Review

An evidence-based synthesis of instructional reading and spelling procedures using telepractice: A rapid review in the context of COVID-19

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Abstract

Background: Due to COVID-19, many educators and allied health practitioners are facing the challenge of rapidly transitioning to telepractice delivery of instructional reading and spelling procedures without being fully informed of the evidence.

Aims: A rapid review was conducted to provide educators, allied health practitioners and policymakers with a synthesis of valid, relevant and actionable evidence relating to telepractice delivery of instructional reading and spelling procedures. The aim was to investigate the nature and outcomes of studies examining instructional reading and spelling procedures delivered via telepractice to school-aged students.

Methods & Procedures: A rapid review was undertaken in accordance with the eight-step process published by the Cochrane Rapid Reviews Methods Group. Medline (all databases), Embase, Cochrane and ProQuest Central were systematically searched with predefined search terms organized across four key concepts relating to the research questions.

Outcomes & Results: Nine studies were included in this rapid review. Reading and spelling instruction and intervention using telepractice can be feasible and engaging. Telepractice assessment for reading and spelling can be equally effective as onsite assessment.

Conclusions & Implications: The evidence base for telepractice delivery of reading and spelling procedures is in its infancy in terms of both the quantity and the quality of the evidence. Insufficient evidence exists to draw clear conclusions about its efficacy, and therefore practitioners should proceed cautiously.

Keywords: COVID-19, reading, spelling, telepractice.

What this paper adds

What is already known on the subject

• For onsite delivery, evidence-based reading and spelling assessment, instruction and interventions delivered by educators and allied health practitioners have been shown to accelerate students’ skills; less is known about the efficacy of instructional reading and spelling procedures in a telepractice model, which have rapidly become the new norm in many countries due to the COVID-19 pandemic. The benefits of telepractice include improved access to services, increased service availability, convenience, time efficiency, caseload management efficiency and removal of logistical barriers relating to cost and geographical location. During the COVID-19 pandemic, telepractice has facilitated continued access to services.

What this study adds to existing knowledge

• Reading and spelling instruction and intervention delivered via telepractice can be feasible and engaging. Telepractice is a viable mode to deliver reading and spelling assessments with strong agreement between telepractice and onsite scores. Given their low methodological quality, the studies in this review provide
Introduction

In response to the COVID-19 pandemic, many educators and allied health practitioners are facing the challenge of rapidly transitioning to online delivery of instructional reading and spelling procedures, without being fully informed of the evidence for this or the practicalities of telepractice delivery. In onsite delivery models, instructional reading and spelling procedures delivered by educators and allied health practitioners have been shown to improve students’ knowledge and skills (McArthur et al. 2018); however, it is not known whether this is effective in a telepractice model of delivery. Telepractice has rapidly become the new norm in many countries due to the COVID-19 pandemic and will likely continue as part of standard practice due to its perceived benefits. Given the importance of telepractice to be feasible, viable and evidence based, as highlighted by the COVID-19 pandemic, a summary of the evidence is urgently needed.

In circumstances such as the COVID-19 pandemic, rapid reviews are often used to inform policy and practice-related decisions (World Health Organization (WHO) 2017). Whilst rapid reviews share similarities with systematic reviews, the rapid review process is accelerated and modified to summarize evidence for key stakeholders in a more time- and resource-efficient manner. Given the rapid transition to telepractice for many practitioners as a result of the COVID-19 pandemic, a rapid review rather than a traditional systematic review was adopted for this study to facilitate timely access to valid, relevant and actionable evidence.

Telepractice uses telecommunications technology to provide real-time services at a distance by connecting educators and health professionals to students, clients and patients for assessment, intervention, consultation or supervision (American Speech–Language–Hearing Association (ASHA) 2020). Telepractice may also be referred to as telehealth, teledelivery, telerehabilitation or included in broader terms like eHealth or mHealth.

The benefits of telepractice are well-documented across both education and allied health (Keck and Doarn 2014, Valentine et al. 2021). These benefits include increased service availability, convenience, improved caseload management resulting in more cost-effective service delivery, improved access to services for people living in rural and remote areas (Fairweather et al. 2016); and removal of travel and geographical barriers (Govender and Mars 2018, Yoo et al. 2020). Telepractice has facilitated access to education for students who are unable to attend full-time classes (Burdina et al. 2019) and has a long history through Distance Learning programs (Cavanaugh et al. 2004). In the context of COVID-19, the benefits of telepractice have become even more pronounced. Telepractice has facilitated continued access to classroom instruction for all students, and to intervention for those students with learning difficulties and learning disabilities. Continued access to services, including evidence-based reading and spelling assessment, instruction and intervention delivered by educators and allied health practitioners, has been shown to accelerate students’ skills and ideally, minimize the well-documented negative secondary consequences commonly associated with low literacy.

Therefore, whilst immediate attention has been focused on the COVID-19 pandemic and the significant global health and economic challenges this presents, it is imperative that educators and allied health practitioners can continue to deliver instructional reading and spelling procedures to their students. Telepractice has facilitated access to services during the COVID-19 pandemic; however, its efficacy for reading and spelling assessment, instruction and intervention is unknown.

Numerous reviews have been published evaluating telepractice studies of student learning and support in areas including speech and language (e.g., Wales et al. 2017) and autism (e.g., Sutherland et al. 2018); yet, no review to date has specifically focused on evaluating telepractice studies of reading and spelling assessment, instruction and intervention. The focus of this rapid review was to examine the existing evidence for instructional reading and spelling procedures using telepractice. A summary of the current state of knowledge of this topic is needed to support practitioners in making informed decisions about telepractice for reading and
spelling assessment, instruction and intervention, particularly in the context of COVID-19.

For the purposes of this review, the phrase *instructional reading and spelling procedures* is inclusive of assessment, instruction and intervention. In this review, the term *instruction* refers to the act of teaching, tutoring or educating (often delivered by educators) and *intervention* refers to therapy delivered by allied health practitioners such as speech-language pathologists and occupational therapists.

