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The impact of repeated reading on deaf and hard of hearing students: Current evidence-based practices

Ahmed Saeed Alshubrumi *

Department of Special Education, College of Education, University of Ha'il, Ha'il, Saudi Arabia

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ABSTRACT

Research shows that d/Deaf and hard of hearing (d/DHH) students often face challenges in reaching grade-level literacy skills. Past systematic reviews involving d/DHH students highlight the need for high-quality experimental research in areas like reading comprehension and fluency. Studies have shown that repeated reading instruction positively impacts literacy for non-disabled students, second language learners, and hearing students with disabilities. In this systematic review, the author explored evidence on the effects of repeated reading instruction for d/DHH students. Ten studies across nine articles met the specified inclusion criteria, including nine intervention studies and one qualitative case study. Analysis of these studies suggests that repeated reading is a promising approach for enhancing literacy skills in d/DHH students. However, as noted in previous reviews, more rigorous experimental studies are necessary. Future research could investigate the long-term effects of repeated reading instruction.

1. Introduction

The term evidence-based practice can be defined as a curriculum, teaching strategy, or educational practice that has been scientifically proven to yield consistent positive outcomes whenever tested (Alshubrumi, 2020). Evidence-based practice can be identified via analytical procedures such as systematic reviews and meta-analyses. Through systematic reviews and meta-analyses, researchers can combine results from different studies to generate more powerful, accurate, and reliable knowledge that overcomes the random errors of smaller studies (Hernandez et al., 2020). Furthermore, through systematic reviews and meta-analyses, researchers may identify the direction and strength of interventions to resolve educational challenges (Hernandez et al., 2020).

A typical example of an educational challenge in the field of d/Deaf education is the low level of literacy skills among most d/Deaf and hard of hearing (d/DHH) students (Paul et al., 2013). Evidence drawn from studies conducted in languages with different typologies and orthographic systems, such as Arabic, Dutch, Spanish, and Chinese, indicated that the literacy skills of most d/DHH students in high school are equivalent to or lower than the fourth-grade level (Kyle and Cain, 2015; Sun et al., 2022; Wauters et al., 2006). Trezek et al. (2010) stated that the annual growth rate of d/DHH students was less than half a year. However, with recent technological advancements such as newborn hearing screening, hearing aids, and cochlear implantation, the authors of studies conducted with English-language participants have reported improvements in literacy skills among d/DHH students (Mayer et al., 2021).

Several researchers have documented evidence surrounding reading components that improve the reading achievement of d/DHH students (Trussell and Easterbrooks, 2017). For instance, Schirmer and McGough (2005) reviewed the literature on reading development and instruction among d/DHH students. Luckner et al. (2005) conducted an exhaustive literature review of literacy skills in d/Deaf education. Luckner and Handley (2008) conducted a literature review to examine evidence of reading comprehension among d/DHH students. Luckner and Urbach (2012) synthesized the literature on the reading fluency of d/DHH students. Tucci et al. (2014) examined the literature on the decoding skills of d/DHH students. Trezek and Wang (2017) examined the literature on the reading instructions among d/DHH students. Trussell and Easterbrooks (2017) conducted a literature review

* Corresponding Author.
Email Address: a.alshubrumi@uoh.edu.sa
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Corresponding author's ORCID profile:
https://orcid.org/0000-0002-8709-5190

to examine the evidence surrounding morphological awareness among d/DHH students.

The above findings suggested a number of gaps in the body of knowledge on this topic: intervention studies carried out among d/DHH students are scarce (Kart; 2022; Mayer and Trezek, 2020; Schirmer and McGough, 2005; Trezek and Wang, 2017), no two studies investigated the same domain (Luckner et al., 2005; Tucci et al., 2014), no systematic replication of earlier studies has been conducted (Luckner et al., 2005; Luckner and Handley, 2008; Luckner and Urbach, 2012; Schirmer and McGough, 2005; Trussell and Easterbrooks, 2017; Tucci et al., 2014), the majority of the studies included in these reviews had descriptive or correlational design (Luckner et al., 2005; Luckner and Handley, 2008; Luckner and Urbach, 2012; Mayer and Trezek, 2020; Schirmer and McGough, 2005; Trussell and Easterbrooks, 2017), and evidence-based surrounding literacy skills in the field of d/Deaf education is lacking (Kart; 2022; Luckner et al., 2005; Luckner and Handley, 2008; Luckner and Urbach, 2012; Schirmer and McGough, 2005; Trezek and Wang, 2017; Trussell and Easterbrooks, 2017; Tucci et al., 2014). In addition, Luckner and Urbach (2012) demonstrated that studies examining repeated reading techniques among d/DHH students did not meet the Institute of Education Sciences (Baron, 2004) criteria for possible evidence of effectiveness. Trezek and Wang (2017) found that studies targeting reading-related skills among d/DHH students did not meet the Council for Exceptional Children (CEC) criteria for evidence-based practice.

In a recent meta-analysis, Aldemir et al. (2023) examined the literature on vocabulary interventions among d/DHH children and adults. Of the 1724 studies identified, only 24 were included. The findings indicated that vocabulary intervention positively affected expressive, receptive, and signed vocabulary in d/DHH children and adults. Indeed, no systematic review evidence has thus far been presented on the impact of repeated reading instruction on the literacy skills of d/DHH students.

1.1. Repeated reading technique

Repeated reading is an intervention that involves reading and re-reading the same passage several times until the desired reading rate or a specific mastery level is reached. Once this is achieved, the student reads another passage until the same level is reached (Zimmermann et al., 2021). Repeated reading can be categorized into two distinct approaches: traditional and unassisted repeated reading. In traditional repeated reading, a student repeats reading out loud while guided by a teacher, paraprofessional, adult tutor, or peer tutor (Romig and Jetton, 2024). Unassisted repeated reading involves silent and independent reading and re-reading of passages. Repeated reading can be delivered alone or in combination with other interventions, such as those that adjust for the difficulty of the text, correct errors systematically, provide performance feedback and offer word previews (Lee and Yoon, 2017; Romig and Jetton, 2024). The underlying theory of repeated reading, proposed by LaBerge and Samuels (1974), states that by improving word recognition and automaticity, readers can free up their attention and direct it toward comprehension.

