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REVIEW AND SYNTHESIS

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# Quality of life for braille users: A scoping review

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## Abstract

Quality of life (QoL) encompasses well-being, life satisfaction and happiness, enabling individuals to lead meaningful lives. Literacy, the ability to read and write, is essential for inclusion in education, employment and society. For people with blindness or low vision (BLV), braille is a critical tool for accessing literacy. However, despite literacy being recognised by UNESCO as a foundation for lifelong learning, braille support in education systems is often inadequate, potentially impacting the QoL of braille users. This scoping review followed PRISMA-Sc guidelines to explore the literature on braille literacy and its link to QoL. The search yielded 3170 peer-reviewed articles and grey literature; however, once screened, only 46 papers were included. The analysis revealed the importance of braille in adulthood but highlighted a lack of published data on the relationship between braille literacy and QoL. Recommendations for a focus on high quality research evidence of the implications of braille literacy for the future are discussed.

**KEYWORDS**

blindness, braille literacy, low vision, quality of life

**Context and implications**

**Rationale for this study:** The contemporary literature is abundant with research indicating high print literacy is associated with high quality of life. This scoping review explores the extent, range, and nature of existing research on braille use and its relationship to quality of life (QoL) for people with blindness or low vision. It maps how braille literacy is conceptualised and measured in the literature, identifying critical gaps and inconsistencies. The study responds to the need for evidence-based insights that can guide future research and inform inclusive educational practice and policy.

**Why the new findings matter:** The findings highlight the fragmented nature of research on braille literacy and its connection to QoL and bring clarity to how this relationship has been explored across studies. The review exposes under-researched areas and measurement challenges, emphasising the importance of developing a more cohesive and robust evidence base to support the educational and social inclusion of braille users.

**Implications for practitioners, policy makers and educators:** The implications of this review lie indicate a lack of comprehensive synthesis of existing knowledge that can inform educational policy, program development, and service provision. The findings support the need for targeted interventions that promote braille literacy as a pathway to improved well-being, independence, and social participation. The review also provides direction for policymakers seeking to refine educational frameworks and create inclusive, evidence-based strategies that enhance quality of life outcomes for people with blindness or low vision.

# INTRODUCTION

## Quality of life

The World Health Organisation (WHO) defines quality of life (QoL) as 'an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns' (1995, p. 109). Burton et al. (2021) support this definition and state that evaluation of QoL entails determining the comprehensive state of well-being as perceived by the individual. It is important that we know if, why, and within what context braille literacy impacts QoL as this will determine educational decision making. The QoL of children with blindness or low vision (BLV) assessed by Elsman et al. (2021) indicates that children with BLV have worse QoL than population-based samples, particularly in the area of physical well-being, social supports and peers. Although the severity of BLV did not indicate literacy media (braille, large print or a combination of both) in this study, moderate and severe BLV was associated with worse QoL scores compared to children with no vision impairment.

## The links between QoL and literacy

UNESCO established the Experimental World Literacy Program in 1966 and characterised literacy as being a fundamental human right (Stromquist, 2009). Even though abundant

evidence exists highlighting the importance of print literacy for human flourishing, the definition of literacy continues to evolve and expand. In the 1950s, UNESCO defined functional literacy quite simply as the acquisition of reading and writing skills enabling individuals to effectively participate in cultural or group activities (Baker & Street, 1994). This is now considered a very limited and skill-centred perspective, while a more recent view on print literacy advocates for a comprehensive approach that encompasses teaching, learning and assessment centred on understanding and interpreting meaning (Baron, 2021). Instead of passively absorbing information, learners are encouraged to interpret the world critically and develop their own viewpoints. Cope and Kalantzis (2000) argue that the fundamental mission of literacy should allow all learners to engage with a variety of dialogues to fully participate in public, community and economic life. This all-encompassing view of literacy entails not only 'reading the word' and 'reading the world' (Freire, 1983) but also being able to evaluate it critically. Neglecting this broader conception reduces literacy to a mere mastery of isolated skills, rather than the transformative experience it should be according to contemporary notions of literacy as a social practice, involving critical engagement, context sensitivity and multiplicity (Barton & Lennon, 2020; Lonsdale & McCurry, 2004; Purcell-Gates, 2020).

## QoL for braille users

For students with BLV, access to full participation in inclusive education is vital to life-long learning, social opportunities and economic outcomes (Englebretson, Holbrook, & Fischer-Baum, 2023; Silverman & Bell, 2018). This includes appropriate resources for the provision of learning including access to braille when determined by appropriate evidence-based assessment. Braille is a system of dots that represents a code to enable a person with blindness or low vision to access and produce written materials to access information.

Braille literacy for people with BLV is equal to print literacy for people with functional vision (South Pacific Educators in Vision Impairment [SPEVI], 2024). Tink and Whitburn (2024) assert that braille literacy enables students with BLV to access the world the same as their print reading peers. Children and adults must be proficient in reading and writing and have a reliable way to access printed information and this includes the ability to access, understand and critically analyse the world around them (Millar, 1997). Historically, world-renowned researchers, including Wormsley (2011), wrote that braille serves as a representation of printed text; therefore all children who require it, should have access to braille (Englebretson, Fischer-Baum, & Holbrook, 2023). Indeed, Clark (2014) argues that braille increases life opportunities to people with BLV by increasing access to education, employment and life and Silverman and Bell (2018) suggest this is a result of increased self-esteem due to the use of braille.

America's National Federation for the Blind declared a 'Braille Crisis' (Silverman & Bell, 2018) due to a number of factors, including the idea that technology—namely access to audio materials—could replace the need for braille. However, many researchers, teachers and braille users argue that an audio-only approach does not teach children the details of literacy—including how to correctly spell, grammar and language structure—and does not provide equal access to education and employment (Tink & Whitburn, 2024). Indeed, braille, as a representative of print, is described by SPEVI (2024) as 'a fundamental right that must be supported, promoted, and preserved'.

Children learning braille exhibit considerable heterogeneity spanning from those without additional needs, who are likely to make steady educational progress, to those with various additional needs, such as physical and medical challenges that may impact the development of braille literacy (Coppins & Barlow-Brown, 2006). Some children who learn braille may have congenital BLV (BLV since they were born) while others may have adventitious

BLV (born with vision but acquired BLV). Braille is often taught to children alongside print when there are factors that influence the need for dual media literacy access, including a degenerative vision impairment (Wegwerth et al., 2023). As such there is no standard curriculum for teaching braille—children often learn braille within a mainstream class simply following the literacy programme designed for sighted peers with adaptations for braille. Two studies (Fanshawe et al., 2023; Roe et al., 2014) indicate a potential for difficulties in developing braille literacy when a specific learning programme focused on braille is not adopted and caution teaching students the braille code is just not enough. Croake et al. (2024) argue that students with BLV must be literate, numerate, lifelong learners who can participate fully in a rapidly changing society.

With an interest in understanding QoL for braille users, the purpose of this review was to answer the research questions:

1. How is braille literacy defined, conceptualised and measured?
2. Does braille literacy lead to better QoL outcomes for people with BLV?

## THEORETICAL FRAMEWORK

McLinden and Douglas (2013) developed a model of access to indicate the importance for students with BLV to have 'access to learning' and the ability to 'learn to access' and this theory will underpin the synthesis and conceptualisation of themes found within the review. This framework utilises the work of Bronfenbrenner (1979), through which context and interdependent relationships can influence a child's learning. McLinden and Douglas (2013), as quoted in McLinden et al. (2016, pp. 8–9) describe the dual model of access framework as:

1. Access to learning: The child is provided with access to appropriate information in order to learn about a particular curriculum area.
2. Learning to access: The child is provided with the means by which he or she is able to access information independently.

McLinden et al. (2016) argue that it is important for education systems to find balance between access to learning and learning to access (Figure 1), as the scaffolding towards independence is associated with more positive employment outcomes.

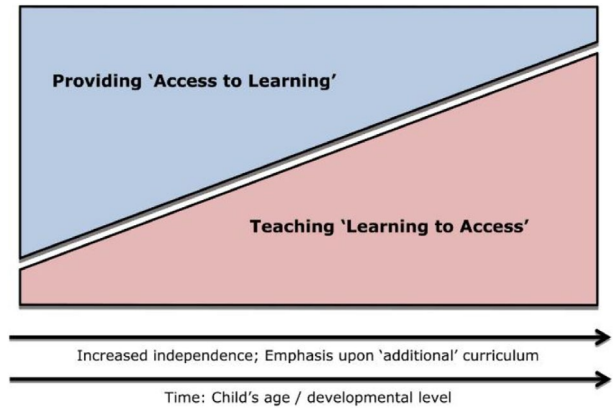


**FIGURE 1** Timeline showing access to learning moving towards learning to access over time (McLinden et al., 2016).

# METHOD

This scoping review followed the PRISMA-ScR (Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews) guidelines (Tricco et al., 2018). A search of published and registered reviews (systematic or scoping) in PROSPERO and Open Science Framework was undertaken and no reviews relating to Braille literacy and QoL were found. It is expected that this scoping review will broaden understanding and awareness, establish new areas and fields of research and highlight research gaps that can argue for new primary research (Haddaway et al., 2022). A scoping review was conducted in April 2024 to identify empirically based primary studies and reports and non-empirical studies (including but not limited to conference presentations, books, government reports and policies) regarding the concept of braille literacy and connections between braille literacy and QoL. 'Researchers may conduct scoping reviews instead of systematic reviews where the purpose of the review is to identify knowledge gaps, scope a body of literature, clarify concepts or to investigate research conduct' (Munn et al., 2018, p. 1). A scoping review, rather than a systematic review or meta-analysis, was chosen as it was anticipated that a scoping review would map the breadth of evidence already known on the particular topic of braille literacy and QoL irrespective of the source (Munn et al., 2022). By not limiting a date range, this scoping review allowed the authors to discover the historical perspectives of global research into braille literacy. The review included grey literature—reports, theses, conference proceedings, government documents, policy briefs, working papers, and industry reports. Grey literature is often not peer-reviewed but can provide valuable insights, especially in niche research areas. It was anticipated by including grey literature, the authors who themselves are print readers, could consider the voices of people who learned and use braille—an important factor in research with people with BLV. This holistic approach allowed diverse perspectives to address the review questions compared to the typically narrower focus of traditional systematic reviews that would have concentrated on effectiveness or qualitative evidence.

## Database selection

Academic, education, health sciences, and multidisciplinary databases were selected to integrate perspectives across fields. The following databases were used: Education Resources Information Centre (ERIC), EBSCOhost Inc: Education Source and PsycArticles via APA PsycNet, ProQuest, Scopus, and Web of Science Core Collection. Search strategies were determined by using relevant key terms. Both qualitative and quantitative studies published in English language on braille literacy and QoL outcomes were included. In addition, cited references from prior systematic and literature reviews and articles included in the review were examined.

To incorporate field knowledge, additional searches were conducted for unpublished studies and various sources of grey literature from professional sources such as association websites, government reports and journals not found on databases such as *Journal of the South Pacific Educators in Vision Impairment* (JSPEVI). This allowed the authors to capture additional information that may otherwise have not been located via typical means. All article bibliographies underwent scrutiny to identify any further pertinent studies. McAuley et al. (2000) propose that grey literature has the potential to complement and communicate findings to a wider audience and may include theses and dissertations, reports, blogs, technical notes, non-independent research or

other documents produced and published by government agencies, academic institutions and other groups that are not distributed or indexed by commercial publishers. Following Haddaway et al.'s (2015) suggestion, the first 300 results of Google Scholar were scrutinised to locate further grey literature.

