and giving children autonomy during the intervention.

Educational psychologists (EPs) are well placed to support schools to make evidence-informed decisions around designing, implementing, and evaluating canine-assisted reading interventions, should they decide to deliver these programmes. For example, EPs can use their research skills to critique emerging evidence in the field, assist with designing theoretically- and empirically-informed school-based programmes, and support their evaluation, using robust research methods (e.g., randomisation, matched control groups, adequate sample size). EPs' consultation skills and relationships with schools can be used to support schools to explore a range of issues around implementing canine-assisted reading interventions (e.g., how this fits within their existing

provision, barriers to implementation) and engage in collaborative problem-solving. By supporting with decisions around the adoption, delivery, and evaluation of canine-assisted reading interventions, EPs play an active role in helping schools to move towards a more evidence-informed approach to providing provision (Pegram et al., 2022).

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Appendix A

Systematic Search Strategy and Study Flow

Identification of Studies

An initial scoping search was conducted using Google Scholar and DelphiS (University of Southampton online journal search portal). Search results informed the identification of key search terms, which were applied to the PICOS framework (Higgins et al., 2019) (Table 1).

Using the search terms, a search of the abstracts of published studies up to 10th September 2022 was conducted using the following online databases: PsycINFO, Education Resources Information Centre (ERIC), and Web of Science. The grey literature was searched using the ProQuest Dissertation and Theses Global database.

Table 1

Search Terms Applied to the PICOS Framework

	Search Terms
Population (P)	child* OR “young people” OR adolescent* OR teenager* OR pupil* OR student*
Intervention (I)	“reading to dog*” OR “reading with dog*” OR “reading aloud to dog*” OR “reading aloud with dog*” OR “assistance dog*” OR “canine-assisted reading” OR “human-dog interaction*” OR “therapy dog*”
Comparison (C)	
Outcome (O)	“reading ability” OR “reading skill*” OR “reading performance” OR “reading accuracy” OR “reading fluency” OR “reading confidence” OR “reading attitude*” OR “reading motivation” OR “reading engagement” OR “reading enjoyment”
Setting (S)	school* OR education OR classroom*

Inclusion and Exclusion Criteria

Table 2 presents the inclusion and exclusion criteria used in the current review.

Table 2

Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
Participants aged under 18 years, with or without identified literacy difficulties	Participants aged 18 years or older
Paper available in English	Review papers
Controlled intervention study (i.e., empirical study which compared an intervention group with a control comparison group)	Non-empirical papers (e.g., opinion pieces, theoretical papers, book chapters)
Assessed the efficacy of an intervention which involved reading aloud to dogs	Did not include a control comparison group
Included reading-related outcomes measured in both intervention and control groups	Did not include reading-related outcomes
Research conducted in schools	Not conducted in a school setting
Full text available	