Repeated reading has been widely studied over the past 40 years (Padeliadu et al., 2021). Researchers have documented its contribution to different reading skills such as reading comprehension, reading fluency (rate and accuracy), and word recognition among various types of students (i.e., monolingual students, second-language learners, and students with disabilities) across grades (from kindergarten to grade 12) (Collins et al., 2023; Lee and Yoon, 2017; NRPUS, 2000; Taguchi et al., 2023; Therrien, 2004; Zimmermann et al., 2021). Also, the contribution of repeated reading has been documented in different languages such as Arabic, English, Greek, and Turkish (Alqahtani, 2020; Lee and Yoon, 2017; Padeliadu et al., 2021; Yılmaz and Melekoğlu, 2023).

The contribution of repeated reading has been explained by several moderating variables. These variables include students' grades. Students in elementary school benefit more than those in secondary grades. These variables also include reading proficiency. Average readers benefit more than less proficient ones. Moreover, the intervention component plays a vital role. For example, repeated reading with performance feedback is more beneficial for less proficient readers, repeated reading with systematic error correction and performance feedback is more beneficial for struggling readers, and repeated reading with either word or listening passage previews is more beneficial for students with reading disabilities. Another moderating variable that can play a vital role is the number of repeated readings. Repeated reading is more beneficial when students re-read the passage four times than two or three times. Textual factors are another influencing variable. Second-grade students' reading rates improve more when they read materials at their grade level (Chard et al., 2002; Lee and Yoon, 2017; NRP, 2000; Therrien, 2004; Zimmermann et al., 2021).

1.2. Previous systematic reviews and meta-analyses of repeated reading

The authors of prior systematic reviews and meta-analyses have shown that repeated reading improves word recognition, reading fluency (accuracy and rate), and reading comprehension in hearing students with and without disabilities (Chard et al., 2002; Collins et al., 2023; Lee and Yoon, 2017; NRP, 2000; Therrien, 2004; Zimmermann et al., 2021). In 2000, the NRP devoted much of its meta-analysis to examining two major approaches: (a) repeated or guided reading and (b) independent reading. The NRP (2000) found a moderate impact of

repeated reading on word recognition (effect size=0.55), reading fluency (effect size=0.44), and reading comprehension (effect size=0.35). Chard et al. (2002) found that the reading fluency of students with learning disabilities improves more when a repeated reading intervention is combined with other interventions (effect size=0.71) than when it is provided alone (effect size=0.68).

Therrien (2004) demonstrated that repeated reading positively impacts the reading fluency and reading comprehension of students without disabilities (effect sizes=0.76 and 0.77, respectively) as well as students with learning disabilities (effect sizes=0.77 and 0.48, respectively). Lee and Yoon (2017) found that repeated reading interventions make a large contribution to students' number of correct words per minute (Hedges' g=1.41, Z=11.18, p<.001). In a recent literature review, Collins et al. (2023) examined evidence surrounding the effectiveness of repeated reading interventions on oral reading fluency among students identified as having emotional and behavioral disorders. Collins et al. (2023) found that repeated reading does not meet the minimum threshold of evidence-or potentially evidence-based practices. Instead, repeated reading can be classified as having mixed evidence.

Although many researchers have examined the effectiveness of repeated reading in students with and without disabilities, systematic reviews of its effectiveness for d/DHH students have not thus far been carried out. Therefore, in this article, the author examined evidence-based practices surrounding repeated reading in the field of d/Deaf education to answer the following questions:

1. What repeated reading research has been conducted with d/DHH students?
2. What specific reading skills have repeat reading research targeted?
3. To what extent does repeated reading research conducted with d/DHH students meet the quality indicators and evidence-based classifications of the CEC (Cook et al., 2015)?

2. Methods

To find the relevant material, the author of this article patterned his procedure on previously published systematic literature reviews (i.e., Luckner and Handley (2008) and Luckner and Urbach (2012)). First, the author established the inclusion criteria for this study, including (a) published in peer-reviewed journals between 1990 and 2023; (b) age of the participants in each study between 3 and 21 years; (c) studies carried out in English; (d) authors examined the effectiveness of repeated reading on d/DHH students; and (e) authors examined the effects of the repeated reading on d/DHH students' reading comprehension, reading fluency, self-correction rate, word recognition, or students ability to retell a story.

Additionally, it is important to note that the author of the current review included studies with different designs (i.e., quantitative, qualitative, and mixed methods). Second, a comprehensive search of seven electronic databases was completed in July 2023, including Academic Search Complete (EBSCOhost), Electronic Resource Information Center (Eric), Google Scholar, JSTOR, One Search IU, Psychological Information (PsycINFO), and Saudi Digital Library. The following terms were used to search for articles: deaf, deafness, deaf and hard of hearing, hard of hearing, and hearing impairments. The author associated each previous term with one of the following: repeated reading, re-reading, reading practice, paired reading, or the Reread-Adapt and Answer-Comprehend (RAAC) intervention. Finally, the author searched the references of the articles to ensure that additional articles were not overlooked. Ultimately, ten studies presented in nine different articles were included in this review.

The CEC's quality indicators and evidence-based classifications were used to evaluate the quality of the nine included articles (Cook et al., 2015). First, The CEC's quality indicators were developed to evaluate whether studies are methodologically sound (Cook et al., 2015). The CEC's quality indicators can be applied to both studies in which authors have adopted group comparison design (i.e., randomized controlled trials, group-level quasi-experimental approaches, and regression discontinuity design) and studies in which authors have adopted single-subject design (i.e., ABAB/reversal, multiple-baseline, changing criterion, and alternating treatments design). The CEC's eight quality indicators are context, participants, intervention, description of the practice, implementation fidelity, internal validity, outcome measure, dependent variable, and data analysis (for further details, see Cook et al. (2015)). Second, the CEC's evidence-based classifications have five levels: evidence-based practice, potentially evidence-based practice, practice with mixed effects, insufficient evidence, and practice with negative effects (for further details, see Cook et al. (2015)).