## Search string and key terms

First, a preliminary search of Google Scholar was conducted to identify initial keywords based on the author's knowledge of the field. This included predictor* OR indicat* AND literac* AND Braille AND 'Quality of Life', braille AND literacy, braille literacy OR braille read* OR braille proficiency OR braille speed. Predictor* and indicat* were removed from the key terms as it was found that they were too limiting and removed some potential literature. Further preliminary searches removed vis* impair* OR BLV OR low vis* as these terms also limited and missed some potential literature. The inclusion of the key terms 'read', 'proficiency' and 'speed' located additional grey literature including newspaper articles about braille competitions. Although these articles did not provide contemporary concepts of braille literacy, they did refer to braille and quality of life so for this reason these key terms were kept.

Subsequently, the titles and abstracts of papers were examined to identify their keywords. These keywords have been added to the keywords for this scoping review. The university librarian provided advice and feedback on the choice of appropriate databases, selected keywords and subject headings, and how to convert the search to other databases. This informed the development of a search strategy which was tailored for each research question as follows:

- Search string 1 (addresses Research Question 1): braille speed OR braille accuracy OR braille literacy OR braille proficiency OR braille read* OR braille measure.
- Search string 2 (addresses Research Question 2): Quality of life OR wellbeing OR happiness OR empower* OR success OR life satisfaction OR employment OR confidence. The term 'quality of existence' was removed and employ* was changed to employment after preliminary searches showed that the words existence and employed are used in academic literature to describe any phenomenon not necessarily related to human quality of life.

Backward snowballing refers to 'the process of examining the references of selected articles' (Freer, 2023, p. 653), therefore the reference lists of all studies selected for critical appraisal were screened for additional references.

## Selection criteria

The scoping review included all research designs in the published literature as well as grey literature, including policy documents and dissertations. The search terms remained broad to elicit any type of documentation. There was not a date range limiter as this increased the number of papers for potential review and provided historical perspectives. The PCC (Population, Concept, Context) eligibility framework (Aromataris et al., 2024) was used to identify all relevant articles. This search tool cuts across both qualitative and quantitative literature. Methley et al. (2014) stated that the search tool is used to support the organising framework for the search strategy. PCC (Table 1) was chosen over PICO and SPIDER as

**TABLE 1** PCC inclusion table.

| PCC | Definition | Search terms |
|---|---|---|
| Participants/ population | People who have BLV who use braille and were taught in school | Braille |
| Concept | How is braille literacy defined, conceptualised and measured? Quality of life | Braille speed OR braille accuracy OR braille literacy OR braille proficiency OR braille read* OR braille measure<br>Quality of life OR wellbeing OR happiness OR empower* OR success OR life satisfaction OR employment OR confidence |
| Context | High-income countries based on United Nations' definition (World Population Review, 2024) | |

PCC serves as the primary tool for scoping reviews, aiding in the formulation of precise and meaningful objectives, as well as determining eligibility criteria for this review style.

## Inclusion/exclusion criteria

### Population

The population of interest in this scoping review encompassed people of any age who are blind or have low vision and use braille. If the literature identified a participant using the terms blind, low-vision, visually impaired or equivalent, and a braille user, they met the eligibility criteria for inclusion in the review. If the inclusion criteria of the evaluated literature enabled participants with co-existing disabilities to participate, and the data could not be segregated, these articles were incorporated into this review. Similarly, participants who are dual-media learners (those that are learning braille alongside print), were included when the data could not be separated. All date ranges were accessed to gather as much literature as possible.

### Concept

This scoping review was twofold: (1) to identify the current concept of braille literacy and (2) identify and map any reported links between braille literacy and quality of life in high income countries.

### Context

The scoping review for review question 1 encompassed all countries to ascertain all evidence pertaining to the definitions, conceptualisations and measurements of braille literacy. The scoping review to answer review question 2 was limited to literature from high-income countries. This formed part of the exclusion criteria during screening of literature. It was anticipated that braille literacy and quality of life data from low-income countries differs to that in high-income countries. Data from only high-income countries was deemed more comparable. This is a scoping review for PhD, and it is hoped that future research based on evidence from high-income countries may support new initiatives in middle- and low-income

countries. High-income countries are defined as per the United Nation classification from 2022 (Statistical Annex, 2022).

## Article extraction and critical appraisal

The screening process involved multiple stages. The original search, prior to identifying duplicates, yielded 7081 papers as follows:

EBSCOhost Research Databases 3313
SCOPUS 930
ERIC 208
Web of Science 1053
ProQuest 1562
Hand search 15

Of these, 3911 duplicates were removed using EndNote and 3170 papers remained; a further 374 duplicates were removed manually by the primary reviewer, leaving 2796 papers. At the initial stage, the 2796 titles and abstracts were screened by two independent reviewers. In cases of discrepancies, discussions were held, and if consensus could not be reached, a third reviewer adjudicated. The second level of screening involved the primary reviewer independently assessing 397 full-text articles against the inclusion/exclusion criteria. Any discrepancies were resolved through discussion with a second researcher until consensus was reached. A further 351 articles were removed, leaving 46 articles for data extraction and critical appraisal. A flowchart depicting the search results and study selection process is presented as Figure 2 according to the PRISMA-ScR (Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews) guidelines (Tricco et al., 2018).

## Data coding and analysis

Information from the data collected was based on demographic features and content of the papers through the use of a data extraction table (Appendix 1) to collate and summarise the studies in line with the research questions (Pollock et al., 2023). An inductive methodology was applied to synthesise findings from the review in relation to the review questions and develop the themes (Thomas & Harden, 2008), allowing themes of braille literacy, teaching and learning, and QoL to naturally emerge from the data itself. An inductive methodology was particularly advantageous in this scoping review as it explored the research for instances where new theories, ideas or concepts were sought (Wicks, 2017).

## Demographic information

The focus of braille literacy research appears to have changed historically. Early papers written from 1976 indicate a focus on the specifics of braille teaching and learning with quality of life not mentioned in the literature until two decades later in 1994. Paper publication dates ranged from 1976 to 2023. During the 1970s and 1980s there was a global research focus on improving the reading rate/speed of students with BLV with a range of strategies implemented and trialled.

Reading strategies, although linked together in this review have morphed and changed in focus since the mid-1980s when word recognition processes were investigated. Graphemes and phonemes have remained a prominent area of research in braille while perceptual and

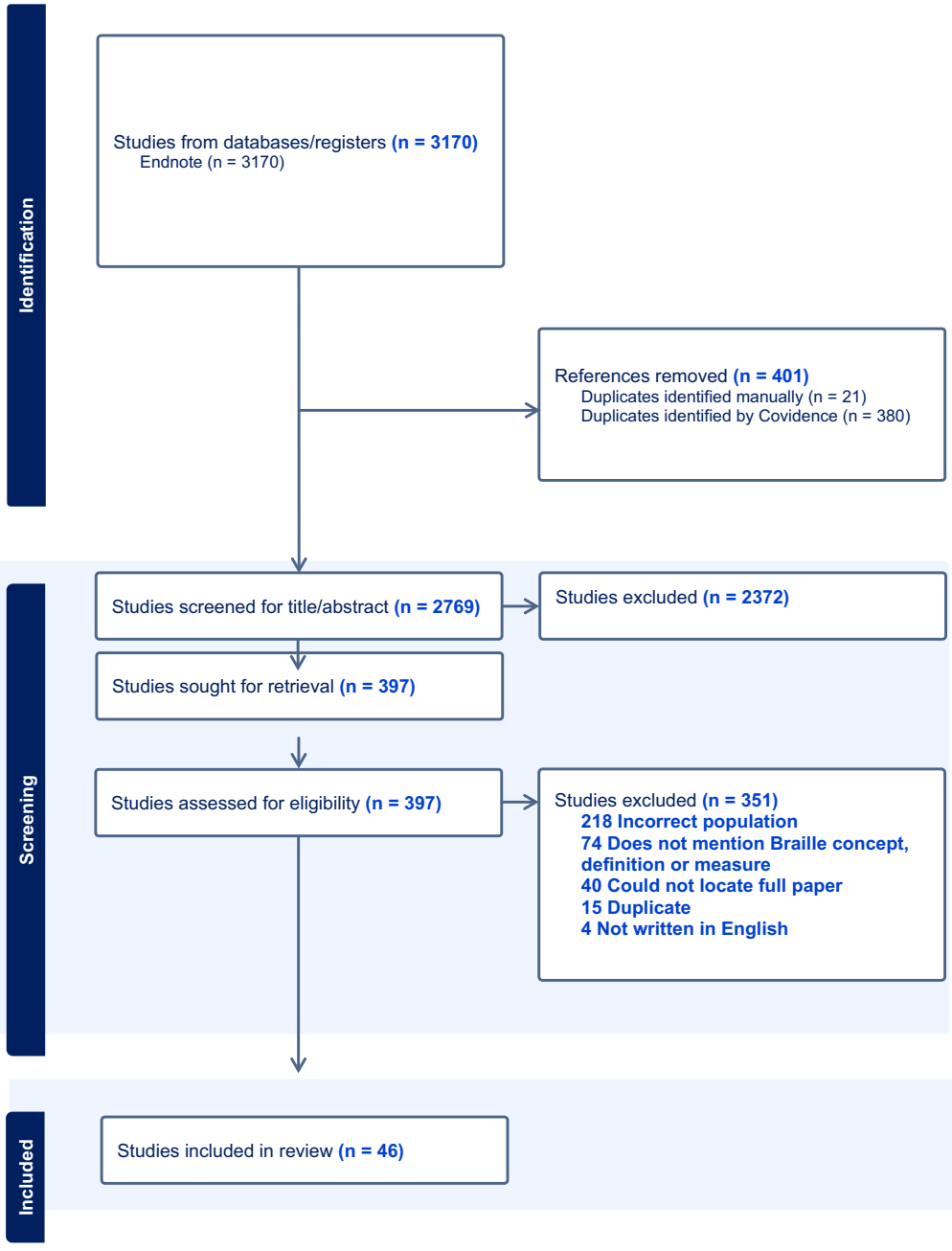


**FIGURE 2** Article extraction and selection procedure.

cognitive differences in print and braille reading were also a focus. More recently the impact of morphology in braille has been investigated with future research areas discussed.

Writing, spelling and comprehension appear not to be a research focus until Ryles's thesis written in 1997. The first two areas are a focus in the early 2000s, while comprehension is still being researched now.

Teacher competencies, qualifications and experiences were analysed and written about from 2006 to 2017 with strategies suggested for improving teacher skills both in preservice and ongoing training and development.

It is noted that although the earliest written paper in this review was in 1976, QoL for people with BLV was not mentioned in the literature until Schroeder's thesis in 1994, this was closely followed by Ryles's paper and follow-up thesis (1996, 1997). The findings from both Schroeder and Ryles have been cited in other works multiple times since publication. Regular publications up until 2022 regarding employment outcomes, mental health and employment, self-reporting of QoL, braille reading speed and correlation with employment were found because of this search.

Figure 3 shows the year of publication of each paper included in this review.