A rapid review method was chosen for this study. Rapid reviews adopt a streamlined process to synthesizing evidence. Whilst systematic reviews are preferable in establishing an evidence base, they are not always feasible, especially during times of crisis, such as the COVID-19 pandemic, when urgent decisions need to be made (Bolton et al. 2020). The timeframe for systematic reviews can take anywhere between 6 months and 2 years to complete (Khangura et al. 2012), which may not meet the needs of key stakeholders, including practitioners. This may lead them to rely on less robust forms of evidence such as expert opinion and single case designs to inform their practice and decision-making. Educators and allied health practitioners have a professional obligation to provide evidence-based instruction and intervention, which extends to delivery mode. Therefore, this rapid review aimed to facilitate practitioners’ ability to provide evidence-based services at a time of rapid change. During the COVID-19 pandemic, numerous health-related rapid reviews have been published. Examples include rapid reviews of clinical swallowing assessments (Bolton et al. 2020), virtual geriatric clinics for outpatient consultations (Murphy et al. 2020) and palliative care and hospice services (Etkind et al. 2020). These reasons justify the authors’ use of the rapid review method for the current study.

The aim of this rapid review was to investigate the nature and outcomes of studies examining instructional reading and spelling procedures delivered by telepractice to school-aged students with identified difficulties in reading and/or spelling. The main research question for this rapid review was: Does educator and allied health practitioner-led telepractice reading and spelling instruction and intervention improve reading and spelling outcomes for school-aged students? A secondary question was: What are the characteristics of practitioner-led telepractice reading and spelling assessment, instruction and intervention with school-aged students?

**Methods**

This rapid review was guided by a document published by the Cochrane Rapid Reviews Methods Group (Garritty et al. 2020). This document describes an eight-step process, which follows a similar procedure to a systematic review through streamlining and omitting specific steps (Garritty et al. 2020). These eight steps are: (1) setting the research question; (2) setting eligibility criteria; (3) searching; (4) study selection; (5) data extraction; (6) risk of bias assessment; (7) synthesis; and (8) other considerations (Garritty et al. 2020).

**Search strategy and selection criteria**

For this rapid review, a senior library research advisor searched the following databases: Medline (all databases), Embase, Cochrane and ProQuest Central. Search terms were organized across four key concepts: (1) telepractice; (2) instruction/intervention; (3) reading and spelling outcomes; and (4) children/students. Supplemental File 1 in the supplemental data online provides a full list of search terms and example search string (Medline). For studies to be included in the review, they had to (1) report on primary research; (2) be published in peer-reviewed journals; (3) be written in English; (4) include school-aged students (aged between 5 and 19 years) with identified difficulties in reading and/or spelling; (5) describe the provision of reading and/or spelling assessment/instruction/intervention via telepractice; (6) report on outcomes relating to reading and spelling; (7) meet the definition of telepractice delivery; and (8) have a publication date post-2005. Exclusion criteria were (1) studies evaluating computer-based interventions or software programs without an instructional agent; (2) conference proceedings; (3) qualitative studies reporting solely on student/practitioner perspectives or experiences of telepractice; (4) studies reporting on asynchronous solely on student/practitioner perspectives or experiences of telepractice; (4) studies reporting on asynchronous delivery; and (5) studies evaluating writing outcomes (e.g., handwriting, text-level writing).

Interim guidance from the Cochrane Rapid Reviews Method Group is to place an emphasis on higher quality study designs and to consider a stepwise approach to study design inclusion for rapid reviews (Garritty et al. 2020). To ensure comprehensive coverage of this topic, where the current state of knowledge was unknown, the authors adopted a wide scope including any study design listed in the National Health and Medical Research Council (NHMRC) Evidence Hierarchy (Merlin et al. 2009).

**Study selection**

The initial search yielded 10,559 studies, of which nine met our inclusion criteria and are presented in this review. The selection process is provided in figure 1. Studies were imported into the reference management software EndNote. Duplicates were removed before screening leaving a total of 8241 studies. Screening of
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Figure 1. Search and selection process. *Six from hand-searching the reference list and one from personal communication.

*Six from hand searching reference lists and one from personal communication

titles was completed by the first author using the pre-defined inclusion and exclusion criteria previously described. A total of 484 studies were included at title screening, and 7757 were excluded. Abstracts were screened by the first author with dual screening of approximately 20% (104 articles) by the second author. Percentage agreement between reviewers at abstract screening was 88%. Disagreements at abstract screening were resolved by consensus (13/104 studies). There were 153 eligible studies identified at abstract screening. Full-text screening of 153 studies was conducted by a research assistant. The research assistant included nine studies and excluded 144. A second reviewer (the third author) screened all excluded full-text studies. Percentage agreement between reviewers at full-text screening for excluded studies was 99% (143/144 full-text articles). One article excluded by the research assistant was recommended for inclusion by the second reviewer and this decision was verified by all co-authors. The 10 included studies were reviewed by all co-authors; two were then excluded as they reported on allied health intervention more broadly, rather than...
reading or spelling assessment, instruction or intervention specifically, resulting in eight studies.

To ensure the most up-to-date results, a second search was conducted just before submission using all the same parameters as the original search. This second search found 30 additional potentially relevant titles that were evaluated using the review’s inclusion and exclusion criteria by the same reviewers involved in the original search. One article was included from this second search. A total of nine studies were included in the final review (figure 1).

**Data extraction**

A research assistant extracted data from the nine included studies using a data-extraction form adapted from the Cochrane Developmental, Psychosocial and Learning Problems Review Group’s Data Collection Form for Intervention Reviews (randomized controlled trial (RCTs) and non-RCTs). The adapted data-extraction form was reviewed by the first and fourth authors before data extraction of the nine included articles was conducted by the research assistant. The adapted data-extraction form is provided in Supplemental File 2 in the supplemental data online. A second reviewer (first author) checked for correctness and completeness of the extracted data.

**Quality appraisal**

Due to the heterogeneity and overall low-level study designs of the included studies (according to the NHMRC), a six-item checklist from the Cochrane Developmental, Psychosocial and Learning Problems Data Collection Form for Intervention Reviews: RCTs and non-RCTs (Version 3) was used to evaluate risk of bias. The risk of bias checklist assesses selection, performance, detection, attrition and reporting bias through six items requiring the assessor to identify the risk as ‘high’, ‘low’ or ‘unclear’. The assessor can also note other forms of bias on the form. A single reviewer (fourth author) rated the risk of bias with full verification of all judgements by a second reviewer (third author).