In this review, the author followed a two-stage procedure. First, the author used CEC eight quality indicators to evaluate studies in which the researchers employed group comparison design with random or non-random assignment, as well as studies in which the researchers adopted a single-subject design. Second, the author applied evidence-based classifications to determine whether repeated reading met the evidence-based standard set by the CEC.

3. Results

3.1. Summary of the reviewed studies

To answer the first question about what repeated reading research has been conducted with d/DHH students, the author summarized ten studies found

in nine articles that met the inclusion criteria, based on the approach by Luckner and Cooke (2010). Table 1 outlines details such as the source, control group use, study design, participant information (age, hearing loss, number, gender, and ethnicity), study location, setting, communication method, type and duration of intervention, dependent variable, and a summary of findings.

3.1.1. Studies' aims

Of the ten studies, nine were intervention studies, and one was a qualitative case study (Enns and Lafond, 2007). In the nine intervention studies, research groups used repeated reading instruction with different aims. Research groups used repeated reading instruction to improve students' overall comprehension (Schirmer et al., 2009; 2012; 2016), awareness of morphosyntax (Richels et al., 2016), vocabulary (Bobzien et al., 2015; Cannon et al., 2010; Richels et al., 2016; Schirmer et al., 2012), self-correction rates (Schirmer et al., 2012), word recognition (Schirmer et al., 2012), reading fluency (Ensor and Koller, 1997; Schirmer et al., 2009; 2012; 2016), and ability to retell a story (Pakulski and Kaderavek, 2001).

3.1.2. Studies' designs

Various research groups used different methods in the intervention studies. Two groups employed group comparison design (randomized controlled trials; Ensor and Koller (1997) and Schirmer et al. (2016)), one group (Pakulski and Kaderavek, 2001) employed a quasi-experimental design, two groups (Schirmer et al., 2009; 2012) employed a quasi-experimental design combined with a single-subject design, and one group (Schirmer et al., 2016) employed a quasi-experimental design with pre-and post-tests. The remaining three groups (Bobzien et al., 2015; Cannon et al., 2010; Richels et al., 2016) used a single-subject design. Of these, Bobzien et al. (2015) employed multiple baselines across children, Cannon et al. (2010) employed multiple baselines (ABC) across three sets of five vocabulary items, and Richels et al. (2016) employed a multiprobe design across children with two generalization and two maintenance phases.

3.1.3. Studies' durations

The durations and numbers of sessions varied among the studies, and several studies required a specific level of mastery before reading another passage or moving on to the next phase (baseline). Therefore, the number of sessions differed among participants in the same study owing to absences and schedule conflicts (Bobzien et al., 2015; Schirmer et al., 2009; 2012; 2016). Overall, the number of sessions ranged from 2 to 25 across the studies.

3.1.4. Sample characteristics

The total number of participants in the ten included studies was 100 d/DHH students. Hearing loss among the 100 students ranged from mild-moderate to profound. The authors of only four studies reported the ethnicity of their participants (Bobzien et al., 2015; Richels et al., 2016; Schirmer et al., 2012; 2016), stating that two d/DHH students were Hispanic, 17 were White, seven were African American, one was Native American, and four were Asian.

The nine intervention studies were conducted in different settings, including preschools; elementary, middle, and high schools; full inclusion schools; self-contained classrooms; schools for the d/Deaf; and summer camps, which used different communication modes (e.g., American Sign Language [ASL], oralism, and total communication). The 100 d/DHH students used different hearing technologies (e.g., cochlear implants and digital hearing aids).

3.1.5. Intervention procedures

Different experimental procedures were used in the nine intervention studies. The authors of four studies (Schirmer et al., 2009; 2012; 2016) examined the effects of the RAAC approach on students' word identification, fluency, comprehension, vocabulary, and self-correction rates. In these studies, students were asked to read and re-read passages as quickly as possible and then answer comprehension questions. This method was repeated until a certain level of mastery was achieved. Richels et al. (2016) used three storybooks from the Noodle series to improve the morphosyntax of d/DHH students. The instructor selected the present progressive as the target morphosyntax. Subsequently, the instructor modified the story to emphasize the target morphosyntax.

During repeated reading, the instructor prompted d/DHH students by asking questions such as "What is happening here?" (p. 355). Bobzien et al. (2015) used repeated reading associated with explicit instruction to teach d/DHH students vocabulary from five stories in the Fly Guy series. Cannon et al. (2010) used repeated reading and expository books presented in ASL on DVD to support students' vocabulary development. Ensor and Koller (1997) adopted Reading for Concepts to improve d/DHH students' reading Fluency—rates, total accuracy, and combined accuracy. In this study, the researchers asked the participants to read five passages. The initial and final sessions were videotaped for analysis. Each session lasted 15 min. Pakulski and Kaderavek (2001) used two books from a story narrative assessment procedure (i.e., One Frog Too Many, and Frog Where Are You?) to implement the repeated reading instruction. They focused on the students' abilities to retell the story after reading it.