The papers were analysed for their location of study and country of publication (Figure 4). While the USA and Canada have published over 30 of the included papers, papers written in Australia did not meet any of the inclusion criteria for this scoping review.

The *Journal of Vision Impairment and Blindness* (*JVIB*) published in the USA was the journal with most publications (Figure 5).

## Methodological quality assessment

Since this was a scoping review, the purpose of assessing the quality of the included papers was not to exclude, but rather to grade the quality of the evidence. This is important when assessing reliability and validity of the literature and ensuring it is rigorous in nature. A quality checklist used from the Johanna Briggs Institute (JBI) suite of critical appraisal tools (Moola et al., 2020) contained a checklist of nine criteria which Pollock et al. (2023) suggest researchers use to analyse the quality of the eligible papers for trustworthiness, relevance and reliability of results (see Appendix 2). The papers included in the study consisted of 40 Cross Sectional Studies (CSS), 3 Systematic Reviews (SR), 2 Expert Opinions (EO), and 1 Qualitative Research Study (QRS). Most papers ($n=40$) were a version of cross-sectional studies. In a cross-sectional study, the investigator uses observational study design to describe a practice at a particular point in time (Wang & Cheng, 2020). However, some of the papers ($n=8$) did not provide clear descriptions of education settings, while some papers ($n=4$) were unclear on the research question, or what was being measured. Only 6 out of the 40 appraised papers measured outcomes using a valid and reliable tool. Three systematic reviews were appraised. The first examined the literature to determine factors impacting braille reading, the next was systematic review of factors related to employment outcomes for adults with visual impairments and finally a literature review was

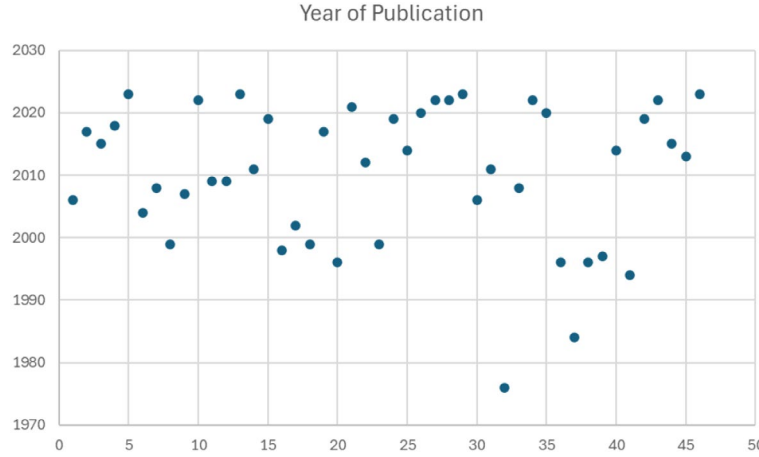


**FIGURE 3** Year of publication.

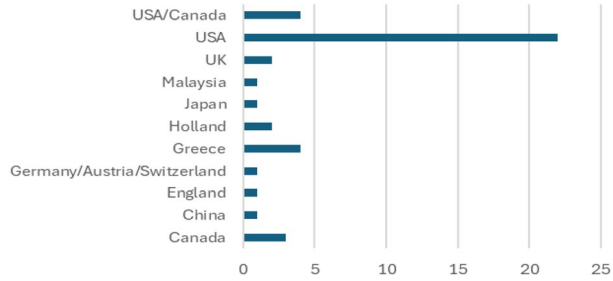


**FIGURE 4** Country of publication.

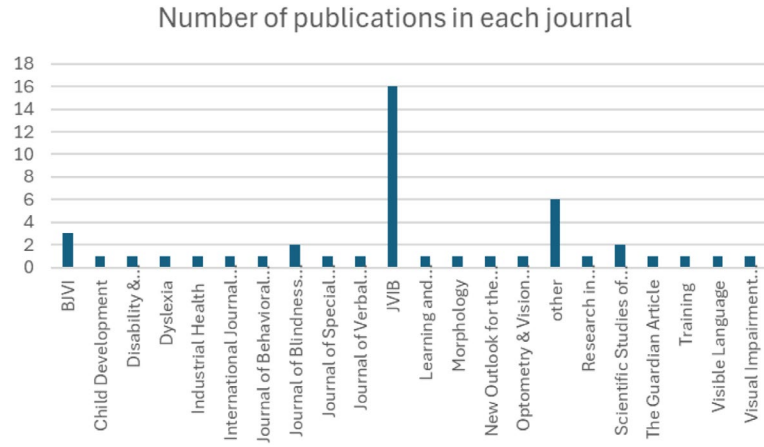


**FIGURE 5** Publications in journals.

conducted to research the literature regarding the development of phonological awareness by braille users. Only one of the three met all appraisal criteria while one only met four and the last nine of the eleven criteria. The expert opinions were appraised and found to lack reference to the current literature; they were a source of one's opinion. As previously discussed, the appraisal was incorporated into this review, not to remove articles, as this scoping review was developed to include lived experience. The only qualitative research study in the form of a PhD (Dylgjeri, 2022) met all nine criteria for appraisal indicating a valid and reliable paper. No subsequent peer reviewed papers based on the PhD thesis could be located.

## FINDINGS

The findings are presented by three themes that were induced from the data extraction table during the data coding process underpinned by McLinden and Douglas's (2013) theory of Learning to access and Access to learning. The three themes are braille literacy, teaching and learning and quality of life.

### Braille literacy

The review question for this review—the conceptualisation of braille literacy—was not described or measured in its totality within the literature; rather, individual papers measured

individual components of literacy including writing and spelling, reading rate, reading strategies and comprehension. Details of the literature on these components is described in more detail below.

## Writing and spelling

From 1997 to 2017, six papers were published measuring braille writing and spelling. Of these papers, one was a thesis, one was published in *International Journal of Educational Research* and four were published in *Journal of Visual Impairment and Blindness*. Two studies were conducted in Greece while three were conducted in the USA/Canada and the thesis was conducted in the USA. The three USA/Canadian papers were based on data collected in the Alphabet Braille and Contracted Braille Study (the ABC Study), therefore writing and spelling were analysed in these studies (Emerson, Holbrook, et al., 2009; Emerson, Sitar, et al., 2009; Erin & Wright, 2011). Overall, younger students in Greece, America, and Canada who used braille more often tended to make fewer spelling and writing errors whereas older students who were under time pressures to complete tasks often used audio access, impacting their spelling results negatively (Argyropoulos & Martos, 2006; Argyropoulos & Papadimitriou, 2017; Emerson, Holbrook, et al., 2009). Ryles's (1997) thesis compared the writing and spelling of four groups (group 1 were fully sighted students, groups 2, 3 and 4 all had legal BLV and were grouped as follows: group 2 were students who learned braille at a young age through a consistent approach; group 3 were infrequent braille users who received braille instruction less than four times per week; and group 4 had never received formal instruction in braille). As expected, the fully sighted and regular braille users were consistently better at spelling, capitalisation, punctuation, grammar and essay construction (spelling, content, sentence construction and organisation of ideas). Ryles (1997) concludes that braille enables students with BLV to compete with sighted peers; however, no interventions or strategies were mentioned across any of the studies to improve spelling or writing of older students or students who did not have regular access to braille instruction.

## Reading rate

Nineteen of the 46 papers measured reading rate and this was first measured and written about in 1976. Historically, researcher's general conclusions are that the student with BLV who is a braille reader (BR), reads slower than their sighted peers. From 1970 to 1973, in Holland, Mommers (1976) collected data on the reading rates of 120 BRs aged 6–14 years and found the reading speed of separate words by sighted pupils is at least two to three times quicker than BRs. Interestingly, the slower BRs lag relatively further behind the slower sighted readers than the good BRs lag behind the good sighted readers. Technical skills needed for reading continue to develop until at least 15 years of age, for both good and poor BRs. A recent study by Lang et al. (2021), supports Mommers's (1976) research finding that reading fluency in BRs is below that of print readers and the difference is greater by grade 6. Legge et al. (1999) measured reading rate using MNRead and had similar findings; that is, a BR reads more slowly than their sighted peers. Worldwide, reading rates of BRs have been investigated. In Malaysia, Mohammed and Omar (2011) were able to show that BRs have slower reading rates than their sighted peers. Gillon and Young (2002) assert that BRs in their study were at least 6 months behind their sighted peers; however, Knowlton and Wetzel (1996) argue that reading rates vary for BRs depending on the purpose of the reading task and Papadimitriou and Argyropoulos (2022) suggest that word length can also impact the reading rate with longer words taking longer to read in braille than in print.

When reading for pleasure a student's reading rate will be faster than when they are reading for comprehension. Similarly, in a study of French-speaking BRs in Canada, Laroche et al. (2012) suggest that BRs are faster when silent reading than reading aloud. In only one study, an intervention strategy (Early Steps Reading Model) was used to collect data in a thesis study and follow-up paper (Day, 2004; Day et al., 2008). The researchers analysed reading rate using the Dolsch word list as the pre- and post-test. A 4-week intervention of 30–45 min per day/4 days per week demonstrated an increased reading rate in the post-test. The subjects ($n = 5$) were assessed using uncontracted braille. In another two published papers based on the ABC study data set, Emerson, Holbrook, et al. (2009) and Emerson, Sitar, et al. (2009) found that the BRs gradually lost speed throughout grade levels compared to their sighted peers and low-achieving BRs were introduced to contractions at a slower rate than their high-achieving BR peers. It is unknown in which direction the connection between the introduction of contractions and literacy performance goes and should be noted that the type of schooling, availability of braille materials and teaching styles were not mentioned in these papers. It is argued that the availability of braille materials has improved with the use of technology (Martiniello, Barlow & Wittich, 2022). A recent study by McCarthy et al. (2023) found no difference in reading speeds of print or refreshable braille although the researchers did find that the number of cells on the refreshable braille impacted reading speed and caution wise decision making about the types of refreshable braille devices to be used.

While 18 papers measured and concluded that BRs read slower than their print reading peers, only one paper offered an intervention to improve reading rate. No papers discussed the impact of slow reading rate on students' ability to learn in a mainstream classroom or life-long impacts of slow reading rates.

## Reading skills

Eleven papers were published between 1984 and 2023 focused on the skills of reading. Many researchers compared the known print reading skills of phonology, morphology and orthography with the skills of BRs. In the previously mentioned study conducted by Day et al. (2008) they explored the five key components of reading—phonemic awareness, phonics, vocabulary development, reading fluency and reading comprehension—but used an unvalidated assessment designed for print readers to measure these BR components. Englebretson, Holbrook, Treiman, et al. (2023) argue that braille contractions often bridge a morphological boundary in words. Contracted braille uses abbreviations or contractions to represent common letter combinations or words. This reduces the number of characters needed. It is the most commonly used form of braille for books, newspapers and other reading materials. Uncontracted braille is a simpler system where each braille cell represents a single letter, number or punctuation mark without abbreviations. It is often used for beginners learning braille. There are two forms of braille: uncontracted and contracted. In uncontracted braille, there is a one-to-one correspondence between letters of the English alphabet and braille cells. ‘Contracted braille endeavours to decrease the length of braille texts by representing common letter combinations and common words with one or more braille cells, thereby masking one-to-one correspondence in those instances. Because there are limited configurations, braille contractions may require syntax and context to discriminate the character’ (Savaiano & Kearns, 2022, p. 109). The example used is miSTook where the ST contraction overrides the affix in this word. The researchers argue that BRs take longer to recognise words and make more errors with bridged morphology and suggest this requires further research (Englebretson, Holbrook, Treiman, et al., 2023). Many researchers argue that phonologic skills are imperative to good braille reading (Day et al., 2008; Greaney & Reason, 1999; Monson & Bowen, 2008; Pick et al., 1966; Xia et al., 2023).