**Results**

The aim of this review was to investigate the nature and outcomes of studies examining instructional reading and spelling procedures delivered by telepractice to school-aged students. The results section begins with a description of the characteristics of the included studies and then presents the review’s findings according to the two specific research questions posed.

**Methodological and demographic characteristics**

Nine studies were included in the review. The methodological characteristics of the included studies, and demographic characteristics of the study samples, are provided in table 1 and synthesized narratively below. Due to the heterogeneous nature of the samples, outcome measures and study designs information provided in the individual studies, and varied study designs, a meta-analysis was not conducted.

**Date of publication, study design and level of evidence**

The included studies were published between 2007 and 2020 in either the United States (n = 5) or Australia (n = 4). A range of study designs was utilized. Reflecting the preliminary nature, or non-conducive research aims of many of the included studies, randomized control conditions were largely unreported. Waite et al. (2010) were the only researchers to use a randomized design in their evaluation of the reliability of conducting reading and spelling assessments using telepractice. Two studies utilized a non-randomized controlled design. Houge et al. (2007) compared improvements in literacy skills for adolescents who received instruction either via webcam or in person. Similarly, Lee et al. (2017) compared these service delivery approaches for school-aged students with hearing loss and phonological awareness difficulty. Vasquez and Slocum (2012) and Vasquez et al. (2011) used a single-subject multiple baseline experimental design to evaluate the effect of online instruction to target reading difficulties. The across-subject design used in both studies allowed the researchers to monitor the effect of the instruction on a single participant (while also monitoring the baseline measures for stability in the other participants) before progressively introducing instruction to the remaining participants. A single case design was also adopted by Wright et al. (2011) with assessment before baseline, after baseline (i.e., 10 weeks), post-test (end of the 10-week intervention) and 10 weeks post-intervention (maintenance). Houge and Geier (2009) provided a single group of adolescents with one-to-one reading and spelling instruction delivered via webcam in a pre-test/post-test design. Hodge et al. (2019) used a diagnostic accuracy study design to evaluate the level of agreement between when simultaneous on-site, and telepractice reading and spelling assessments were conducted. Kohnen et al. (2020) adopted a pre-test/post-test design where participants acted as their own controls in a no-training phase (waitlist), followed by an intervention phase with testing at three timepoints (baseline, following the no-training period and post-intervention).
Table 1. Demographic and methodological characteristics of the included studies

| Reference         | Study design   | Overall sample size (n) | Age range (years) | Participant diagnoses                      | Aims                                                                 | Treatment agent                                                                 | Outcomes                                                                 | Main results                                                                 |
|-------------------|----------------|-------------------------|-------------------|--------------------------------------------|----------------------------------------------------------------------|-------------------------------------------------------------------------------|----------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| Hodge et al. (2019) | Diagnostic accuracy study | 37                       | 8–12              | Specific Learning Disorder with impairment in reading | To determine whether literacy assessments can be administered reliably via remote testing compared with face-to-face evaluation To obtain feedback from teachers and parents in relation to the child’s behaviours and about their satisfaction with telepractice | Teachers with modest experience in technology and a psychologist | Literacy assessment scores given by the online and face-to-face staff Behavioural observation scores made by the local staff and RA² | Strong agreement between telepractice and face-to-face-rated assessment scores Parents reported a high degree of comfort with the telepractice assessments |
| Houge and Geier (2009) | Pre-test/post-test | 61                       | 9–18              | Difficulties in one or more literacy components: word recognition, decoding, reading fluency and comprehension | To determine the reading and spelling progress of adolescents receiving 8 weeks of twice weekly one-to-one literacy instruction delivered by tutors via webcam | Undergraduate teacher candidates who were trained and supervised | GORT-4⁴ TWS-4⁵ Qualitative feedback from parents and teacher administrators | Significant improvement in all three areas of the GORT-4 Significant improvement in TWS-4 scores Increased interest in reading |
| Houge et al. (2007) | Non-RCT       | 25                       | 12–19             | Scored below the proficiency level in the Dakota STEP³ | To determine the extent to which middle- and high-school students could improve their literacy skills through supervised literacy instruction from preservice secondary teacher candidates via webcam and in person | Undergraduate teacher candidates who were trained and supervised | Reading Inventory for the Classroom assessment | Non-significant between-groups difference in reading comprehension Significant improvement in the level of reading for both groups Significant improvement in vocabulary in both groups |
| Kohnen et al. (2020) | Pre-test/post-test | 18                       | 7–12              | Children with reading/spelling difficulties | To determine whether a literacy intervention delivered through videoconferencing can improve literacy skills in a group of 18 children with poor reading and spelling | Trained clinicians from the Macquarie University Reading Clinic | TOWRE SWE⁶ TOWRE PDE⁷ LeST² | Significant improvement in raw scores and standard scores for non-word reading (TOWRE PDE) and letter-sound knowledge (LEST) to within the average range or close to it. No significant improvement for word reading (TOWRE SWE). Delivering reading and spelling intervention through videoconferencing can improve reading scores |