Table 1: Summary of the reviewed studies

Reference	Control group	Study design	Age	Hearing loss	Participants/ gender	Ethnicity/ Where conducted	Setting	Communication Modality	Intervention type and duration	Dependent variable	Summary
Bobzien et al. (2015)	No	Single-subject design (Multiple baseline)	3.5-5 years	The participants' hearing loss ranged from mild-moderate to profound. The types of hearing loss were either sensorineural or mixed	N=4 (F=1, M=3). Participants had been identified with hearing loss. one participant had a cochlear implant, and the other 3 participants were using digital hearing aids	2 participants were Caucasian, 1 Chinese Caucasian, and 1 African American	A preschool program in a public school. Participants had an opportunity to access full inclusion classrooms	Participants received oral instruction. Sign language was not allowed during daily practices	Repeated reading and explicit instruction to learn vocabulary. The researchers used the Fly Guy series. A specific level of mastery was required to move onto the next phase. This meant the duration varied by subject	Vocabulary	Participants showed improvement from the baseline to intervention phase. Participants were able to maintain vocabulary. The explicit instruction was shown to be more effective than implicit instruction. The study found that participants were able to generalize the new vocabulary
Cannon et al. (2010)	No	Single-subject design (ABC)	10 to 12 years	Participants' hearing loss ranged from severe to profound	N=4. Gender was not reported. Participants were English-language learners	Ethnicity was not mentioned. The study was conducted in the southeast of the United States	An elementary school for the d/Deaf	ASL	Researchers used repeated reading and expository books presented in ASL on DVD to support participants' vocabulary development. The intervention lasted six weeks	The number of vocabulary words correctly expressed via sign language	Participants did not improve when shown the DVD alone. Instead, the improvement was associated with the previous explicit instruction
Enns and Lafond (2007)	No	Case study	14 and 15 years	Not mentioned	N=2. Both participants had d/Deafness and dyslexia	Not mentioned	A high school for the d/Deaf	ASL	Participants were taught the same words over 10 days via repeated reading. After completing the schedule, they were provided with new passages that encompassed the new words. The intervention lasted six months	Accuracy of decoding, drilling practice, functional skills, and spelling reflection	Participants showed an improvement. They reported changes in their attitude toward reading and showed more self-confidence. They also became more willing to participate in unfamiliar activities and teachers noticed improvements in writing
Ensor and Koller (1997)	Yes	Experimental (Randomized controlled trial)	15 to 19 years	Participants had moderate to severe hearing loss (minimum of 55 db in their better ears)	N=42. (F=18, M=24). All participants reported that they had hearing parents	Ethnicity was not mentioned. The study was conducted in Missouri	A resident school	Total communication approach	The researchers used Reading for Concepts. Repeated reading of five passages	Reading rate, total accuracy, and combined accuracy	There was no statistically significant difference between the control and experimental groups. The experimental group showed greater improvement. A main effect was found between the pre- and post-tests (p<.001)
Pakulski and Kaderavek (2001)	No	Quasi-experimental	7 to 14 years	Two participants had mild hearing loss (26 to 40 db). Remaining participants had hearing loss at a level higher than 60 db	N=14 (F=6, M=8), 4 participants had cochlear implants and 10 participants wore digital hearing aids	The intervention was conducted in the Midwest United States. Ethnicity was not mentioned	Summer camp	Oral communication	Participants were required to listen to two books once a day over three days. On the fourth day, participants engaged in role-playing of the story. On the fifth day, they were shown the book's cover and asked to retell the story	Retelling the story using oral narrative. Reader theater	Participants who repeated the reading and engaged in role-playing showed statistically significant improvements (p<.01). Descriptive data showed that those who role-played had higher grammar scores
Richels et al. (2016)	No	Single-subject design (Multiple baseline)	3.7-4.4 years	Participants' hearing loss ranged from mild to moderate-severe	N=3 (F=2, M=1). Participants wore digital hearing aids	1 participant was Caucasian, 1 Chinese Caucasian, and 1 African American	A self-contained preschool	Oral communication. One participant spoke English at home and Chinese with his grandparents. The other participant spoke English and French at home	Teaching participants morphosyntax and vocabulary via repeated reading. Researchers used stories from the Noodle series. The intervention took 8 to 15 mins. Repeated reading was required until mastery was reached	Morphosyntax and vocabulary	All three participants showed positive outcomes. They showed improvements in the use of morphosyntax and target vocabulary. In addition, all children were able to generalize learned skills into a new context
Schirmer et al. (2012)	No	Quasi-experimental + single-subject	8.11-12.5 years	Participants' hearing loss ranged from mild-severe to profound	N=13 (F=7, M=6), 4 participants had d/Deaf parents. The other 9 participants indicated that their parents were hearing	9 participants were white, 2 African American, 1 Asian, and 1 Hispanic	An elementary school for the d/Deaf	The main language in school was ASL. 8 participants demonstrated limited use of sign language at home. The other five subjects indicated that their parents were fluent in sign language	Repeated reading (RAAC). The intervention lasted eight weeks. Each participant received two or three sessions per week. The total number of sessions ranged from 5 to 19 due to absences and conflicts in schedules	Word identification, reading fluency, comprehension, reading vocabulary, and the self-correction rate	Results from the t-test demonstrated statistically significant improvements for all (including word identification, reading fluency, reading vocabulary, and the self-correction rate) but comprehension did not improve (p<.01). Third graders were able to gain a level of comprehension that allowed them to answer 6 to 8 questions. Fifth graders were able to answer all but one question. The sixth grader showed the best performance
Schirmer et al. (2016) Study I	Yes	Experimental design	10.10-14.8 years	Profound=3, severe to profound=1, severe=1, and moderate to severe=1	N=6 (F=4, M=2). All participants were d/Deaf from hearing parents	1 participant was Hispanic, 1 Native American, and 4 White All from the Midwest	A Middle school, state school for the d/Deaf	ASL	Repeated reading (RAAC). Two or three times/week over two months; the number of sessions ranged from 14 to 16	Comprehension and reading fluency	There was no statistically significant difference for reading fluency and reading comprehension
Schirmer et al. (2016) Study II	No	Quasi-experimental (pre-and post-tests)	13.9-18.7 years	All eight participants had profound hearing loss	N=8 (F=2, M=6). 6 participants were d/Deaf from hearing parents. 2 participants were d/Deaf from d/Deaf parents	4 participants were White, 3 African American, and 1 Chinese participant. All from the Midwest	A high school, State school for the d/Deaf	ASL	Repeated reading (RAAC) for five to seven sessions	Comprehension and reading fluency	In terms of fluency, no statistically significant difference (p=0.416) was found. However, analysis of the reading comprehension showed statistically significant differences (p=0.019)
Schirmer et al. (2009)	No	Quasi-experimental + Single-subject	7.1-7.11 years	Three participants had profound hearing loss. The fourth participant had severe hearing loss	N=4 (F=1, M=3), 2 participants reported that their parents were d/Deaf	Ethnicity was not mentioned	An elementary school for the d/Deaf	ASL and total communication approach	Repeated reading (RAAC) Each participant received two or three sessions per week over five weeks. The total number of sessions ranged from 8 to 12	Word identification, reading fluency, and reading comprehension	Of 4 participants, 3 demonstrated improvements. Whereas the result for running reading was p<.05, the result for reading fluency showed a statistically significant improvement (p<.01). Although participants' comprehension improved, data did not show statistically significant improvements