Veispak et al. (2013) found that BRs tend to only ever use an indirect grapho-phonological strategy to decode, whereas print readers—as they gain proficiency—can switch between a direct orthographic and an indirect grapho-phonological reading style. An example of this is a proficient print reader sees the word 'elephant' and recognises it immediately by its shape and letter pattern, but a BR, even a proficient one, will always need to read it letter by letter to sound it out. This concept was supported by another small study of students in a residential school, where Pring (1984) measured the influence of word recognition on BRs by assessing reading of words that make up pairs (e.g., bread and butter). Although word recognition appeared to assist all readers, they concluded that print readers could still read word pairs quicker than BRs. Conversely, Xia et al. (2023) measured the reading of Chinese BRs and found that early BRs (grades 1–3) are dependent on morphological and phonological skills. BRs, along with their print reading peers, can move from learning to read to reading to learn, accurately reading sentences and texts, using cognitive resources to processing reading fluency and begin to read texts quickly. Based on this, the authors argue that focusing on the complete construction of morphological awareness and phonological awareness in the lower and middle grades will help BRs make a smooth transition to fluent and efficient reading in the upper grades. It is important to note that Chinese is a logographic language where each character represents a word or morpheme whereas English language is made up by 26 letters that represent a variety of individual sounds (phonemes) that when put together, using a combination of rules, make words (e.g., the individual sounds /m/, /a/, /t/ spell "mat" when put together, by adding and /e/ to the end and the words becomes 'mate' and the /a/ sound is changed by a spelling rule). It could be argued that the logographic Chinese language without the use of contractions, especially those that bridge morphology, may make braille reading a simpler process.

## Comprehension

Five papers included reading comprehension as a measurement of braille literacy. Three of these papers compared the comprehension levels of BRs against their sighted peers (Mohammed & Omar, 2011; Ryles, 1997; Veispak et al., 2013) using a variety of assessment criteria and found that there was no significant difference in the comprehension scores for BRs compared to print readers. This implies that vision loss, braille use and reading rate have very little effect on understanding. Ryles's (1997) thesis extends this finding by comparing comprehension levels based on the type of braille teaching and learning received. She found that students who received braille instruction four to five times per week comprehended better than students who received infrequent braille lessons (less than four times per week in the early years or those who learned braille later) and those who had never received braille instruction so were reliant on large print for reading. In the most recent paper, D'Andrea et al. (2023) used an iPad app with refreshable braille display to assess students' comprehension via a reading and multiple choice answer test and were able to show that younger students answered more comprehension questions correctly and this worsened as students got older. When comparing comprehension after reading print or braille and listening, research by Stepien-Bernabe et al. (2019) concludes both sighted and students with BLV comprehend better when they read the text/braille compared to listening to the text, suggesting that braille should not be replaced by audio, but rather braille should be supplemented by the use of audio when required. These five papers concluded that although BRs need more time to read, they comprehend at the same rate provided they receive regular and early braille instruction.

Overall, braille literacy has been discussed in the literature for some time but there are few studies using validated measures and very little agreement on what constitutes braille

literacy. Few studies have attempted to align braille literacy skills and strategies with the strategies and skills used in the development of print literacy, again with little to no agreement on whether BRs develop and utilise the same literacy skills as their sighted classmates. Many of the studies suggest the limitation of small cohorts makes it difficult to transfer evidence to population level.

## Teaching and learning

In the context of this review the theme teaching and learning included training and qualifications of teachers who teach students with BLV. Barriers to positive braille outcomes, globally, included a lack of guidelines, no development of a standardised braille curriculum, lack of valid and reliable assessments, and scarceness of ongoing training and development. Three separate studies included measures and analysis of teaching and learning, and reported a lack of validated guides for teaching braille literacy (Emerson, Sitar, et al., 2009; Herzberg et al., 2017; McKinley, 2006). McKinley (2006) in their thesis interviewed 30 adults who learned braille at school and most described positive literacy experiences attributed to the teacher of students with BLV; however, most teachers of these students used a variety of unvalidated materials and programmes to teach braille literacy. The decision on introducing contracted or uncontracted braille was inconsistent and most often based on personal beliefs and decided solely by the teacher of students with BLV.

There were three overarching themes that were mentioned in many of the papers and perhaps underpin the future needs for research.

### Difference in braille codes (contracted/uncontracted)

Researchers agree that many contractions used in braille are not linked to skills associated with early reading success (Day et al., 2008; Englebretson, Holbrook, Treiman, et al., 2023). Many studies found students who were reading primarily uncontracted braille were reading at much lower levels and demonstrated worse vocabulary and spelling skills than those who read contracted braille (Emerson, Holbrook, et al., 2009). This may be as a result of the way the reading rate was assessed as some authors have identified a braille reading window of one character per second, so when contracted/uncontracted braille reading is measured on characters/second the speeds are actually similar (Legge et al., 1999). When measured on words per minute, contracted braille is faster. This finding argues for the use of characters/second as an appropriate way to measure braille reading. This is supported by Veispak et al. (2013) who discuss braille cells as being encountered one at a time, contrary to print reading. Researchers highlight the need to consider differences in participant groups when developing assessment tools (Stepien-Bernabe et al., 2019). As there are no guidelines for the introduction on uncontracted/contracted braille, this is done in an ad-hoc manner with possible negative outcomes for students.

### Braille teaching and learning

The BR teenagers in Ryles's (1997) study who were more literate were those whose schools had provided them the opportunity to become proficient in braille by providing early and daily instruction in braille. Interestingly, research by Legge et al. (1999),

Martiniello, Barlow and Wittich (2022) and Laroche et al. (2012) found that the earlier age of acquisition of braille resulted in significantly faster reading speed, however, all of the studies assessed students using different methods so it was impossible to compare findings across studies and across countries due to the variances in teaching and assessment methods. In their study of student comprehension, D'Andrea et al. (2023) assert that when questions answered correctly was correlated with teacher instruction it was found that students who received more instructional hours by the general education teacher tended to answer fewer comprehension questions correctly. They conclude that students could benefit from specific instruction from a specialist vision teacher who is knowledgeable about braille literacy. There are considerable discrepancies in teacher training expectations and the ways students are educated, thus impacting braille literacy. Although some countries expect teachers to gain qualifications specifically in teaching students with BLV (USA and UK) (Keil, 2012), other countries have varying expectations for educators working in the field depending on the state they live in (Australia) (Fanshawe, 2017). The way education departments distribute resources throughout the world is variable and often unclear and inconsistent; some students continue to be educated in residential facilities (D'Andrea, 2009), while others are educated alongside their mainstream peers by a general education teacher and supported by a specialist vision teacher (Argyropoulos & Martos, 2006; Day et al., 2008; Lang et al., 2021). The amount of service by the teacher of students with BLV varies greatly depending on the resource allocation in their state/country (Farrand et al., 2022; Keil, 2004).

### Valid teaching and assessment tools

A variety of tools were used to teach and assess braille literacy in these studies (Argyropoulos & Martos, 2006; Emerson, Holbrook, et al., 2009; Ryles, 1997). Unfortunately, due to the differing assessment types, the results across these papers could not be compared. Although braille reading rate seems to be the most researched area of braille literacy, Savaiano et al. (2014) argue that methods and measures for assessing reading may not be valid for BRs. In their systematic review they concluded most studies did not meet quality indicators and most standardised tests do not include BRs and are therefore invalidated if they are simply transcribed into braille. Most other papers report on the need for appropriate assessment across all areas of braille literacy (Argyropoulos & Papadimitriou, 2015; Gillon & Young, 2002; Morgan, 1993; Stewart et al., 2022).

Overall, the researchers on teaching and learning of braille agree that regular daily instruction by a trained professional with time for practice and consolidation of skills is of upmost importance. There is little agreement on the qualifications required to be a specialist teacher of students with BLV globally. Differences in how student skills are measured, and a lack of validated tools make it difficult to generalise findings.

## Quality of life (QoL)

In an effort to better understand braille's impact on QoL for people with BLV, two questions were answered in this review. It was felt by the authors that the first question—what is braille?—needed to be defined before its impact on QoL could be ascertained. Review Question 2 focused on empirical and non-empirical data regarding braille literacy and QoL. There were 19 papers that mentioned an element of QoL. Schroeder (1994) was the first to conduct in-depth interviews with braille users to evaluate the impact of braille on their lives; however, only one piece of research was conducted that measured all

aspects of QoL (Dylgjeri, 2022). Six adults were interviewed for this thesis, and all participants contributed their adult success to their high levels of education and learning to read and write braille at a young age. While another paper compared school setting with employment outcomes in sheltered industrial settings and concluded that participants who attended mainstream schools in America had significantly higher salaries than those who attended specialised schools, and the salaries of those who attended both types of schools (dual enrolment or a transfer between schools) were between the salaries of the other two groups (Fireison & Moore, 1998). Neither job satisfaction nor work preference was found to be significantly different in a comparison between the two school settings in this study (Fireison & Moore, 1998). Surveys were conducted on older people with BLV, many of whom had been taught braille at school and concluded that a higher level of education, frequent braille use and being a member of a blindness organisation improved employability and increased annual salary (Bell & Mino, 2015; Bell & Silverman, 2018; Lund & Cmar, 2019; Monson & Bowen, 2008). Approximately 50% of these survey participants were married, had children, and owned their home. In a Japanese study of massage practitioners with BLV, Donoyama and Takeda (2007) found that marriage positively impacted the QoL of this group; however, emotional exhaustion, anxiety and depression were significantly higher in persons who could read written text compared to those who read braille only. The researchers concluded that this is because the BRs in the cohort had comprehended and accepted their disability whereas those losing their vision were still adapting to the change. Many of the papers made mention of employment of people with BLV. One intervention study described a job readiness programme for people with BLV (does not differentiate BRs from large print readers) and concluded that regular practice in workplace expectation, recognition of strengths and passions, documenting career goals, orientation and mobility, and interactions with potential employers assisted participants in finding and keeping jobs (Farrow & Parkin-Bashizi, 2019). Ryles's paper written in 1996, and subsequent thesis written in 1997 has since been cited hundreds of times in the field of BLV as they concluded that the impact of braille reading skills on people's employment rates was significant; those who had learned to read braille as their original reading medium and used it extensively were employed at a significantly higher rate. Macrae (2014) raised concerns in their opinion piece about the negative impact on QoL when braille is not taught to those who need it. Although all of this significant research was conducted over three decades ago, there continues to be major differentiation in the way students are taught braille with little understanding of the role braille literacy may play in the quality-of-life outcomes for people with BLV. In his thesis written in 1994, and cited numerous times since, Schroeder interviewed four BRs and found that all had a strong emotional bond with braille, and BRs had improved self-esteem, attitude, independence and functionality. The associations between braille learning and QoL appear positive in this very small-scale study conducted 30 years ago, but the thesis did not include any assessments of braille literacy or validated measures of QoL.

Much of the research on adults and QoL was conducted in America and of this literature there were positive links made between early braille teaching, daily use in adulthood and improved employability. Although many people reported on the ways in which braille has enhanced their lives, within this review a validated tool for measuring the QoL of people with BLV was not found.