Continued
| Reference          | Study design  | Overall sample size (n) | Age range (years) | Participant diagnoses                                                                 | Aims                                                                 | Treatment agent                                                                 | Outcomes                                                                 | Main results                                                                                                                                                                                                 |
|--------------------|---------------|-------------------------|-------------------|--------------------------------------------------------------------------------------|-----------------------------------------------------------------------|---------------------------------------------------------------------------------|--------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Lee et al. (2017)  | Non-RCT       | 20                      | 4–6; 8–11         | Children with hearing loss who presented with phonological awareness difficulty     | To examine the feasibility of a 12-week telepractice intervention to improve phonological awareness skills in children with hearing loss as compared with conventional in-person intervention | SLP graduate students trained and supervised by certified SLPs                  | ELLA                                                                 | Telepractice service delivery model is feasible for young children with hearing loss. Telepractice may be as effective as in-person intervention in improving phonological awareness skills. |
| Vasquez et al. (2011) | Multiple-baseline design | 3                        | Fourth grade: age not reported | Fourth-grade students with teacher identified reading difficulties                  | To evaluate the effect of online reading tutoring for at-risk 4th grade students’ reading skills To compare tutor delivery across delivery methods | Pre-service teachers who received supervision                                  | ORF measured by ORF subtest of the DIBELS                                   | Reading instruction in an online format led to a marked increase in oral reading fluency. Delivery was largely delivered in a similar way both face to face and online. |
| Vasquez and Slocum (2012) | Multiple-baseline design | 4                        | Fourth grade: age not reported | Fourth-grade students with teacher identified reading difficulties                  | To evaluate the effectiveness of an online system for delivering remedial reading instruction to students at a distance | Preservice undergraduate teachers who were trained and supervised             | Oral reading fluency measured by the ORF subtest of the DIBELS Selected WJ-III subtests Questionnaires for teachers, tutors, students and parents     | Participants improved in oral reading fluency. Both participants and other stakeholders perceived that participants had improved their reading skills. Participants and tutors reported that online delivery was beneficial. Very good agreement between all ratings made on literacy assessments in the online and in-person environments. No clinically significant difference between assessment ratings on most outcomes. Only agreement on subtests for non-word spelling, non-word reading and an overall classification of reading did not achieve predetermined clinical criteria. |
| Reference       | Study design     | Overall sample size (n) | Age range (years) | Participant diagnoses                                                                 | Aims                                                                 | Treatment agent                        | Outcomes                           | Main results                                                                 |
|-----------------|------------------|-------------------------|-------------------|---------------------------------------------------------------------------------------|----------------------------------------------------------------------|----------------------------------------|------------------------------------|--------------------------------------------------------------------------------|
| Wright et al.   | Single case study| 1                       | 10                | History of learning difficulties and a mild expressive language weakness             | To investigate whether a Voice over the Internet Protocol (VoIP) could be used to deliver reading intervention for children with refractory reading difficulties | Dual educator/psychologist             | CC2, CBM and the NARA-3            | Significant improvement in reading accuracy and comprehension on all measures except the irregular word list of the CC2 |
|                 |                  |                         |                   |                                                                                       | Substantial improvement in non-word reading accuracy based on the CBM |
|                 |                  |                         |                   |                                                                                       | Gains were maintained at 10-week follow-up testing                   |
|                 |                  |                         |                   |                                                                                       | Participant’s mother was satisfied with gains made during intervention and with VoIP as a platform |

Notes: *Research assistant.

1 Gray Oral Reading Test—4.
2 Test of Written Spelling—4.
3 Randomized controlled trial.
4 South Dakota State Test of Educational Progress.
5 Test of Word Reading Efficiency—Sight Word Efficiency.
6 Test of Word Reading Efficiency—Phonemic Decoding Efficiency.
7 Letter Sound Test.
8 Speech-language pathologist.
9 Emerging Literacy & Language Assessment.
10 Oral reading fluency.
11 Dynamic Indicators of Basic Early Literacy Skills.
12 Letter—Word Identification, Reading Fluency, Passage Comprehension, Word Attack and Picture Vocabulary subtests.
13 Queensland University Inventory of Literacy.
14 South Australian Spelling Test.
15 Neale Analysis of Reading Ability, 3rd edition.
16 Castles and Coltheart Test, 2nd edition.
17 Curriculum-based non-word reading test.
Methodological quality

The Cochrane Developmental, Psychosocial and Learning Problems Review Group’s Risk of Bias Assessment Form was used to evaluate the quality and risk of bias of the nine included studies. With six types of bias assessed for each article, a total of 54 judgements were made. The level of agreement between the two assessors was high, with agreement on 92% of items (50/54 items). Consensus was reached on all conflicting judgements following discussion between the assessors.

While randomized control conditions were largely not used, six of the nine studies incorporated various controls. For the three studies without control conditions (Houge and Geier 2009, Houge et al. 2007, Lee et al. 2017), it is impossible to ascertain whether gains in reading and/or spelling were due to the instruction/intervention or other factors such as maturation. The risk of bias due to lack of blinding was high across all studies. This potentially presented both performance and detection bias in all studies. It should be acknowledged that, given the nature of the instructional procedures and control conditions (evaluating online delivery), it was not possible to blind the participants and personnel to the instructional procedure. What is potentially more problematic was the tendency for study outcomes to be measured by the same personnel rather than independent, blinded assessors. To account for this, most studies reported inter- and intrarater reliability procedures that demonstrated acceptable levels of agreement. Alternatively, objective measures of reading were also used (e.g., Houge and Geier 2009) used the Gray Oral Reading Test—4 (GORT-4) (Wiederholt and Bryant 2001) and the Test of Written Spelling—4 (TWS-4) (Larsen et al. 1999). Most studies incorporated standardized outcome measures with established acceptable psychometric properties. Houge et al. (2007), however, used the Reading Inventory for the Classroom (Sutton Flynt and Cooter 2004), which is described as a preliminary assessment of students’ reading abilities. Test–retest reliability evaluations of this measure have been mixed and the authors noted that use of a standardized measure in future research was needed.

For those studies reporting the results of an instruction or intervention (n = 7), three reported treatment fidelity checks and these indicated that their instruction or intervention was delivered accurately. Houge et al. (2007), Houge and Geier (2009), Kohnen et al. (2020) and Wright et al. (2011) did not report treatment fidelity. Several studies were potentially impacted by co-intervention bias. While this is difficult to control given students were concurrently attending school while participating in the research, it makes it difficult to attribute improvements to the independent variable alone. For example, in Vasquez et al. (2011), students continued to receive reading instruction from their general education teachers while being involved in the study; and in Lee et al. (2017) students also received phonological awareness instruction from their classroom teachers.