3.1.6. Repeated reading and literacy outcomes

The findings of the studies examining the effects of repeated reading using the RAAC approach on the reading comprehension of d/DHH students in elementary and middle schools revealed non-statistically significant results (Schirmer et al., 2009; 2012; 2016). However, the analyses of the reading comprehension test scores of d/DHH students in high schools revealed statistically significant differences between the pre-and post-tests (Schirmer et al., 2016). Similarly, the findings of the studies examining the effects of repeated reading on the reading fluency of d/DHH students in middle and high schools revealed non-statistically significant results (Schirmer et al., 2016). By contrast, Ensor and Koller (1997) and Schirmer et al. (2009, 2012) found that repeated reading improves the reading fluency of d/DHH elementary school students. The analyses of the reading fluency test scores of elementary school students indicated statistically significant differences between the pre-and post-tests (Ensor and Koller, 1997; Schirmer et al., 2009; 2012) but not between the control and experimental groups (Ensor and Koller, 1997). The research groups reported that repeated reading positively affects word recognition (Schirmer et al., 2012), vocabulary (Bobzien et al., 2015; Cannon et al., 2010; Richels et al., 2016; Schirmer et al., 2012), morphosyntax (Richels et al., 2016), self-correction rates (Schirmer et al., 2012), and ability to retell a story (Pakulski and Kaderavek, 2001).

Enns and Lafond (2007) used a qualitative case study to examine the effects of repeated reading on students' attitudes toward reading and social interactions. However, as they did not provide a cause-effect relationship, their results should be interpreted with caution (Gall et al., 2014). Enns and Lafond (2007) included two students identified as having d/Deafness and dyslexia. These students reported issues related to retaining information and visual discrimination, which refers to the ability to identify text features, including color and size. The researchers used repeated readings and drills to improve those students' outcomes. Enns and Lafond (2007) found that the students became more positive toward reading and demonstrated higher self-confidence. According to Enns and Lafond (2007), the teachers of these two d/DHH students also reported that they had shown significant improvements in reading and writing.

3.2. Repeated reading and reading skills

To address the second question, what specific reading skills have the repeat reading research targeted? The author summarized the identified studies based on the intended outcomes of the repeated reading interventions (Table 2).

Table 2: Reading skills targeted

Source	Reading fluency	Reading comprehension	Morphosyntax	Vocabulary	Self-correction rate	Word recognition	Students' ability to retell a story
Bobzien et al. (2015)				√			
Cannon et al. (2010)				√			
Ensor and Koller (1997)	√						
Pakulski and Kaderavek (2001)							√
Richels et al. (2016)			√	√			
Schirmer et al. (2012)	√	√		√	√	√	
Schirmer et al. (2016) Study I	√	√					
Schirmer et al. (2016) Study II	√	√					
Schirmer et al. (2009)	√	√					

3.2.1. Reading fluency

In five studies, the research groups examined the impact of repeated reading on the reading fluency of d/DHH students. Ensor and Koller (1997) conducted a study using a group comparison design with random assignment to examine the impact of repeated reading on the reading fluency, rates, and accuracy of d/DHH students. The participants were 42 d/DHH students enrolled in a residential school for the d/Deaf. Participants were between 15 and 19 years old, and their hearing loss ranged from

moderate to severe. The researchers did not identify significant differences between groups' characteristics. The d/DHH students in the control group were asked to read five passages using the total communication approach. The initial and final sessions were videotaped for analysis. Each session lasted 15 min. The number of words per minute was used to measure the reading rate, while the number of student errors was used to measure accuracy. Ensor and Koller (1997) found a non-statistically significant difference between the control and experimental groups. The main effect was found between the pre-and post-tests (p<.001).

The remaining four studies were conducted by the same research group. Schirmer et al. (2009) used a quasi-experimental design with pre- and post-tests combined with a single-subject design to examine the impact of repeated reading on the reading fluency of four d/DHH students enrolled in an elementary school for the d/Deaf. The students' ages ranged from 7 years and 1 month to 7 years and 11 months, while their hearing loss ranged from severe to profound. ASL and written English were used in this study. During this study, the teacher asked d/DHH students to repeat the passage either four times or until fewer than two errors were reached. Sessions were provided two or three times per week over five weeks. The number of sessions ranged from 8 to 12. The results of the reading fluency subtest of the Woodcock-Johnson III achievement test indicated statistically significant differences (p<.01) between the pre-and post-tests.

Schirmer et al. (2012) used a quasi-experimental design with pre-and post-tests, combined with a single-subject design, to examine the impact of repeated reading, RAAC approach, on the reading fluency of 13 d/DHH students enrolled in an elementary school for the d/Deaf in which ASL and written English were used. The students' ages ranged from 8 years and 4 months to 12 years and 5 months. Their hearing loss ranged from mild-severe to profound. In this study, students were asked to read passages as quickly as they could, using oralism ASL. The results of the reading fluency subtest of the Woodcock-Johnson III achievement test indicated statistically significant differences (p=.003) between the pre-and post-tests. The effect size was small (d=0.33).