## DISCUSSION

In reviewing the literature on braille literacy using the Access to Learning, Learning to Access Framework (McLinden & Douglas, 2013), quite a few significant issues have

emerged, which require a larger discussion. With an unlimited date range and the inclusion of grey literature, it was anticipated that the voices of people with BLV would be captured in this review; however, only two articles were located. Macrae (2014) speaks of liberation and pride in independently accessing the world through braille, and Dobbs (1999) argues that adequate education allows people with BLV to do the same job as anyone else. Further research capturing the voices and experiences of people with BLV is imperative and should be considered by all future researchers. Research on the connection between literacy and QoL for print readers is abundant, with many studies reporting on the association between increased literacy and improved QoL (Axelsson et al., 2007; Ehmann et al., 2020; Eiser & Morse, 2001; Fusar-Poli et al., 2020). The Organisation for Economic Cooperation and Development (OECD, 2010) affirms that success in reading provides the foundation for achievement in all subject areas and for full participation in adult life. Indeed, literacy encompasses an individual's proficiency in reading and writing, including their capacity to navigate written content across both digital and print mediums (Khaled, 2023). In 2008, the United Nations Educational, Scientific and Cultural Organisation (UNESCO) proclaimed the impact of literacy on individuals as significant, shaping their interpersonal interactions as well as their approach to education, employment, and governance. Despite much research showing the links between print literacy and improved QoL, we do not know if, how, or why braille literacy impacts QoL. There is little written about how students with BLV access their learning, if it is provided by the education system and what provisions there are for supporting students to become independent assessors of their own learning (McLinden et al., 2016). Data on the numbers of BLV in children and adults younger than 40 years are not well established (Burton et al., 2002; Dolphin et al., 2024). The Vision Loss Expert Group of the Global Burden of Disease Study group (VLEG–GBD) estimated that for 2020, 1.44 million children aged 0–14 years have BLV (including uncorrected refractive error) globally (Burton et al., 2021). However, we do not have reliable data for Australia (Croake et al., 2024). In Australia, the Nationally Consistent Collection of Data on School Students with Disability (2023) collects data regarding students with disability under the following categories: cognitive, physical, sensory, social/emotional. Sensory therefore includes students with blindness or with low vision, students who are deaf or hard of hearing, and students who are Deafblind. The data identifying the number of students who are BR has not been collected. Nevertheless, it is agreed by researchers that educating children with BLV who require braille ensures effective access to literacy, the curriculum, and fosters positive future outcomes (Cain et al., 2021; Dodd & Conn, 2000; Emerson, Holbrook, et al., 2009; Toussaint & Tiger, 2010). It is concerning that the impact of braille literacy has not been more widely researched. The lack of valid tools to measure braille literacy may be a barrier to student learning. Indeed, Englebretson, Holbrook, and Fischer-Baum (2023) raise concerns regarding the limited research pertaining to the teaching, learning and attainment of braille literacy and this may be because BLV is an extremely low incidence disability, and few children use braille as their literacy medium. There was no mention of styles of teaching and learning and the impact, if any, that this had on braille learning. Through McLinden and Douglas's (2013) lens, it is as yet unknown how, when and whether (or not) students who are BRs are only ever provided with access to learning and what is needed to teach students to learn to access. This scoping review did not identify a measure, conceptualisation or definition of braille literacy, nor did it provide evidence regarding QoL outcomes for adults who were taught braille as part of their schooling.

The overall quality of research evidence in the field of braille literacy and QoL is low. Many studies are methodologically weak with small sample sizes, lack of validated tools and insufficient longitudinal data. These limitations impact the ability to generalise findings. Much of the existing research lacks peer review, further compromising its credibility.

This low-quality evidence impedes the development of effective interventions and policies to support braille literacy. A significant issue complicating the study of braille literacy is the lack of an agreed-upon definition. Various researchers and practitioners use different criteria and benchmarks to assess components of braille literacy, leading to inconsistencies in how literacy levels are measured and reported. This lack of standardisation makes it difficult to compare findings across studies and to develop appropriate educational guidelines. An agreed definition of braille literacy is essential for establishing clear goals and measuring student progress effectively (McLinden et al., 2020). Most research tends to focus on individual components of braille literacy, such as reading rate and comprehension, rather than a more holistic approach. While these components are important, this fragmented focus fails to capture what constitutes all of braille literacy for students. An approach that considers the interplay of various skills and knowledge areas is necessary to provide a complete picture of braille literacy and to develop more effective educational programmes, especially considering the global movement to inclusion in mainstream schools. Another significant gap in the literature is the paucity of data on the impact of braille literacy on QoL. Although some evidence acknowledges that braille literacy improves independence, employment opportunities and overall well-being, empirical evidence supporting these claims is sparse. Without robust data, it is challenging to advocate for the resources and support needed to promote braille literacy. Research that examines the broader impacts of braille literacy on people's lives is crucial for demonstrating its value and arguing for necessary funding and policy support.

## Strengths and limitations of this scoping review

One of the main strengths of this research was not restricting it by date limitations and crossing global borders to include papers from research conducted across 11 countries, however, there were few articles written outside of the United States. This allowed a historical perspective to be included—this may the first of its kind in the field of BLV and QoL research. The education of students with BLV in America is often still in residential settings and this makes it difficult to generalise findings in countries where inclusion and mainstream schooling are the expectation for students with BLV. This scoping review was not limited to countries who use the English braille code, allowing for analysis of data from countries with a logographic language. As braille aligns with the logographic code, this research could open options for the ways students learn braille in future. The inclusion of theses and online news articles allowed for lived experiences and the inclusion of research that was not otherwise found in peer-reviewed journals. This enriched the review by incorporating the perspectives of people with BLV. Limitations mentioned in most of the papers are sample sizes. BRs make up a small percentage of the global population, and this was acknowledged via the quality appraisal process.

## Conclusion

This scoping review presented a synthesis of literature pertaining to quality of life for braille users from an international and historical context, including peer-reviewed journals and grey literature written by people with lived experience. The findings revealed that researchers have been writing about braille literacy for decades, yet little agreement has formed on the concept of braille literacy. It is well documented that qualifications of specialist teachers impact the braille learning for students and resourcing for daily instruction of braille is required for life-long braille use. Current literature reveals as yet there is no evidence-based guide for

braille literacy instruction that meets the needs of BR learning in mainstream classrooms, nor is there a definition, concept or measure of braille literacy that is valid and reliable (Croake et al., 2024; D'Andrea, 1996). Addressing these issues requires a concerted effort from researchers, educators and policy makers and could include:

1. improving the quality of research evidence
2. establishing a clear and agreed definition of braille literacy
3. adopting a comprehensive approach to studying braille literacy, and
4. gathering robust data on its impact on quality of life.

These areas for research are essential steps towards advancing the field. By tackling these challenges, we can better support students with BLV to initially access learning with a view to improving independence and learning to access (McLinden et al., 2016). This will enhance educational and life outcomes.

## AUTHOR CONTRIBUTIONS

**Aasha Rose:** Conceptualization; investigation; writing – original draft; formal analysis; writing – review and editing; validation; methodology; visualization; project administration; software. **Melissa Fanshawe:** Investigation; writing – review and editing; supervision; validation. **Georgina Barton:** Supervision. **Melissa Cain:** Writing – review and editing; supervision.

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## DATA AVAILABILITY STATEMENT

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

## ETHICS STATEMENT

This scoping review involved the analysis of publicly available literature and did not involve human participants, identifiable personal data, or unpublished primary data. As such, ethical approval was not required in accordance with institutional and national guidelines for research ethics. The review was conducted in line with established scoping review methodologies, ensuring transparency, accuracy, and integrity in data collection, analysis, and reporting.

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# APPENDIX 1

## EXTRACTION TABLE

| Author year/journal/country population of study details of study | Writing/spelling | Reading rate | Reading skills |
|---|---|---|---|
| Argyropoulos, V. S. and Martos, A. C.<br>2006 *JVIB* Greece<br>16 BR Ss aged 11–18. Interviews and brl writing task (text was read to the Ss twice, first time quickly and second time slowly while the Ss took notes) | Notes analysed for spelling errors | | |
| Argyropoulos, V. and Papadimitriou, V.<br>2015 *JVIB* Greece<br>21 school aged Ss in Greece (11 congenitally BLV, 10 adventitiously BLV)<br>Assess brl accuracy of BLV Ss based on gender, cause of visual impairment (or age at sight loss), and level of education; and 2. find out potential correlations among the error categories based on gender, age at loss of vision, and level of education of BLV Ss | | | Test A consists of 10 subscales, which comprise 4 structural axes: decoding, fluency, morphology-syntax and comprehension |
| Argyropoulos, V. and Papadimitriou, V.<br>2017 *International Journal of Educational Research* Greece<br>49 Greek Ss age 8–27 | Standardised Inventory of Listening and Analysing Spelling Errors designed and standardised for sighted Ss and adapted by authors for BR Ss | | |
| Bell, E. C. and Mino, N. M.<br>2015 *Journal of Blindness Innovation and Research* USA<br>Survey of 1056 Ss collected in 2011. Average age 46 years. Adult Rehabilitation and Employment Survey (ARES). 66% blind, 33% LV. 72% were taught brl, 58% read on a daily or weekly basis | | | |
| Bell, E. C. and Silverman, A. M.<br>2018 *Journal of Blindness Innovation and Research* USA<br>1153 Ss aged 18–89 who self-identified with BLV living in America; 58% reported congenital blindness | | | |

| Comprehension | Teacher competency in brl | QoL | Outcome/decision |
|---|---|---|---|
| Ss reported re: choice of brl or audio—when/ why and impact on comprehension | | Ss reported importance of spelling on QoL | Spelling improved from elementary to high school but worsened in college |
| | | | Female Ss (gender), Ss who were adventitiously BLV (age at loss of vision) and elementary school Ss (grade level) made more errors on average in all subscales |
| | | | The main categories of spelling errors are discussed and analysed including differences in correlation of age at vision loss |
| | | Ss with blindness were employed at a rate of 54%, while Ss with LV were employed at a rate of 49%; | |
| | | 57% own a home, 40% married, 46% have children, 70% live in a large town or large city. Ss with a higher level of education, who reported reading brl frequently, and who were members of a blindness consumer organisation, were most likely to be working either in a traditional FT job or in self-employment | |

(Continues)