For the majority of studies, it is not possible to establish whether the results of the instruction or interventions were maintained beyond the duration of the studies. Outcome measures for most studies were only assessed at baseline and again immediately after the instruction or intervention. Wright et al. (2011) was the exception with a 10-week post-intervention data point. It is also difficult to determine the generalizability of the findings from each study. This is largely due to the preliminary nature of the research which impacted several factors such as the tendency to recruit unrepresentative samples. Additionally, most studies provided insufficient information regarding the nature of the training provided to the treatment agents (i.e., the pre-service teachers, speech–language pathologists, etc.) to allow replication.

Participant characteristics

Aside from the three studies reporting single-subject designs (where \( n = 1, 3 \) or 4), the group studies evaluated samples of between 18 and 61 participants. The age of participants in each study was typically restricted to a segment of the population, with an age range of 2–5 years (i.e., students aged 4–8 years, etc.). Participants were referred to studies via their school (i.e., by a speech–language pathologist, teacher or other school staff member); after attending a specialist reading support service; or by responding to an advertised tutoring opportunity. The participants’ reading difficulties were established through a range of methods, including observations made by their classroom teacher, formal assessment measures or a prior diagnosis from a speech–language pathologist.

Outcome measures

For the seven studies evaluating telepractice delivery of reading and spelling instruction and intervention, a range of outcome measures was reported. The two studies evaluating telepractice delivery of reading and spelling assessments reported the level of agreement between telepractice and onsite scoring for a range of assessment tools (table 1).

In addition to quantitative measures, four studies included qualitative measures to understand parents’, caregivers’ and students’ experiences of telepractice. Two studies used surveys (Hodge et al. 2019,
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Vasquez and Slocum (2012), one recorded qualitative observations of student engagement during telepractice sessions (Houge and Geier 2009) and one used informal conversation (Wright et al. 2011). Together, these four studies suggest that students were engaged in their telepractice sessions (Hodge et al. 2019) and wanted to attend. They reportedly showed an increased interest in reading following telepractice instruction (Houge and Geier 2009). Online instruction was perceived as beneficial by parents/caregivers and a feasible way to deliver reading instruction as students demonstrated improved reading outcomes, including generalization, to other reading environments (Vasquez and Slocum 2012). Parents were satisfied with gains made during intervention (Wright et al. 2011). For telepractice delivery of reading and spelling assessments, parents were generally satisfied and acknowledged the benefits of telepractice for delivering assessment to families in remote areas (Hodge et al. 2019, Wright et al. 2011).

Summary of the main findings

Question 1: Does educator and allied health practitioner-led telepractice reading and spelling instruction and intervention improve reading and spelling outcomes for school-aged students?

Findings from this review suggest that telepractice as a service delivery mode may be equally effective as onsite delivery for some instructional reading and spelling procedures. The combined findings of the seven studies delivering telepractice reading and spelling instruction and intervention indicate that school-aged students can make gains in their reading and spelling ability. Statistically significant gains were reported within groups between pre- and post-test for four out of five studies (Houge and Geier 2009, Houge et al. 2007, Kohnen et al. 2020, Lee et al. 2017) and between pre- and post-test in a single case study (Wright et al. 2011); however, only two of these studies reported a control condition (Kohnen et al. 2020, Wright et al. 2011).

The results of the two studies investigating telepractice delivery of reading and spelling assessments (Hodge et al. 2019, Waite et al. 2010) indicate that telepractice is a feasible mode to deliver assessments with strong agreement between telepractice and onsite scores.

Telepractice reading and spelling instruction

Four studies evaluated telepractice reading and spelling instruction delivered by educators (Houge and Geier 2009, Houge et al. 2007, Vasquez et al. 2011, Vasquez and Slocum 2012). Houge and Geier (2009) reported statistically significant gains for a group of 61 students who received twice-weekly reading and spelling instruction via telepractice for eight weeks. Higher post-treatment scores were reported for reading and spelling accuracy, reading fluency and reading comprehension. In Houge et al.’s (2007) comparative study, significant improvements in reading accuracy and vocabulary knowledge were observed after treatment for each group (telepractice and onsite). There was no significant difference in the gains made between the groups, interpreted to indicate that instruction was equally effective (Houge et al. 2007); however, neither of these studies included a control condition (Houge and Geier 2009, Houge et al. 2007).

For Vasquez et al. (2011), the results revealed an increase in the mean number of words read correctly between baseline measures and those taken during instruction. These researchers used the percentage of non-overlapping data (PND) measure, which is used to quantify treatment effectiveness, that is, the percentage of data in the intervention phase that are more extreme (in the direction of improvement) than the single most extreme data point at baseline (Scruggs and Mastropieri 1998). A PND of 70–90 is considered an effective intervention; 50–70 is considered questionable; and <50 is regarded as an ineffective intervention (Scruggs and Mastropieri 1998). PND was only reported for two of the three participants in Vasquez et al. (2011): participant one (66%) and participant two (36%). From these PND data, it can be concluded that the effectiveness of the intervention was questionable at best. In a subsequent study by Vasquez and Slocum (2012), the mean number of words read correctly per min between baseline and post-instruction increased for all four participants, with a PND of 100% supporting the instruction’s effectiveness. The students’ standard scores increased for the Basic Reading cluster and Broad Reading Skills cluster of the Woodcock–Johnson III Tests of Achievement (WJ-III) (Woodcock et al., 2001) after instruction. Improved standard scores for the Letter Word Identification, Reading Fluency and Word Attack subtests of the WJ-III were also reported. There was more variability in improvements on the Passage Comprehension and Picture Vocabulary subtests of the WJ-III, with two of the four students demonstrating gains for Passage Comprehension and two students demonstrating small gains for the Picture Vocabulary subtest.

Telepractice reading and spelling assessment

For the two studies evaluating the use of telepractice for administration of reading and spelling assessments, results revealed a high level of agreement between onsite and online scoring of assessments by administrators (Hodge et al. 2019, Waite et al. 2010). For Hodge
et al. (2019), results showed very strong agreement between telepractice and onsite scores across all but one assessment, which still demonstrated strong agreement (Hodge et al. 2019). For Waite et al. (2010), scores obtained from the onsite and online environments were not significantly different indicating that the testing environment did not affect the accuracy of the online assessment (Waite et al. 2010). Percentage levels of agreement were > 90% for all raw scores obtained across the Queensland University Inventory of Literacy (QUIL) (Dodd 1996), Neale Analysis of Reading Ability—Third Edition (NARA-3) (Neale 1999) and South Australian Spelling Test (SAST) (Westwood 2005), except for the QUIL non-word reading score. A weighted kappa analysis revealed very good agreement ($\kappa = 0.92–1.00$) for all scaled scores across the subtests of the QUIL and NARA-3. Online assessment was found to have both high overall inter- and intra-rater reliability (Waite et al. 2010).