Schirmer et al. (2016) conducted two studies, which are presented in one article. In the first study, Schirmer et al. (2016) conducted a group comparison with a random assignment design to examine the effects of repeated reading, the RAAC approach, on the reading fluency of d/DHH students. Six d/DHH students were included. The participants attended a middle school for the d/Deaf, where ASL and written English were used. The participants' ages ranged from 10 years and 10 months to 13 years and 4 months. In this study, individual sessions were provided two or three times per week over two months. The number of sessions ranged from 14 to 16. The results of the reading fluency subtest of the Woodcock-Johnson III achievement test indicated non-statistically significant differences between the groups. In the second study, Schirmer et al. (2016) used a single-group experimental design with pre- and post-tests to examine the effects of repeated reading using the RAAC approach on the reading fluency of eight profoundly d/Deaf students enrolled in a high school for the d/Deaf. The age of the participants ranged from 13 years and 9 months to 18 years and 7 months. The number of sessions ranged from five to seven. The results of the reading fluency subtest of the Woodcock-Johnson III achievement test again indicated non-statistically significant differences between the pre-and post-tests.

3.2.2. Reading comprehension

All four of the studies (Schirmer et al., 2009; 2012; 2016) examining the impacts of repeated reading, using the RAAC approach, on the reading comprehension of d/DHH students were conducted by the same research group (for further details of the studies, see the descriptions earlier in reading fluency section as well as Table 1). In Schirmer et al. (2009, 2012), where participants attended an elementary school for the d/Deaf, the results of the passage comprehension subtest of the Woodcock-Johnson III achievement test indicated non-statistically significant differences between the pre- and post-tests. In the first study of Schirmer et al. (2016), in which participants attended a middle school for the d/Deaf, the results of the passage comprehension subtest of the Woodcock-Johnson III achievement test also indicated non-statistically significant differences between the pre-and post-tests. However, in the second study of Schirmer et al. (2016), in which participants attended a high school for the d/Deaf, the results of the passage comprehension subtest of the Woodcock-Johnson III achievement test indicated statistically significant differences (p=.0199) between the pre-and post-tests.

3.2.3. Morphosyntax

Only one study—Richels et al. (2016)—employed a single-subject multiprobe design across children with two generalization and two maintenance phases to examine the effects of repeated reading on students' abilities to respond to morphosyntactical forms. The participants were three d/DHH students aged from 3 years and 7 months to 4 years and 4 months. Their sensorineural hearing loss ranged from mild-moderate to moderate-severe. All the participants wore hearing technologies. The participants were enrolled in a self-contained class and received inclusion opportunities with their hearing peers. Participants were educated using oral communication. In this study, the teachers of the d/DHH students probed each student individually using three storybooks from the Noodle series. A certain level of mastery was required to move on to the next phase. The number of sessions varied

between students, ranging from 4 to 25 sessions. The independent variables were repeated reading and teaching strategies. The dependent variable was the students' responses to verbal probes in the targeted morphosyntactical form. All three d/DHH students showed improvements in the morphosyntactical form taught in this study. Also, students were able to maintain and generalize the information they had learned into a new context.

3.2.4. Vocabulary

Four different research groups conducted four studies to examine the effectiveness of repeated reading on students' vocabulary. One of these studies was the single-subject multiprobe design study by Richels et al. (2016), discussed above. The design of this intervention was as above, except that vocabulary was the dependent variable. Richels et al. (2016) found again that all the children showed improvements in the targeted vocabulary and were able to maintain and generalize the learned vocabulary into a new context.

Bobzien et al. (2015) employed multiple baselines across children to measure the effect of repeated reading combined with explicit instruction on vocabulary learning. The participants were four d/DHH students attending a public preschool. Their ages ranged from 3 years and 5 months to 5 years and 1 month. Their sensorineural hearing loss ranged from mild-moderate to profound. All the participants used hearing technologies such as amplifications or cochlear implants. In this study, the teachers of the d/DHH students read a story from the *Fly Guy* series until each student reached a 100% mastery level. As such, the number of sessions varied between students, ranging from two to eight. Six vocabulary items were taught explicitly, and three were not formally taught. Bobzien et al. (2015) found that the vocabulary of all four participants improved and that explicit instruction was more effective than implicit instruction. The participants were also able to maintain and generalize the learned vocabulary into a new context.

Cannon et al. (2010) employed multiple baselines (ABC) across three sets of five vocabulary items to examine the impact of repeated reading on vocabulary acquisition by d/DHH students enrolled in a school for the d/Deaf. The ages of the participants ranged from 10 to 12 years. All had migrated to the United States within five years prior to the start of the study. Their hearing loss ranged from severe to profound. In this study, Cannon et al. (2010) used books presented in ASL on DVD to target three sets of five vocabulary words. Cannon et al. (2010) found that the participants did not improve when they were shown the DVD alone. Rather, their improvement was associated with the previous explicit instruction.

Only one research group—Schirmer et al. (2012) detailed above—used a quasi-experimental design with pre- and post-found that the reading vocabulary subtest of the Woodcock-Johnson III achievement test indicated statistically significant differences (p=.005) between the pre-and post-tests. The effect size was moderate (d=.51).

3.2.5. Self-correction rates

Schirmer et al. (2012) also examined self-correction rates under this same quasi-experimental design discussed above. Using the running record, Schirmer et al. (2012) found statistically significant differences (p=.000) between the pre-and post-tests. The effect size was moderate (d=0.43).

3.2.6. Word recognition

Schirmer et al. (2012), in the reading fluency section above, examined the impacts of repeated reading using the RAAC approach on the word recognition of 13 d/DHH students. Schirmer et al. (2012) found that the word identification subtest of the Woodcock-Johnson III achievement test indicated statistically significant differences (p=.000) between the pre-and post-tests. The effect size was moderate (d=0.46).

3.2.7. Students' ability to retell a story

Pakulski and Kaderavek (2001) conducted the only study to examine the impact of repeated reading on d/DHH students' ability to retell a story. Pakulski and Kaderavek (2001) used a within-subject quasi-experimental design. The participants were 14 d/DHH students aged from 7 to 14 years. All of whom enrolled in a summer camp. Their hearing loss ranged from mild to moderate-severe. All the participants used an oral communication approach. The participants were required to listen to two books once a day for three days. On the fourth day, they engaged in role-playing the story. On the fifth day, the participants were shown the book's cover and asked to retell the story. Pakulski and Kaderavek (2001) found that those participants who repeatedly read and engaged in role-playing showed statistically significant improvements (p<.01). Pakulski and Kaderavek (2001) also found that those who role-played had higher grammar scores.