**APPENDIX 1** (Continued)

| Author year/journal/country population of study details of study | Writing/spelling | Reading rate | Reading skills |
|---|---|---|---|
| D'Andrea, F. M., McCarthy, T., Kamei-Hannan, C. and Holbrook, M. C.<br>2023 *BJVI* USA<br>52 Ss—31 (63.27%) Ss received the services of an ST, one (2.04%) Ss received services via a resources room specifically for Ss who BLV, one (2.04%) Ss attended a specialised day class, and 16 Ss (32.65%) attended a specialised school for BLV | | | *Reading Adventure Time!* instructional tool, provides Ss with multiple passages to practise reading and technology skills using an iPad and refreshable brl display |
| Day, J. N.<br>2004 Thesis USA<br>5 BR Ss aged 688 years in mainstream schools supported by a ST in Utah. All were accessing a different brl programme prior to this intervention. Ss receive 1:1 instruction daily. The Early Steps programme is designed to support the recognition of high frequency words for young BR dissertation study to determine if using a research-validated reading approach designed for sighted students, could be implemented for Ss with BLV | | | |
| Day, J. N., McDonnell, A. P. and O'Neill, R.<br>2008 *Journal of Behavioural Education* USA<br>5 × 5–8-year-old, with BLV beginning BR/ST with at least 5 years teaching experience | | Used Dolsch Words List pre and post-test. Intervention-Early Steps Reading Model for beginning BRs using uncontracted brl reading with five beginning BRs | BR will likely eventually read contracted brl, there is no evidence indicating teaching either method first negatively impacts the outcome of Ss developing successful reading strategies including fluency and comprehension |
| Dobbs, K.<br>1999 *Training Journal* USA<br>Article: employment/unemployment of Ss with BLV | | | |
| Donoyama, N. and Takeda, F.<br>2007 *Industrial Health* Japan<br>155 massage practitioners with BLV in Japan in hospitals, medical clinics, nursing homes and own clinic | | | |
| Dylgjeri, L.<br>2022 Thesis USA<br>6 adults aged 33–60<br>All the Ss read and write brl proficiently | | | |

| Comprehension | Teacher competency in brl | QoL | Outcome/decision |
|---|---|---|---|
| The Reading Time Adventure! app included 720 passages arranged in year levels. Each passage was followed by five multiple-choice comprehension questions | | | Generally, Ss in lower grades demonstrated higher rates of reading comprehension than Ss in upper grades |
| | Two out of four STs wrote that they felt that the programme moved them beyond teaching brl to teaching reading using brl as the medium | | Over time all Ss demonstrated an increase in reading the high frequency words when moving from baseline to the intervention |
| | | | The treatment consisted of a 4-week intervention of 30–45 min daily, four sessions a week. Ss demonstrated an increase in reading the high frequency words. This study found: a research-based PR reading programme transcribed into uncontracted brl appeared to be more effective than the contracted brl reading programmes that were used prior to the study |
| | | 'The education system is increasingly letting BLV kids down', Pierce says | Quotes from Ss with BLV re: their lived experiences of applying for, getting and maintaining employment |
| | | Reports on age, marital status etc. as positively impacting mental health | Emotional exhaustion, anxiety and depression were significantly higher in persons who could read written text only compared to those who read brl only |
| | | Ss emphasised learning brl when they are young. Ss dedicated their success in life to brl at a very young age | |

(Continues)

**APPENDIX 1** (Continued)

| Author year/journal/country population of study details of study | Writing/spelling | Reading rate | Reading skills |
|---|---|---|---|
| Emerson, R. W., Holbrook, C. M. and D'Andrea, F. M.<br>2009 *JVIB* USA/Canada<br>18 Ss entered in year 1 of study, 18 entered in year 2 and 6 entered in year 3. Prekindergarten/kindergarten Ss followed until the end of year 4 | Specifically, Ss who were reading primarily uncontracted brl were reading at much lower levels and demonstrated worse vocabulary and spelling skills | Ss gradually lost ground in reading speed compared to their sighted peers, but reading fluency may not be targeted | |
| Emerson, R. W., Sitar, D., Erin, J. N., Wormsley, D. P. and Herlich, S. L.<br>2009 *JVIB* USA/Canada<br>Annual literacy assessments given to Ss:<br>• Texas Primary Reading Inventory<br>• Johns Basic Reading Inventory<br>• Brigance Comprehensive Inventory of Basic Skills-Revised.<br>• Assessment of Brl Literacy Skills (ABLS) | | | |
| Englebretson, R., Holbrook, M. C., Treiman, R. and Fischer-Baum, S.<br>2023 *Morphology* US<br>Analysis of contracted brl use in brl spelling tests (brl challenge) of Ss in years 1–4 over a 4-year period | | | Determine the factors influencing contraction use. Examine interplay between morphological structure and prescriptive rules of brl contractions |
| Erin, J. N. and Wright, T. S.<br>2011 JVIB USA/Canada<br>18 Ss entered in year 1 of study, 18 entered in year 2 and 6 entered in year 3. Prekindergarten/kindergarten Ss followed until the end of year 4 | Writing miscues were analysed for all the writing samples. | | |
| Farrow, K. and Parkin-Bashizi, N.<br>2019 *JVIB* USA<br>5-year study on a Job Readiness Program (JRP) with 84 Ss—does not differentiate BR | | | |
| Fireison, C. K. and Moore, J. E.<br>1998 *JVIB* USA<br>270 Ss with BLV working in sheltered workshops-employment outcomes and education backgrounds were compared<br>Two levels of the dependent variable brl literacy: ability to read Grade 1 and/or Grade 2 brl and the inability to read Grade 1 and/or Grade 2 brl | | | |

| Comprehension | Teacher competency in brl | QoL | Outcome/decision |
|---|---|---|---|
| | | | Teachers of Ss with BLV should continue to monitor their Ss' reading fluency as one useful benchmark of progress in reading. Poorer scores may be the result of the lack of instruction or the lack of sufficient practice |
| | The high-achieving Ss tended to have higher amounts of daily involvement with paraeducators, the low-achieving Ss tended to have slightly more involvement with their teachers of Ss with visual impairments | | Literacy instruction for young BRs needs to occur daily (Koenig & Holbrook, 2000), and there is evidence that the Ss in the study received daily instruction. The differences in the time spent by the teachers of Ss with BLV and the brl instruction that the two groups received tended to be over and above this basic level of required literacy instruction |
| | | | Morphology matters for both brl, and PR but does not work in the same ways in both modalities. The affordances of the tactile system differ from those of the visual system, and a variety of questions have yet to be asked about the nature of orthographic morphemes in brl and how they are processed |
| | | Real-world activities: informational interviews and internships triggered Ss feelings of anxiety, depression or low confidence Counsellors/registered nurse invited to group: signs, symptoms and resources | Ss attended a weekly class with peers where they completed work personality assessments, practised explaining their vision, and used their adaptive tools to complete work tasks. The foundation of the JRP was built on Ss recognising their passions and strengths and connecting how these can be parlayed into work |
| | | The 1994 instrument assessed job satisfaction, attitudes, behaviours and perceptions of working conditions at industries associated with NIB across the country | |

(Continues)

**APPENDIX 1** (Continued)

| Author year/journal/country population of study details of study | Writing/spelling | Reading rate | Reading skills |
|---|---|---|---|
| Gillon, G. T. and Young, A. A. 2002 *JVIB* USA Ss were introduced to Grade 2 brl with one of two approaches, depending on their teacher: 1. Ss taught Grade 1 brl until a reading age of 7 years and then Grade 2 brl; 2. Grade 2 brl following the tactile and alphabet training | | Used Neale Analysis of comprehension and the Burt Word Reading Test-NZ Revision (contracted/ uncontracted depending on Ss) and the Reading Freedom Diagnostic Reading Test | The Queensland University Inventory of Literacy (QUIL) (Dodd et al., 1997) was used to measure phonological-awareness skills |
| Greaney, J. and Reason, R. 1999 *Dyslexia* UK 22 BR aged 7:10–12:1 tested using Neale Analysis and Phonological Assessment Battery (PhAB) | | | Tactile sensitivity, perception and memory are prerequisites for brl, is phonological processes implicated? Two studies support that phonological processes play a central role in brl |
| Herzberg, T. S., Rosenblum, L. P., and Robbins, M. E. 2017 *JVIB* USA/Canada Survey responses from 84 teachers of Ss with BLV who provided literacy instruction to dual-media Ss | | | |
| Knowlton, M. and Wetzel, R. 1996 *JVIB* USA 23 expert BR adults. All but one learned brl from age 5 (one from age 9) | | Assessments included:<br>1. Read aloud as fast as you can with no concern for comprehension<br>2. Silent read and comprehension<br>3. Studying unlimited time to comprehend and retain information<br>4. Scanning for specific information | |
| Lang, M., Hofer, U. and Winter, F. 2021 *BJVI* Germany/Austria/ Switzerland 119 BR aged 11.0–22.11 Assessed fluency, reading comprehension and speed, listening comprehension and speed and spelling | BR performed normally in terms of spelling | Reading fluency in BR is below PR and the difference is greater by year 6. Results show listening speeds, especially in lower grades higher than speeds of sighted Ss of the same age in PR | |

| Comprehension | Teacher competency in brl | QoL | Outcome/decision |
|---|---|---|---|
| | | | Longitudinal and intervention studies of the development of phonological awareness skills in Ss with BLV found training to strengthen young BR phonological awareness skills may significantly enhance Ss' development of brl reading |
| | | | Outlined 2 case studies but did not give details of one of the Ss schooling and did not indicate if/what programme was used to teach brl, type of schooling etc |
| | The teachers' personal beliefs were almost equally divided between beginning with uncontracted brl ($n=10$) and beginning with contracted brl ($n=9$) | | The teachers reported they introduced brl to their Ss at the mean age of 7.8 years. Three most common reasons were the Ss's diagnosis, PR reading speed and PR reading stamina |
| | | | Significant research conducted on brl in the past 90 years: optimal structure of brl, contractions, psychophysics, reading rates, learning and reading brl, strategies, teaching methods, tactile discrimination and hand movements; however little research on process of reading—taking symbolic information, assigning meaning to it and comprehending it— the primary purpose of reading |
| | | | The results of the study also show that an early start and longer periods of brl use can have a positive effect on reading fluency. The introduction of brl should always be as early and intensive as possible. Future research should address ways and methods to improve brl reading fluency |

(Continues)

**APPENDIX 1** (Continued)

| Author year/journal/country population of study details of study | Writing/spelling | Reading rate | Reading skills |
|---|---|---|---|
| Laroche, L., Boulé, J. and Wittich, W. 2012 *JVIB* Canada—French speaking 30 French BR aged over 15 (age range 18–67 M 40), primarily brl user for at least 3 years attending high school or post-secondary education/10 sighted French PR readers (age range 20–57 average 40) age matched and attending high school or post-secondary education | | 1. Continuous text from a newspaper article 2. Narrative text from novel, both at the Grade 4 reading level: read aloud for 3 min, read silently for 3 min, comment on the text they read to ensure a reasonable level of comprehension | |
| Legge, G. E., Madison, C. M. and Mansfield, S. J. 1999 *Visual Impairment Research* USA 44 brl users aged 18–47 learned brl from age 3–65, yes reading brl 2–69 | | Ss timed using MNRead on ten sentences in each of five conditions. Using normal reading strategies | |
| Lund, E. M. and Cmar, J. L. 2019 *JVIB* Literature review 1990–2018 coded all included articles for sample parameters, participant characteristics, quality indicators (QIs), and study outcomes | | | |
| Macrae, I. 2014 *The Guardian* article | | | |
| Marshall, L. and Moys, J.-L. 2020 *Visible Language* UK 38 survey respondents re: experiences of brl in an evolving technological world | | | |
| Martiniello, N., Haririsanati, L. and Wittich, W. 2022 *Disability and Rehabilitation* Canada 14 working age and older adults (aged 33–67) with acquired BLV who pursued brl rehabilitation training | | | |

| Comprehension | Teacher competency in brl | QoL | Outcome/decision |
|---|---|---|---|
| | | | Ss are faster reading silently than out loud; however, the gain in speed in reading silently was almost 5 times as large for the PR readers as for the BR. Exam times need to be 2.5 times longer than that of PR readers |
| | | All knew and preferred to use Grade 2 brl. All Ss relied on brl for vocational, recreational, or other activities of daily life | Contracted/uncontracted and interpoint. Grade 1 sentences from printed MNREAD sentences on a character-for-character basis. Grade 2 sentences from Grade 1 sentences by including the brl contractions but same number of words on each line |
| | | Employment was significantly positively associated with life satisfaction and friend support but negatively associated with cynicism, low self-esteem, overprotection and conflict with social network members | Thirteen articles met inclusion criteria. In four univariate analyses, researchers found significant associations between brl use and employment earnings |
| | | Comments from the author on ways brl promotes independence | Describes brl decline, fears of underfunding as a result |
| | | Ss asked how brl has influenced their QoL. Their responses: brl is important for independence and social integration—e.g., 'It makes the difference between me being able to work, study and do other activities' which allow for personal expression, learn new languages, read music and do other activities which would not be possible without it | The future of Brl was explored, with multiple themes: Affordable refreshable displays, which 'may offer a positive contribution to the continuation of Brl' increased access to brl. Reduced quality of brl teaching due to the integration of BLV Ss into mainstream schools, the increase of modern technologies poses a threat to brl, medical developments resulting in fewer Ss needing brl |
| | | A variety of personal, social and institutional factors facilitate or impede adult brl learning before, during and after training concludes. Findings: barriers addressed through policy and practice changes | |