**Telepractice reading and spelling intervention**

Three studies evaluated telepractice reading and spelling intervention delivered by allied health practitioners (Kohnen et al. 2020, Lee et al. 2017, Wright et al. 2011).

Reading and spelling intervention delivered via videoconferencing resulted in statistically significant gains in scores for non-word reading and letter-sound knowledge in Kohnen et al. (2020) involving a group of 18 children with poor reading and/or spelling. For non-word reading and letter-sound knowledge, participants’ scores fell within the average range (or very close to it) following the 30 intervention sessions. The intervention consisted of training for phonics-focused reading and spelling (adopting explicit, systematic and synthetic phonics), sight word reading and spelling, and text reading (for all but one participant) using a suite of Macquarie University Reading Clinic programmes (Kohnen et al. 2020).

Phonological awareness intervention delivered via telepractice significantly increased within-group mean test scores on the Emerging Literacy and Language Assessment (ELLA) (Wig and Secord 2006). Participants’ scores improved from a below-average rating to an average rating (Lee et al. 2017). Intervention was provided to 10 students via telepractice and 10 students onsite. Students in the onsite group also demonstrated improvements on the ELLA after intervention; however, there were no significant differences between groups. The authors suggested that telepractice was equally effective as onsite delivery for this phonological awareness intervention (Lee et al. 2017).

The Understanding Words (Wright 2011) program was used to delivered reading intervention to a 10-year-old male in Wright et al. (2011). Four 40-min intervention sessions were provided per week over 10 weeks via the software program iChat. A standard deviation change of > 0.8 between baseline and post-intervention was reported for all measures except the Coltheart and Castles Test—Second Edition (CC2) irregular-word list (Castles et al. 2009). This was equivalent to a strong effect. Gains in reading accuracy and comprehension were maintained at a 10-week follow-up assessment.

**Question 2: What are the characteristics of practitioner-led telepractice reading and spelling instruction and intervention with school-aged students?**

In the telepractice literacy domain, instruction was the most common service provided via telepractice (Houge and Geier 2009, Houge et al. 2007, Vasquez et al. 2011, Vasquez and Slocum 2012), followed by intervention (Kohnen et al. 2020, Lee et al. 2017, Wright et al. 2011) and assessment (Hodge et al. 2019, Waite et al. 2010). There is no published empirical evidence for telepractice delivery of reading and spelling instruction within a classroom setting. The key characteristics of educator and allied health practitioner-led telepractice reading and spelling procedures relate to structure, instructional agents/intervention agents, technology and resources, and technological issues.

**Structure of telepractice instruction and intervention sessions**

For the seven studies involving reading and spelling instruction or intervention, six followed a prescriptive or program-based approach involving three (Kohnen et al. 2020), five (Houge and Geier 2009, Vasquez et al. 2011, Vasquez and Slocum 2012), six (Houge et al. 2007) or eight steps (Wright et al. 2011) within each session. For these studies, steps included a combination of the following tasks for prescribed amounts of time: repeated reading practice, word study/vocabulary instruction, guided reading (with and without question and answer instruction), written retelling of text, tutors reading aloud to students, assisted reading, summarizing, discussion of words read daily at home, administration of the Dynamic Indicators of Basic Early Literacy Skills (DIBELS) (Good and Kaminski 2002), progress monitoring assessment, reading instruction at the student’s predetermined reading level, use of the Corrective Reading (CR) program activities (SRA 2008) (e.g., workbook, spelling checks), comprehension checks, use of the Understanding Words program (Wright 2011) and use of the Macquarie University Reading Clinic programmes to target phonics reading.
and spelling, sight word reading and spelling, and text reading (Kohnen et al. 2020).

For the telepractice phonological awareness intervention study by Lee et al. (2017), the intervention was developed from evidence-based principles for phonological awareness intervention based on Gillon (2008). Basic phonics and key phonological awareness skills were targeted in the telepractice sessions: rhyme, phoneme identity, syllable-phoneme changes (blending, segmentation, deletion, manipulation) and speech to print (one letter or single sounds, digraphs and complex connections, e.g., /fl/ - ‘f, ph’).

Structure of telepractice reading and spelling assessment sessions

Two studies evaluated delivery of reading and spelling assessments via telepractice. In Hodge et al. (2019), simultaneous scoring took place between an online research assistant (delivering the assessments via telepractice) and a teacher (sitting in the same room as the student in a remote location). Similarly, an online speech-language pathologist administered and scored assessments simultaneously with an onsite speech-language pathologist (sitting with the student in another room) in Waite et al. (2010).

A wide range of standardized and either norm-referenced or criterion-referenced literacy assessments were used by Hodge et al. (2019): The Woodcock Reading Mastery Tests—Third Edition (WRMT-III) (Woodcock 2010), selected subtests of the Test of Word Reading Efficiency—Second Edition (TOWRE-2) (Torgesen 1999), the Multilit Sight Words Test, the Multilit Word Attack Test (Multilit 2007), and the Dalwood Spelling Test (Dalwood Assessment Center 2008). Waite et al. (2010) used eight subtests of the QUIL, SAST and NARA-3 (Waite et al. 2010). In both studies, all assessment materials were scanned and digitized for online use following permission from the test developers. Written responses for the two spelling tests in Waite et al. (2010) were sent to the online speech–language pathologist from the face-to-face speech–language pathologist (located in the same room as the student) for scoring. Hodge et al. (2019) did not report how written responses to the Dalwood Spelling Test were collected.