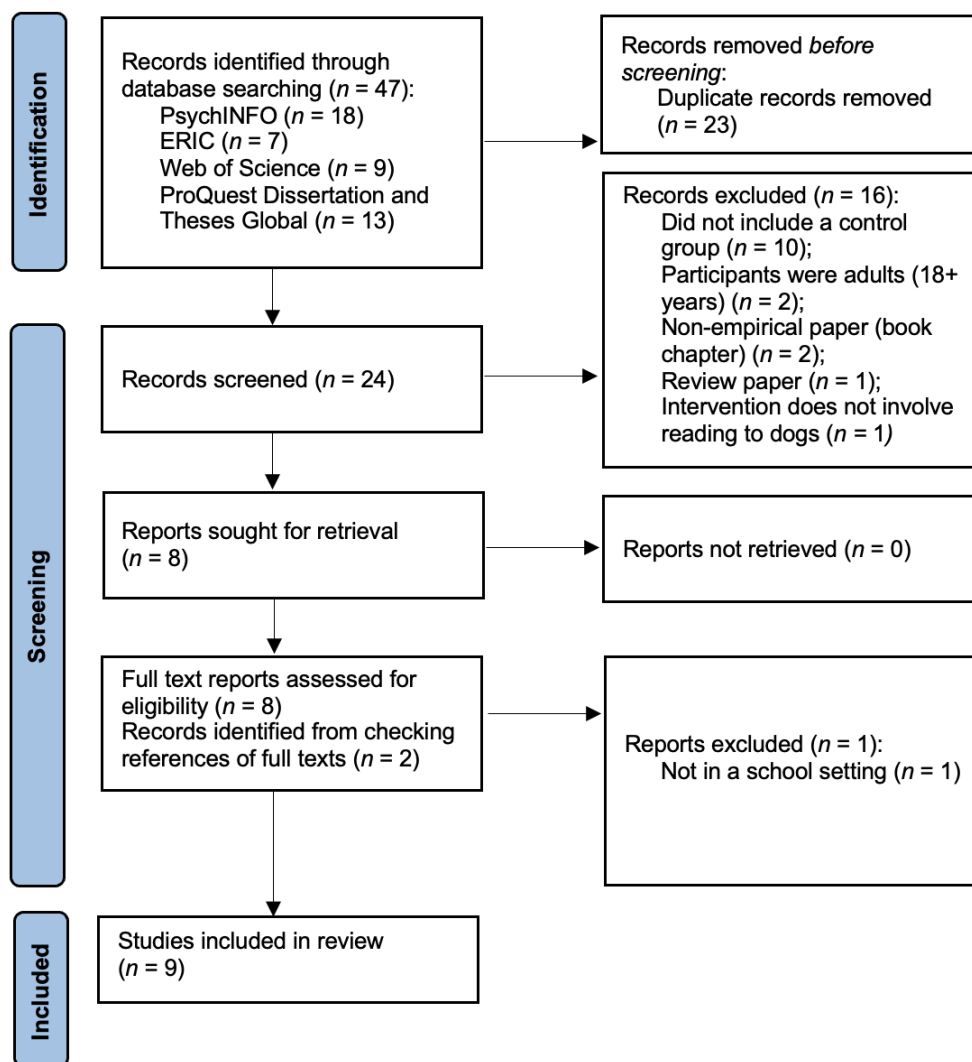
Study Flow

Figure 1 presents the PRISMA (2020) flow diagram, which shows the flow of studies through the review. The database search using the search terms from Table 1 identified 47 papers, 23 of which were duplicates. Of the remaining 24 papers, 16 were excluded based on the title or abstract and the remaining eight full texts were assessed for eligibility. The reference lists of these full texts were examined for further eligible studies; two further studies were identified. The final number of

studies which met the inclusion and exclusion criteria (Table 2) and were included in the review was nine.

Figure 1

PRISMA (2020) Flow Diagram



Quality Appraisal

The included nine studies were appraised for their quality using the Downs and Black (1998) checklist for appraising quantitative studies (Appendix C).

Appendix B

Data Extraction Table

Study	Sample Characteristics	Design	Intervention	Control Condition(s)	Reading-related outcomes (Measure) collected in both arms	Findings
Booten (2011)	32 grade five students from an elementary school in the US: 17 in the intervention group and 15 in the control group. No other demographic information reported.	Quasi-experiment	Therapy dog is brought into classrooms at least three full days per week and children have the opportunity to read books to the dog. Intervention period and duration not specified.	Not specified; assumed to be TAU.	Reading scores (Pearson-Scott Foresman reading assessment)	Sig. differences in pre-post reading scores for both the intervention and control groups (both groups improved). No sig. between-group differences in reading scores at post-intervention. Group by time interaction was not tested.
Clune (2019)	Seven grade three students with a diagnosis of dyslexia from an elementary school in the US: four in the intervention group (1 female, 3 males) and three in the control group (1 female, 2 males). No other demographic information reported.	Mixed-methods case study	Presence of a therapy dog during a 10-week individual reading fluency intervention delivered by a teacher (twice per week for 20 mins). Intervention involved reading aloud to the dog rather than teacher. Students did not necessarily have all of their sessions with the same dog.	10-week individual reading fluency intervention delivered by a teacher (twice per week for 20 mins), without the presence of a dog. Involved reading aloud.	Reading fluency (standardised easyCBM Lite assessment; Alonzo et al., 2006); reading anxiety (Abbreviated Reading Anxiety Scale; Katzir et al., 2018); reading motivation (Motivation to Read Profile-Revised; Malloy et al., 2013)	Due to small sample size, graphical analysis and descriptives were used. Three students in the intervention group showed pre-post percentile increases in reading fluency and decreases in anxiety; the other student showed no change. All showed pre-post increases in motivation. One student in the control group showed a pre-post percentile increase in fluency and decrease in anxiety; the others showed no improvement or deterioration. Two control