(Continues)

**APPENDIX 1** (Continued)

| Author year/journal/country population of study details of study | Writing/spelling | Reading rate | Reading skills |
|---|---|---|---|
| Martiniello, N., Haririsanati, L. and Wittich, W. 2022 *Scientific Studies of Reading* Canada 46 Ss (aged 23–88) learned Brl between ages of 4 and 63. 36 BLV from birth, 30 learned brl before age 12 with 78% using brl weekly | | Four tests used read aloud and silently on paper and on refreshable brl followed up by comprehension questions | |
| McCarthy, T., Holbrook, C., Kamei-Hannan, C. and D'Andrea, F. M. 2023 *Journal of Special Education Technology* USA 49 Ss in grades 1–9 16-week study—Ss used the Reading Adventure Time! app to complete a pretest, intervention, and eight progress monitoring checks | | Few miscues for Ss at all grade levels. Predictors of reading speed: number of brl cells on the refreshable brl display, proportion of Ss receiving free and reduced lunch recipients, time in literacy instruction with general education teacher, and whether Ss used dual media | |
| McKinley, P. L. 2006 Thesis USA Ethnography of 4 Ss aged 18–77 on schooling, technology advances, curriculum, impact on lives. 30 interviews with Ss | | | |
| Mohammed, Z. and Omar, R. 2011 *BJVI* Malaysia 299 Ss from two schools, one mainstream and one special school in Kuala Lumpur, Malaysia. 52 large PR BLV Ss, 54 BR, 193 with 'normal' vision | | Reading rate of BR and PR are lower than those with NV. Some Ss in PR group showed high reading rate: 100 wpm. Almost twice the time for the Ss with BLV to read this PR material and three times longer for a BR to read brl | |
| Mommers, M. J. 1976 *New Outlook for the Blind* Holland Data collection of 120 BR in Holland between 1970 and 1973 | | 1. Speed test of words<br>2. Speed test of sentences<br>3. Reading of 100 words extending in difficulty<br>4. Comprehension | |

| Comprehension | Teacher competency in brl | QoL | Outcome/decision |
|---|---|---|---|
| | | Adult brl rehabilitation, two categories of clients: congenital BLV/learned brl early in life but seek rehab for changing needs as they age, and those who experience vision loss later in life and who require brl training to regain independence | These findings suggest that, as experienced BRs age, they do not exhibit significant changes in their brl reading speed due to age alone. This is somewhat inconsistent with research on PR reading and ageing |
| | | | |
| | Ss have a Literacy Media Assessment (LMA) which recommends media and primary learning medium | Ss with brl participate in extracurricular activities more. Brl is at the front and centre; 24 Ss said that brl is extremely important for people with BLV | |
| Comparison of comprehension tests between the three groups showed no significant difference between them. Comprehension scores for PR are very similar to NV, implying that degraded vision and slow reading speed have little effect on understanding | | | |
| | | | 1. The reading speed of separate words by PRs is at least two to three times quicker than that of BRs. The differences in reading power and reading comprehension are much smaller.<br>2. Poor BRs lag the poor sighted readers than the good BRs lag the good, sighted readers.<br>3. Technical skills needed for reading develop until at least 15 years for good and poor BRs.<br>4. The degree of blindness shows hardly any relation to the reading achievement of Ss |

(Continues)

**APPENDIX 1** (Continued)

| Author year/journal/country population of study details of study | Writing/spelling | Reading rate | Reading skills |
|---|---|---|---|
| Monson, M. R. and Bowen, S. K. 2008 *JVIB* Literature review re the development of phonological awareness by braille users—peer-reviewed journals resulting in 9 articles that met criteria, 2 contained 2 studies each: totalling 11 studies | | | Theme 1: similarities between PR and BR Theme 2: differences between PR and BR (brl readers did better on phonemic fluency, alliteration, alliteration fluency, and rhyme subtests). Theme 3: four largest areas of contradiction were performance of skills that were used to measure phonological awareness, determination of the relationship between phonological awareness and literacy, logographic, and the relevance of phonological awareness skills to reading brl |
| Papadimitriou, V. and Argyropoulos, V. 2022 *Scientific Studies of Reading* Greece 30 BR with a mean age of 13.8 ranging 8–22 attending primary or secondary education. 63% with congenital BLV, while 36 with adventitious BLV | | Assessment of Ss reading level via the first three subscales of the standardised Test-A, which assesses the reading ability of Ss within the third grade up to the twelfth grade | |
| Rosenblum P. L. and Herzberg, T. S. 2020 *JVIB* USA 4 Ss with BLV who began formal brl instruction at Grade 4 or later and were currently in Grades 6–12 participated in the study with their current teacher and a family member | | | |

| Comprehension | Teacher competency in brl | QoL | Outcome/decision |
|---|---|---|---|
| | | Given the importance of brl reading to success later in life (Ryles, 1996), research that examines the interaction among these two factors is paramount, and the processes by which brl reading is learned are essential and must be examined | Other than the broad category of phonological awareness, there was no single common theme among the 11 studies |
| | | | Practical instructive implications: ST can design instruction and intervention programmes more precisely regarding brl reading. Teachers should insist on development of morphemic awareness skills, so BR improve their decoding skills, especially in the rather challenging second half of long words |
| | Teachers reported NOT using commercially available curriculum or product. Process of learning brl differed for each Ss, they struggled to be efficient BRs although received brl instruction for several years. Inefficient brl affected ability to use brl as a meaningful tool in literacy toolbox | To be competent in postsecondary education and employment, people with BLV must have a 'literacy toolbox'. Several Ss: balance of determining how much time to allocate to brl instruction and how much time to technology instruction, especially as the Ss fell further behind academically | |

(Continues)

**APPENDIX 1** (Continued)

| Author year/journal/country population of study details of study | Writing/spelling | Reading rate | Reading skills |
|---|---|---|---|
| Pick, A. D., Thomas, M. L. and Pick, H. L., Jr.<br>1996 *Journal of Verbal Learning and Verbal Behaviour* USA<br>The Ss were 26 BRs (18 boys and 8 girls) from 9 to 21 years varied in age at onset of blindness, cause of blindness, amount of residual sight, and number of years of reading brl | | | Sixty pseudo-words three to six letters in length. Pronounceable pseudo-words: initial consonant spelling, a vowel spelling, and final consonant spelling. An unpronounceable counterpart constructed for pronounceable pseudo-word by reversing the positions of the initial and final consonant spellings, for example, LODS is a pronounceable pseudo-word; DSOL is its unpronounceable counterpart |
| Pring, L<br>1984 Ss Development England<br>9 Ss with congenital BLV in residential school/ 14 sighted Ss—different ages but comparable in reading ability (10.4/10.6). Experiment 1: influence of semantic information on word recognition (bread and butter). Experiment 2: automatic processing component in word recognition | | In this study BLV Ss read 2 1/2–3 times slower than their PR reading peers | Set 1: 40 words that make up pairs of semantically related words (nurse-doctor). Set 2: 28 words of colour related words (sky blue) Set 3: 84 non-words. Degradation of brl dots and PR was also analysed |
| Ryles, R.<br>1996 *JVIB* USA<br>74 congenitally BLV aged 18–55 and had no concomitant disabilities who resided in Washington. 15–20-min interviews with 35–40 questions | | | |

| Comprehension | Teacher competency in brl | QoL | Outcome/decision |
|---|---|---|---|
| | | | The results support the hypothesis that grapheme-phoneme correspondences function as grouping principles in the perception of brl words in the same manner as has been shown for the perception of print words. Pronounceable pseudo-words are read more quickly than unpronounceable pseudo-words by BRs. Pronounceable pseudo-words are also read with greater accuracy even though Ss took more time to read the unpronounceable words and hence might have been expected to read them as accurately as the pronounceable words |
| | | | When dots are degraded, Ss rely further on semantic factors. The speed of recognising infrequent words was slow—perhaps indicating a smaller working vocabulary |
| | | Thirty-one subjects were employed, 6 part time, 25 full time, 43 unemployed, yielding an unemployment rate of 58%; impact of brl on the employment rates was significant. Knowledge of brl, even as a primary reading medium, did not increase a subject's chances of employment, but those who had learned brl as their original reading medium and used it extensively were employed at a significantly higher rate | The extensive and early acquisition of brl reading skills were the two factors that had a strong impact on employment rates. The Ss who had been taught to read brl as Ss were employed (either full time or part time) at more than twice the rate of those who were taught to read PR. However, the subjects who learned brl after they learned to read PR did not have a higher employment rate than those who had not learned brl |

(Continues)