Agents of intervention

Instruction was delivered by preservice teachers in the four studies evaluating telepractice reading and spelling instruction (Houge and Geier 2009, Houge et al. 2007, Vasquez et al. 2011, Vasquez and Slocum 2012). In contrast, telepractice intervention was delivered by speech–language pathology interns and graduate students with supervision (Lee et al. 2017); an educator/psychologist (Wright et al. 2011) and by trained clinicians in Kohnen et al. (2020). The two studies evaluating telepractice assessment utilized teachers and a psychologist (Hodge et al. 2019) and speech–language pathologists (Waite et al. 2010).

For three studies an adult was present with the student to support their participation in the telepractice sessions (Hodge et al. 2019, Lee et al. 2017) or to simultaneously score the student’s assessment data for studies comparing telepractice and onsite delivery of reading and spelling assessments (Waite et al. 2010, Hodge et al. 2019). One study reported that the support of an adult onsite with the student was essential for equipment positioning and behaviour management (Hodge et al. 2019). Behaviour management was also identified as a potential obstacle to telepractice by Vasquez et al. (2011). They described using several strategies: a high pace of instruction with opportunities for response and reinforcement; a token economy associated with game-based rewards; and explicit instruction around expected behaviours (Vasquez et al. 2011).

Technology and resources

Seven of the studies reported details of the device, platform or resources used for telepractice. For two of the studies evaluating telepractice delivery of instruction, Adobe Connect Internet Protocol Video software was used (Vasquez et al. 2011, Vasquez and Slocum 2012). This program allows the tutor and student to see one another, as well as to view and interact with instructional materials in real-time, for example, virtual whiteboard, video, document sharing and access to a writing tablet to annotate documents digitally. In Vasquez et al. (2011), the CR Direct Instruction materials were also presented in PDF/Flash Paper format.

For one of the studies evaluating telepractice delivery of assessments (Waite et al. 2010), a custom-built PC-based telepractice system was used. This included a touch screen on the participants’ monitor for tasks requiring them to point (e.g., for rhyme recognition), audio recording of assessment stimuli (e.g., QUIL non-word spelling items) and presentation of scanned images and text (e.g., NARA-3) (Waite et al. 2010). For the other study evaluating telepractice literacy assessment (Hodge et al. 2019), the web-based application Coviu was used. This program includes click-markers for pointing and synchronized image viewing (Hodge et al. 2019).

One study evaluating telepractice reading and spelling intervention used a variety of videoconferencing programmes, including Skype, Zoom and FaceTime (Kohnen et al. 2020). The telepractice phonological
awareness intervention evaluated by Lee et al. (2017) used the telepractice platform, Presencelearning.com, via a computer. This platform can allow for interaction between clinician and client using various games and hands-on activities. Pictures can be shown on screen and the client can circle items, point, etc., using the mouse (Lee et al. 2017). The third intervention study used the software program iChat operating from an Apple Macintosh (Wright et al. 2011). iChat provides high-resolution screen sharing with annotation features to enable prompting or modification to words on screen (e.g., phoneme manipulation tasks).

Technological issues encountered

Technological issues encountered during telepractice delivery were common to most studies. Issues relating to audio quality were reported in four studies (Hodge et al. 2019, Houge and Geier 2009, Vasquez et al. 2011, Waite et al. 2010). These included audio latency, break-up, low voice volume, poor signal-to-noise ratio due to background noise and echo during paragraph reading. In some cases, these issues impacted on the clinician/educator’s ability to perceive and score student responses (Hodge et al. 2019, Waite et al. 2010). Two studies attributed such issues to insufficient bandwidth (Hodge et al. 2019, Waite et al. 2010). Issues were managed by refreshing the internet connection, restarting the programme, correctly positioning the student in front of the microphone and coaching the student about voice volume. One study employed a staff member to manage minor technological difficulties and to be present during the initial connection to the sessions (Houge and Geier 2009). One study reported issues with the visual clarity of scanned materials, this was managed by enlarging the original file before converting it to flash paper format (Vasquez et al. 2011).

Discussion

In the context of COVID-19, many educators and allied health practitioners have been required to rapidly adopt telepractice to continue delivering reading and spelling instruction and intervention to their students. To support these practitioners in their transition to telepractice delivery, a rapid review was undertaken.

We identified nine studies reporting outcomes for telepractice reading and spelling assessment, instruction and intervention. Despite several limitations in the methodological quality of these nine studies, overall findings suggest reading and spelling instruction and intervention delivered via telepractice has the potential to be feasible and engaging. Moreover, the two studies that focused on assessment reported that either modality, telepractice or onsite, were indistinguishable.

While our review may indicate that instructional reading and spelling procedures delivered onsite or via telepractice compare favourably, stronger evidence is required. This rapid review summarizes the current best available evidence; however, the authors acknowledge that the included studies are of low methodological quality. For this reason, there is currently no conclusive evidence regarding the efficacy of instructional reading and spelling procedures delivered via telepractice, particularly for instruction and intervention. To the authors’ knowledge, this is the first review of the literature on this topic and therefore, the findings may serve to strengthen the design and methodological quality of future studies in this area. These studies might include consideration of standardized assessment measures, intervention fidelity checks, longitudinal tracking of progress and more rigorous control conditions.

The initial search yielded many studies; however, only nine were found to be relevant and included in the review. There is very little empirical evidence specific to telepractice outcomes in the reading and spelling domain. The amount of research, and the quality of the evidence, seems to contrast with far larger amounts of documented support for other areas of telepractice, for example, speech-sound disorders (e.g., Grogan-Johnson et al. 2013) and oral language difficulties (e.g., Wales et al. 2017). The limited evidence in telepractice targeting reading and spelling is surprising given the long history of Distance Learning, access to sophisticated technology, and the critical importance of reading and spelling foundations for all students. The absence of research may be symptomatic of literacy having its foundations in education, which historically does not produce or seek empirical evidence to guide practice in the same way as health. This pandemic has prompted many discussions, across many disciplines and roles that things will inevitably change for service delivery. While the results of this rapid review appear to highlight no negative aspects to telepractice for reading and spelling, it is essential to proceed cautiously at present given the low methodological quality of the included studies.