Kirnan et al. (2016)	Students from kindergarten to fourth grade (all abilities) in an elementary school in the US: 169 in the intervention condition (48.7% female; 74.3% Caucasian; 9.9% ESL) and 152 in the control condition (50.3% female; 71.6% Caucasian; 16.6% ESL). Age not reported.	Mixed-methods quasi-experiment	Small group (four to six students) reading to a dog and dog-themed writing activities. Groups were formed based on reading level. Each classroom received a dog visit once a week for an hour.	TAU (kindergarten to fourth grade students from the previous academic year, before the intervention was implemented)	Standardised reading score (Northwest Evaluation Association’s Measures of Academic Progress – archival data; measure was not administered by the researchers)	students showed pre-post increases in motivation. Analysed their data by grade. Sig. between-group difference in reading score (favouring the intervention group) for kindergarten grade only. Differences were non-sig. for all other grades.
Le Roux et al. (2014)	102 grade three students in an elementary school in South Africa identified by the ESSI Reading Test as being poor readers: 27 in the intervention group and 26 (adult only), 24 (teddy bear), and 25 (TAU) in control groups. Mean age was 8 years 2 months (SD = 0.92); age range was 7 to 13 years. School was in a low SES community. No other demographic information reported.	RCT	10-week reading programme (Reading Educational Assistance Dogs; R.E.A.D.) involving weekly individual reading to a dog, with an adult present, for 20 mins per session. Adults encouraged to correct errors and support students. Children met with the same dog each week.	Three control conditions: 10-week programme of weekly reading to an adult only, 10-week programme of weekly reading to a teddy bear with an adult present, and TAU (no intervention). Across the control programmes, each session lasted 15-20 mins. Adults encouraged to correct errors and support students.	Reading rate, accuracy, and comprehension (Neale Analysis of Reading Ability test)	Sig. group by time interaction. Both at 10 weeks (post-intervention) and two-months follow-up, reading comprehension scores were significantly higher in the intervention group compared to all three control groups. Sig. group by time by gender interaction. Boys showed sig. between-group differences in reading comprehension (favouring intervention) at both 10 weeks and two months follow-up. For girls, there were no sig. between-group differences at 10 weeks but sig. differences at follow-up between intervention and teddy bear group (favouring intervention). No sig. group by

Linder et al. (2018)	28 grade two students in an elementary school in the US with average reading ability, selected randomly from a pool of eligible students: 14 in the intervention group and 14 in the control group. No other demographic information reported.	RCT	Six-week after-school canine-assisted reading programme: six weekly one-hour long individual sessions (30 mins reading aloud). In addition to dog handler, at least two teachers were present. Children met with the same dog-handler team each week.	TAU (standard classroom curriculum)	Literacy skills (standard curriculum assessment); attitude towards reading (Elementary Reading Attitude Survey; McKenna & Kear, 1990)	time interaction for rate or accuracy. Non-sig. group by time interaction for literacy skills or attitude towards reading. However, for those in the intervention group, there was a sig. pre-post improvement in attitudes towards academic reading (but not recreational reading); this effect was non-sig. for control students.
Paradise (2007)	Struggling readers from first to fifth grade in elementary schools in the US; 98 in the intervention group, 19 in the control group who received teacher instruction, and 46 struggling readers who were not assigned to therapy dogs. No other demographic information reported.	Mixed-methods quasi-experiment	C.A.R.E. (Canine Assisted Reading Education) programme: one-to-one reading to a dog, with a trained dog handler present to facilitate reading. Sessions lasted from 30 to 50 mins. Intervention time period was not clear.	Two control conditions: one-to-one reading to, and instruction from, a teacher and TAU (assumed; this was not made clear)	Reading skills (Student Data Sheet for Pet Teacher and Handler); standardised reading scores (Florida Comprehensive Assessment Test scores)	Sig. between-group difference in reading performance improvement (favouring intervention). Non-sig. between-group effects on standardised reading scores.
Smith (2009)	Second grade students from elementary schools in the US: 152 in the intervention group (ethnicity was 99-100% Black in five of the schools and 69% Hispanic and 26% Black in the sixth intervention school; 39.5% female) and 98 in the control group (ethnicity was	Mixed-methods quasi-experiment	SitStayRead programme: eight-week intervention involving weekly one-hour long sessions. Adults first lead small group of children in paired reading (30 mins) then students engage in writing and illustrating activity (30 mins). During the	TAU	Reading skills: phonemic awareness, phonics skills, fluency, vocabulary, and comprehension (Dynamic Indicators of	Sig. between-group difference in overall reading skills from pre-post (favouring intervention).