3.3. Evaluation of the included studies

To address the third question of this study, the author applied quality indicators and evidence-based classifications to assess the extent to which the included studies met the standards set by the CEC. The two studies in which research groups used randomized controlled trials (Ensor and Koller, 1997; Schirmer et al., 2016) indicated non-statistically significant results between the experimental and control groups. The three studies in which research groups used a single-subject design (Bobzien et al., 2015; Cannon et al., 2010; Richels et al., 2016) yielded positive effects and met the CEC's quality indicators. While all three studies

targeted vocabulary, only Richels et al. (2016) targeted morphosyntax. As such, only the effects of repeated reading on d/DHH students' vocabulary can be classified as potentially evidence-based practice.

4. Discussion

In this systematic review, the author examined evidence-based studies on repeated reading instruction among d/DHH students from 10 studies presented in nine peer-reviewed articles published between 1990 and 2023. The authors of the ten studies used different methods (i.e., experimental design, quasi-experimental design, single-subject design, and a combination of quasi-experimental design with single-subject design) and targeted different outcomes. Table 3 summarizes the studies by the targeted outcomes: reading fluency (i.e., rates and accuracy), reading comprehension, morphosyntax, vocabulary, self-correction rates, word recognition, and ability to retell a story. Table 3 encompasses the following categories: source, study design, number of participants, results, and status of evidence-based practice.

As shown in Table 3, the author's analysis of the existing literature indicated that the effects of repeated reading on d/DHH students' vocabulary can be classified as potentially evidence-based practice. However, there is insufficient research supporting the effectiveness of repeated reading on d/DHH students' reading comprehension, reading fluency, morphosyntax, self-correction rates, word recognition, and ability to retell a story. The author's analysis of the existing literature also indicated the minimal number of participants across studies—as proposed by Cook et al. (2015)— still needs to be met. Therefore, as with previous reviews of the literature (Kart, 2022; Luckner and Cooke, 2010; Luckner and Handley, 2008; Luckner et al., 2005; Luckner and Urbach, 2012; Mayer and Trezek, 2020; Schirmer and McGough, 2005; Trezek and Wang, 2017; Trussell and Easterbrooks, 2017), there is a continued need to increase the quality and quantity of intervention research among d/DHH students. Finally, the author's analysis of the existing literature shows that all four studies on reading fluency and reading comprehension were conducted by the same researchers. Therefore, the replication of these studies by other researchers is warranted.

The results of this systematic literature review align with those of previous systematic reviews of evidence-based practices related to the literacy skills of d/DHH students (Luckner and Cooke, 2010; Luckner and Handley, 2008; Luckner et al., 2005; Trussell and Easterbrooks, 2017; Trezek and Wang, 2017; Tucci et al., 2014). The findings of this systematic review demonstrated that evidence surrounding the effects of repeated reading on reading comprehension, reading fluency (i.e., rates and accuracy), morphosyntax, self-correction rates, word recognition, and ability to retell a story is lacking. Trezek and Wang (2017) found that studies targeting reading-related skills among d/DHH students did not meet the CEC criteria for evidence-based practice, and repeated reading among d/DHH students did not meet the minimal criteria for evidence-based practice as proposed by the CEC. Luckner and Urbach (2012) discovered study studies that examined the impact of repeated reading on reading fluency among d/DHH students. Therefore, they concluded that repeated reading techniques among d/DHH students did not meet the Institute of Education Sciences (Baron, 2004) criteria for possible evidence of effectiveness. After more than 10 years, the author of the current review reached a similar conclusion. There is insufficient research supporting the impact of repeated reading on d/DHH students' reading fluency. Studies targeting reading fluency among d/DHH students did not meet the CEC criteria for evidence-based practice.

Although the effects of repeated reading among d/DHH students did not meet the minimum threshold for evidence-based practice, there is no compelling reason for teachers of d/DHH students to refrain from using repeated reading techniques in class to improve d/DHH students' reading skills. Overall, the findings of this systematic review indicated that repeated reading is still an effective technique, and improves d/DHH students' comprehension (Schirmer et al., 2016), morphosyntax (Richels et al., 2016), vocabulary (Bobzien et al., 2015; Cannon et al., 2010; Richels et al., 2016; Schirmer et al., 2012), self-correction rates (Schirmer et al., 2012), word recognition (Schirmer et al., 2012), fluency (Ensor and Koller, 1997; Schirmer et al., 2009; 2012), and ability to retell a story (Pakulski and Kaderavek, 2001). That said, whereas hearing students learn to read after acquiring spoken language, d/DHH students learn to read while learning a language. Therefore, repeated reading instruction should be implemented with caution.

Like previous systematic reviews and meta-analyses on the effectiveness of repeated reading instruction in hearing students with and without learning disabilities (Chard et al., 2002; Collins et al., 2023; Lee and Yoon, 2017; NRP, 2000; Therrien, 2004; Zimmermann et al., 2021), the author of this review found that repeated reading instruction enhanced the literacy skills of d/DHH students. In addition, as with previous meta-analyses of hearing students (Lee and Yoon, 2017; Therrien, 2004), the author of this article found that the reading fluency of d/DHH students in elementary school benefited from repeated reading intervention more than the reading fluency of d/DHH students in middle or high schools.

In contrast to the findings of previous systematic reviews, which indicated no systematic replication (e.g., Luckner et al. (2005), Luckner and Handley (2008), Luckner and Urbach (2012), Trussell and Easterbrooks (2017), and Tucci et al. (2014)), the findings of this systematic review indicated that one study was replicated four times by the same researchers (Schirmer et al., 2009; 2012; 2016).