In the context of COVID-19 social distancing requirements, telepractice has facilitated continued access to assessment, instruction and intervention. Yet, the findings of this rapid review highlight that telepractice for reading and spelling has been taking place in the absence of a robust evidence base and the COVID-19 pandemic has meant this has become even more pronounced. Throughout the world, health providers have implemented telepractice to continue providing allied health services (Sarti et al. 2020), pharmaceutical services (Kjerengtroen et al. 2020) and clinical neuropsychology services (Peterson et al. 2020). While most services have been positively received, Sarti et al. (2020) appropriately caution that telepractice services need to
be evaluated, efficacy determined and sustainable models developed, as supported by empirical evidence.

For the studies included in this rapid review, many parents, teachers and clients acknowledged the benefits of telepractice and found it to be engaging, beneficial and accessible. These findings support previous research indicating high consumer satisfaction with telepractice delivery of instruction and interventions (Lincoln et al. 2014). The common misconception that consumers are not interested in technology or not able to use it, was not echoed in the findings of these nine studies. Indeed, previous research has shown that client attitudes to telepractice are more positive than treatment agents anticipate (Krusel et al. 2017). Barriers or resistance to accepting technology, including telepractice, can relate to the service provider, client/patient or larger healthcare context (Krusel et al. 2017, Chen and Bode 2011). Educators’ and allied health professionals’ uptake of telepractice may be influenced by intrinsic factors including their experiences, confidence and willingness to engage with telepractice, as well as extrinsic factors such as access to technology and training (Dunkley et al. 2010, Krusel et al. 2017). Previously, these factors may have been barriers to equitable services; however, in the context of the COVID-19 pandemic, educators and allied health professionals have been left with little option but to engage with telepractice to continue providing services to their students.

Conclusions

The sudden onset of restrictive social distancing regulations resulting from the COVID-19 pandemic has highlighted that telepractice has, and may again in the future, become a non-negotiable reality for students as well as educators and allied health practitioners. The findings from our rapid review about telepractice for reading and spelling, albeit small in scale, combined with more impressive outcome data for other areas of educational and clinical practice, are cause for cautious optimism. Nevertheless, as highlighted by this rapid review, the current evidence base is in its infancy in both quantity and quality. To advance the empirical evidence regarding telepractice for reading and spelling, higher quality studies are necessary. This will afford educators and allied health practitioners greater confidence in determining whether to advocate for, and routinely use telepractice to advance students’ reading and spelling.

Implications for practice and policy

While we await further evidence to inform this topic, educators, allied health practitioners and policymakers need to proceed cautiously with telepractice delivery of instructional reading and spelling procedures. The studies included in this review are not of evidence-based practice; rather, they evaluate the use of evidence-based practice using a different service-delivery model, that being telepractice. These studies provide evidence for delivery of instructional reading and spelling procedures via telepractice in the context of highly controlled research environments, rather than home or school-based environments where many educators and allied health practitioners are currently practising due to the COVID-19 pandemic. We do not know which factors may impact outcomes in home or school-based services (as in the circumstances surrounding COVID-19), where there can be considerable variability in terms of the environment, internet connectivity, facilitators and distractions. Therefore, these studies provide valuable information around the how of telepractice for instructional reading and spelling procedures and highlight the factors that may contribute to positive outcomes with this service delivery model. These factors relate to (1) the telepractice environment; (2) the educator/allied health practitioner; (3) the student; and (4) technology.

Educators and allied health practitioners need a thorough understanding of the student’s telepractice environment. This includes knowing the device the student is using to connect to the session, the capabilities of the device (e.g., microphone, speakers), and consideration of the student’s physical environment, for example, lighting, background noise and workspace configuration. Background noise can interfere with perception and evaluation of students’ reading accuracy. Having the student wear noise-cancelling headphones and video recording sessions are two possible solutions. Using both video and audio in sessions allows the educator/allied health practitioner to see the student as they are reading, and video recording the session provides an option to review the session later to confirm observations that were made. Consideration of the student’s workspace and their positioning in relation to their microphone is an important consideration for optimal sound during telepractice sessions, particularly for assessment. Assessment within a telepractice environment requires consideration of the availability of digitized assessment tools or permission from the test developers for online use. Subscription-based web-platforms that host online assessment tools may be one option for educators and allied health practitioners. The two studies evaluating assessment of reading and spelling via telepractice indicate that reliable and remote evaluation of literacy skills is possible. Telepractice therefore has the potential to provide access to assessment services for students living in remote locations.

Providing appropriate training to educators and allied health practitioners delivering instructional reading and spelling procedures via telepractice is an important consideration. In most studies, this was identified
as a key factor contributing to student outcomes. Educators and allied health practitioners need to operate the equipment and provide services according to educational, clinical and operational standards. This might require formal training and mock-sessions, or practice runs with colleagues to test equipment and resources.

Educators and allied health practitioners need to consider students for telepractice on a case-by-case basis in relation to their physical functioning, sensory status, motor dexterity, cognitive functioning, the severity of their difficulties, and their behavioural and motivational characteristics. These factors may influence individual student outcomes. Contingencies for managing students’ engagement and behaviour may be required. This might include maintaining an appropriate pace of instruction during the session and setting clear expectations for the sessions. Learning materials should be interactive to support motivation to participate. In some cases, the presence of an adult onsite to support the student may be required as the remote location of the instructional agent posed a challenge in some of the studies.

Whilst technology was not identified as factor directly contributing to student outcomes, it is an important consideration for the success of telepractice sessions. Technological issues most often relate to internet connectivity and bandwidth resulting in audio latency and freezing. This creates problems during reading tasks with educators/allied health professionals being unable to perceive and score student responses. It can also result in problems with the timing of verbal prompts provided during reading tasks. Refreshing the connection, restarting the program and setting a dedicated bandwidth between the two sites are potential solutions.

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Conflict of Interest
The authors report no declarations of interest.

Data Availability Statement
Data sharing not applicable to this article as no datasets were generated or analysed during the current study.

Notes
1. These terms were chosen to capture studies evaluating outcomes relating to any of the skills and subskills associated with reading and spelling including phonics, phonological awareness, word reading, reading accuracy, reading fluency, reading comprehension, oral spelling, written spelling, etc.

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