	98-99% Black for all control schools; 49.0% female). All schools were identified as low-income schools. No other demographic information reported.		session, students are taken aside to individually read aloud to dogs, with trained dog handlers present. Not clear how long individual sessions with dogs were.		Basic Early Literacy Skills)	
Tamborello (2017)	Eight fourth grade students in an elementary school in the US: five in the intervention group and three in the control group. The school area is considered economically disadvantaged. No other demographic information reported.	Quasi-experiment	10-week R.E.A.D. programme: involved weekly individual reading to a dog, with a dog handler present, for 15 to 20 mins per session. Dog handlers were trained to facilitate the session. As much as possible, students read to the same dog-handler team every session.	Waitlist	Standardised reading performance, vocabulary, comprehension, and reading level scores (Gates-MacGinitie Reading Test)	Non-sig. pre-post changes in reading performance (combination of vocabulary and comprehension), vocabulary, comprehension, and level in both the intervention group and control group.
Treat (2013)	17 second to fifth grade students with SEND from an elementary school in the US: nine in the intervention group (55.6% female; 88.9% White) and eight in the control group (12.5% female; 62.5% White). Effort was made to match participants across groups in terms of learning difficulties, grade-level, and pre-intervention reading level. No other demographic information reported.	Quasi-experiment	Five weeks (10 sessions) of reading aloud to a dog for 10 to 15 mins, with the teacher present.	Five weeks of reading aloud to a teacher for 10 to 15 mins.	Reading performance (Basic Reading Inventory); self-efficacy in reading (Reader Self-Perception Scale)	Only descriptive statistics were reported. Both groups improved in mean reading fluency, accuracy, and comprehension. Intervention students made greater gains compared to the control group in all reading skill areas. Overall pre-post improvement in mean self-efficacy was greater for the intervention group than the control group.

14. Blinding of participants to the intervention?	N	N	N	N	N	N	N	N	N
15. Blinding of researchers measuring outcomes?	Not known	N	N	Not known	N	N	N	N	N
16. Unplanned analyses reported?	Not known	Not known	Not known	Not known	Not known	Not known	Not known	Not known	Not known
17. Did analyses adjust for different lengths of follow-up?	Y	Y	Y	Y	Y	Not known	Not known	Y	Y
18. Were analyses appropriate?	N	Y	Y	Y	Y	Unclear	Y	N	N
19. Reliable fidelity to intervention?	N	Y	Y	Y	Y	Y	Y	Y	Y
20. Valid and reliable measures?	Y	Y	Y	Y	Y	Y	Y	Y	Y
21. Were participants in different groups recruited from the same population?	Y	Y	Y	Y	Y	Y	Y	Y	Y
22. Were participants in different groups recruited over the same period of time?	Y	Y	N	Y	Y	Y	Y	Y	Y
23. Randomisation to groups?	N	N	N	Y	Y	N	N	N	N
24. Random allocation appropriately concealed?	N	N	N	Y	Not known	N	N	N	N
25. Adequate adjustment for confounders in the analyses?	N	N	Y	Not known	Not known	N	N	N	N
26. Loss to follow-up taken into account?	Not known	N	Not known	Y	Not known	Y	Not known	Y	Not known
27. Adequately powered? (adapted item)	Not known	N	Not known	Not known	Not known	Not known	Not known	N	N