**APPENDIX 1** (Continued)

| Author year/journal/country population of study details of study | Writing/spelling | Reading rate | Reading skills |
|---|---|---|---|
| Ryles, R.<br>1997 Thesis USA<br>4 × groups of 15 Ss Group 1 Sighted Ss Group 2 early brl group received brl instruction four to five times week in grades 1–3. Group 3: infrequent brl group, received brl instruction less than four times a week in grades 1–3, or did not receive instruction in brl until later than the primary grades. Group 4: The 'no brl' group Ss who had never received formal instruction in brl reading | | | |
| Savaiano, M. E., Compton, D. L. and Hatton, D. D.<br>2014 systematic review published as a book chapter<br>The purpose of this review was to examine the existing literature to determine what factors impact brl reading comprehension (12 studies in 10 articles) | | | |
| Schroeder, F.<br>1994 Thesis (followed by a published paper in *JVIB* in 1996) USA<br>In-depth interviews with 8 BLV adults: 4 BR adults/4 non-BR<br>All 4 BR expressed a strong emotional tie to brl. The longer an individual had been a brl reader, the stronger the tie. Those that learned brl in school are satisfied with brl as a method for reading and writing. While all the BRs like to read the NBRs were ambivalent about reading | | | |

| Comprehension | Teacher competency in brl | QoL | Outcome/decision |
|---|---|---|---|
| | | Literacy increases employment chances among general population. Ss in this study who were more literate were those whose schools had provided them the opportunity to become proficient in brl by providing early daily instruction in brl | It should be noted that Ss who had been given instruction in brl reading on an infrequent, later or inconsistent basis did not improve their reading skills substantially, as evidenced by the poor performance of the infrequent brl group. The performance of the early brl group substantiates that visually impaired Ss need not only instruction in brl reading, but also require it on the same basis as sighted peers—daily during the earliest school years |
| 4 articles from the last 20 years, 8 from 1970 to 1990. Overall met 28% (15%–50%) of the quality indicators. The primary focus of reading research in Ss BR has been on increasing reading rate and overall reading fluency found very little research regarding brl reading comprehension and its underlying processes. Research on brl reading: tactile, perceptual issues. Unclear whether current methods and measures for assessing reading comprehension are valid for Ss who read brl | | | Most standardised tests do not include samples of Ss who are BLV. In addition, most standardised tests are invalid if they are adapted in any way, including transcribing them into brl (Goodman, 2020) |
| | | Ss expressed belief that lives have substantially benefitted using brl. NBR believe knowing brl would have helped their self-esteem. Self-esteem and independence were tied to brl. For BRs, brl is an essential part of attitude and functionality. Some NBRs at school went to adult rehab to learn brl as they felt they needed it. BRs appeared to have more strategies to be independent | Later BR feel disadvantaged by not learning brl earlier, while NBR don't think they needed it; however, they do acknowledge that brl may have made functioning easier. Factors that influence beliefs about brl and reading: the amount of remaining vision impacts perceived need for brl (at any point throughout life); experiences with brl in education—school type may have an impact; skills and attitude of advisoty teacher (AT); amount of support from AT. Attitudes about blindness and self—all the BRs considered themselves BLV |

(Continues)

**APPENDIX 1** (Continued)

| Author year/journal/country population of study details of study | Writing/spelling | Reading rate | Reading skills |
|---|---|---|---|
| Stepien-Bernabe, N. N., Lei, D.; McKerracher, A. and Orel-Bixler, D. 2019 *Optometry and Vision Science* USA Thirty-four BLV (19–71 years; median, 45 years) and 31 sighted (18–64 years; median, 22 years) | | | |
| Stewart, R., Zebehazy, K. T. and Holbrook, M. C. 2022 *JVIB* USA Case study intervention with one Ss | | | Kamei-Hannan and Ricci Reading Assessment (2015) and the Brl Reading Analysis Chart (Harley et al., 1997) to determine areas of need for a Ss in grade 2 in a brl literacy programme. |
| Veispak, A., Boets, B. and Ghesquière, P. 2013 *Research in Developmental Disabilities* Holland 28 BRs (mean age 15 years) all lost vision before age 10 matched with 28 sighted Ss | | BR readers predominantly use indirect grapho-phonological strategy to decode words and pseudo-words as coherent text. PR readers, depending on their proficiency level, fluently switch between a direct orthographic and an indirect grapho-phonological reading route | Accuracy of BR and PR was similar, however younger BR were slower |
| Xia, Y., Xie, R., Wu, X., Zhao, Y., Sun, P. and Chen, H. 2023 *Learning and Individual Difference* China Chinese BRs in grades 3–6 | | | Measures including rapid number naming, working memory, phonological awareness, morphological awareness and reading comprehension of brl text and sentences were administered to BLV Ss |

*Note*: BR, braille reader; brl, Braille; PR, print reader; Ss, subjects/students/children; ST, specialist teacher of students with blindness/low vision.

| Comprehension | Teacher competency in brl | QoL | Outcome/decision |
|---|---|---|---|
| Comparing comprehension following a listening task to a PR (sighted Ss) or brl (BLV Ss) | | | On average, sighted and BLV Ss comprehended the scientific passages better when they were presented in text or brl compared with when a voice actor read them aloud |
| | | | This report shows the importance of targeted, assessment-based intervention in brl literacy instruction to address needs that are specific to the brl code. Assessment-based instruction is key to identifying and meeting the needs of Ss who BLV are |
| BR performed better on verbal short-term memory. PR did better on vapid automatic naming tasks | | | Intensive training of phonological awareness skills should be considered a fundamental part of brl instructions, starting already at the pre-reading stage |
| | | | The younger the Ss, the more that morphological awareness and phonological awareness contributed to BLV Ss's sentence and text comprehension and reading ability. By year 5 and 6 rapid automatised naming was only a contributor to sentence and text comprehension and reading of brl |

# APPENDIX 2

## QUALITY ANALYSIS

### CROSS SECTIONAL STUDIES (CSS)

CSS are used to answer a particular research question pertaining to a specific population. Cross-sectional simply analyses what is happening at a specific point in time and often a subset of the population is represented in the study (Olsen & St George, 2004).

| | Clearly defined criteria | Ss and setting described | Reliable and valid exposure method | Objective, standard criteria used for measurement | Confounding factors identified | Strategies to deal with confounding factors stated | Outcomes measured in a valid and reliable way | Appropriate statistical analysis used | Score |
|---|---|---|---|---|---|---|---|---|---|
| Argyropoulos and Martos (2006) | y | y | y | na | n | na | n | y | 4 |
| Argyropoulos and Papadimitriou (2017) | y | n | y | na | n | na | n | y | 3 |
| Argyropoulos and Papadimitriou (2015) | y | y | y | na | na | na | n | y | 4 |
| Bell and Mino (2015) | y | y | y | n | na | na | n | y | 4 |
| Bell and Silverman (2018) | y | y | y | n | na | na | n | y | 4 |
| D'Andrea et al. (2023) | y | y | y | y | y | y | y | y | 8 |
| Day (2004) | y | y | y | y | y | y | n | y | 7 |
| Day et al. (2008) | y | y | y | y | y | y | n | y | 7 |
| Donoyama and Takeda (2007) | y | n | y | n | na | na | n | y | 3 |
| Emerson, Holbrook, et al. (2009) | y | u | y | y | u | u | n | y | 4 |
| Emerson, Sitar, et al. (2009) | y | y | y | y | u | u | n | y | 5 |
| Englebretson, Fischer-Baum, and Holbrook (2023) | y | u | y | y | n | n | n | y | 4 |
| Erin and Wright (2011) | y | y | y | n | n | n | n | y | 4 |
| Farrow and Parkin-Bashizi (2019) | y | y | y | n | y | y | n | y | 6 |
| Fireison and Moore (1998) | y | y | y | n | n | n | n | y | 4 |
| Gillon and Young (2002) | y | y | y | y | y | y | y | y | 8 |
| Greaney and Reason (1999) | y | y | y | y | na | na | n | y | 5 |

| | Clearly defined criteria | Ss and setting described | Reliable and valid exposure method | Objective, standard criteria used for measurement | Confounding factors identified | Strategies to deal with confounding factors stated | Outcomes measured in a valid and reliable way | Appropriate statistical analysis used | Score |
|---|---|---|---|---|---|---|---|---|---|
| Herzberg et al. (2017) | y | y | y | na | na | na | n | y | 4 |
| Knowlton and Wetzel (1996) | y | y | y | na | na | na | n | y | 4 |
| Lang et al. (2021) | y | y | y | y | y | y | n | y | 7 |
| Laroche et al. (2012) | y | y | y | y | y | y | y | y | 8 |
| Legge et al. (1999) | y | y | y | y | y | y | y | y | 8 |
| Marshall and Moys (2020) | y | y | n | n | na | na | | | |
| Martiniello Barlow and Wittich (2022) | y | y | y | n | n | n | n | y | 4 |
| Martiniello Haririsanati and Wittich (2022) | y | y | y | na | na | na | n | y | 4 |
| McCarthy et al. (2023) | y | Y | y | y | y | y | y | y | 8 |
| McKinley (1996) | y | y | n | n | na | n | n | n | 2 |
| Mohammed and Omar (2011) | y | y | y | n | n | n | n | y | 4 |
| Mommers (1976) | y | y | y | na | na | na | n | y | 4 |
| Papadimitriou and Argyropoulos (2022) | y | y | y | na | n | na | n | y | 4 |
| Pick et al. (1966) | y | y | y | na | na | na | n | y | 4 |
| Pring (1984) | y | y | y | na | na | na | n | y | 4 |
| Rosenblum and Herzberg (2020) | y | y | y | n | n | n | n | y | 4 |
| Ryles (1996) | y | y | y | n | y | na | n | y | 5 |
| Ryles (1997) | y | y | y | y | y | y | y | y | 8 |
| Schroeder (1994) | y | y | y | na | na | na | n | y | 4 |
| Stepien-Bernabe et al. (2019) | y | y | y | y | y | y | n | y | 7 |
| Stewart et al. (2022) | y | y | y | n | n | n | n | y | 4 |
| Veispak et al. (2013) | y | y | y | n | n | n | n | y | 4 |
| Xia et al. (2023) | y | y | y | y | y | y | n | y | 7 |

*Note*: y = yes (scores 1); n = no (scores 0), u = unclear (scores 0); na = not applicable (scores 0).

## SYSTEMATIC REVIEWS

Although SR were initially designed for the medical field to help practitioners keep up to date with the literature that summarised large bodies of evidence and explained the similarities and differences across studies of the same question (Cook et al., 1997), the formula for a systematic review can be used across all fields including education.

| Author | Clear review question | Inclusion criteria | Search strategy | Sources and resources adequate | Criteria for appraisal | Conducted by two or more reviewers | Error minimisation in data extraction | Appropriate combination of studies | Publication bias | Recommendations supported by data | Appropriate directives for new research | Score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lund and Cmar (2019) | y | y | y | y | y | y | y | y | y | y | y | 11 |
| Monson and Bowen (2008) | y | u | u | n | n | y | n | u | u | y | y | 4 |
| Savaiano et al. (2014) | y | y | y | y | y | y | y | u | u | y | y | 9 |

*Note*: y = yes (scores 1); n = no (scores 0), u = unclear (scores 0); na = not applicable (scores 0).

## EXPERT OPINIONS

| Author | Source of the opinion clearly identified | Source of opinion has standing in the field of expertise | Interests of the relevant population the central focus | Logically defended argument to support the conclusions drawn | Reference to the extant literature | Incongruence with the literature/ sources logically defended | Score |
|---|---|---|---|---|---|---|---|
| Dobbs (1999) | y | u | y | u | n | n | 2 |
| Macrae (2014) | y | y | y | y | n | n | 4 |

*Note*: y = yes (scores 1); n = no (scores 0), u = unclear (scores 0); na = not applicable (scores 0).

## QUALITATIVE RESEARCH STUDY

QRS collect and analyse data, develop and modify theory, develop a research question and design ensuring validity and reliability (Maxwell, 2008).

| Author | Congruity between the stated philosophical perspective and the research methodology | Congruity between the research methodology and the research question or objectives | Congruity between the research methodology and the methods used to collect data | Congruity between the research methodology and the representation and analysis of data | Congruity between the research methodology and the interpretation of results | Statement locating the researcher culturally or theoretically | Participants, and their voices, adequately represented | Ethical according to current criteria or, for recent studies, and is there evidence of ethical approval by an appropriate body | Conclusions drawn in the research report flow from the analysis, or interpretation, of the data | Score |
|---|---|---|---|---|---|---|---|---|---|---|
| Dylgjeri (2022) | y | y | y | y | y | y | y | y | y | 9 |

*Note*: y = yes (scores 1); n = no (scores 0), u = unclear (scores 0); na = not applicable (scores 0).