Table 3: Status of evidence-based practice

Reading skills	Source	Study design	Participants	Results	Status of evidence-based practice
Reading fluency	*Ensor and Koller (1997)	Experimental design with randomized controlled trial	N=42	There was no statistically significant difference between the control and experimental groups	Insufficient evidence
	Schirmer et al. (2012)	Quasi-experimental design combined with single-subject design	N=13	There was a statistically significant difference for reading fluency	
	*Schirmer et al. (2016) Study I	Experimental design with randomized controlled tria	N=6	There was no statistically significant difference for reading fluency	
	Schirmer et al. (2016) Study II	Quasi-experimental design with pre-and post-tests.	N=8	There was no statistically significant difference for reading fluency	
	Schirmer et al. (2009)	Quasi-experimental design combined with single-subject design	N=4	There was a statistically significant difference for reading fluency	
Reading comprehension	Schirmer et al. (2012)	Quasi-experimental design combined with single-subject design	N=13	There was no statistically significant difference for reading comprehension	Insufficient evidence
	*Schirmer et al. (2016) Study I	Experimental design with randomized controlled trial	N=6	There was no statistically significant difference for reading comprehension	
	Schirmer et al. (2016) Study II	Quasi-experimental design with pre-and post-tests	N=8	There was a statistically significant difference for reading comprehension	
	Schirmer et al. (2009)	Quasi-experimental design combined with single-subject desig	N=4	There was no statistically significant difference for reading comprehension	
Morphosyntax	*Richels et al. (2016)	Single-subject design.	N=3	All three participants showed positive outcomes. They showed improvements in the use of morphosyntax and target vocabulary	Insufficient evidence
Vocabulary	*Bobzien et al. (2015)	Single-subject design	N=4	Participants showed improvements. The explicit instruction was shown to be more effective than the implicit instruction	Potentially evidence-based practice
	*Cannon et al. (2010)	Single-subject design	N=4	Participants improved when vocabulary associated with the previous explicit instruction	
	*Richels et al. (2016)	Single-subject design	N=3	All three participants showed positive outcomes. They showed improvements in the use of morphosyntax and target vocabulary	
	Schirmer et al. (2012)	Quasi-experimental design combined with single-subject design	N=13	There was a statistically significant difference for vocabulary	
Self-correction rate	Schirmer et al. (2012)	Quasi-experimental design combined with single-subject design	N=13	There was a statistically significant difference for the self-correction rate	Insufficient evidence
Word recognition	Schirmer et al. (2012)	Quasi-experimental design combined with single-subject design	N=13	There was a statistically significant difference for word recognition	Insufficient evidence
Students' ability to retell a story	Pakulski and Kaderavek (2001)	Quasi-experimental design	N=14	Participants who repeated the reading and engaged in role-playing showed statistically significant improvements	Insufficient evidence

Asterisks before the references indicate that the study used either a group comparison design or a single-subject design, therefore, they were included in the evidence-based practice analysis

Similarly, in contrast to the findings of previous systematic reviews that showed no authors having investigated the same domain (e.g., Luckner et al. (2005) and Tucci et al. (2014)), the findings of this systematic review indicated that four research groups examined the effectiveness of repeated reading techniques (i.e., the RAAC intervention) on d/DHH students' reading fluency and comprehension (Schirmer et al., 2009; 2012; 2016). The findings of this systematic review also identified that four research groups examined the effectiveness of repeated reading techniques on the vocabulary of d/DHH students (Bobzien et al., 2015; Cannon et al., 2010; Richels et al., 2016; Schirmer et al., 2012). Unlike most previous systematic reviews in the field of d/Deaf education, the author of this systematic review found an increased number of studies in which experimental approaches were used. Ninety percent of the identified studies used experimental approaches, quasi-experimental approaches, single-subject design, or a combination of quasi-experimental approaches and single-subject design rather than descriptive studies. The author's review of the existing literature indicated that repeated reading generally improves students' literacy skills and attitudes toward reading. The teachers who participated in Enns and Lafond's (2007) study reported that repeated reading helped students experience success. In addition, Enns and Lafond (2007) found that d/DHH students were more likely to spend more time reading after participating in the repeated reading intervention.

5. Limitations and future direction

Although the author attempted to collect all studies on the effectiveness of repeated reading among d/DHH students, studies that should have been included may have been inadvertently missed. It is also possible that the author missed a search term that could have significantly affected the finding. The author of this systematic review found that four of the included studies were conducted by the same researchers. Therefore, systematic

replication is warranted in future work. Future researchers should investigate whether students dedicate more time to using repeated reading techniques independently and the long-term effects of repeated reading on students' literacy. Future researchers may also examine the effects of repeated reading on students' morphological and syntactic abilities. Future researchers could also investigate whether repeated reading promotes higher-level thinking. According to Enns and Lafond (2007), teachers-participants reported that their students' writing skills improved. Future researchers may consider experimental design to examine the extent to which repeated reading improves students' writing skills. Finally, in further studies, authors could collect longitudinal data to observe the same variables over a longer period.

6. Conclusions

The authors of previous systematic literature reviews have shown a clear need for high-quality studies in the field of d/Deaf education (Luckner and Cooke, 2010; Luckner and Handley, 2008; Luckner et al., 2005; Trussell and Easterbrooks, 2017). Like previous systematic literature, the author of this review identified the need for high-quality studies examining the effects of repeated reading on the reading skills of d/DHH students. Like those of previous researchers who have examined repeated reading instruction for students with and without learning disabilities, the author suggests that d/DHH students benefit from repeated reading instruction. Our findings also revealed that repeated reading aids d/DHH students to experience success. Thus, d/DHH students were likely to spend more time reading. However, researchers must document whether these students begin practicing re-reading materials independently. Further studies may examine the effectiveness of repeated reading in students' writing.

Compliance with ethical standards

Ethical considerations

The study adhered to ethical standards, with informed consent obtained from all participants. Confidentiality and data security were strictly maintained, and the research received approval from the relevant ethics board.

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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