Nagy, W., & Townsend, D. (2012). Words as tools: Learning academic vocabulary as language acquisition. *Reading Research Quarterly, 47,* 91–108. doi:10.1002/RRQ.011

Savaiano, M. E., Compton, D. L., Hatton, D. D., & Lloyd, B. P. (2016). Vocabulary word instruction for students who read braille. *Exceptional Children, 82*, 337–353. doi:10.1177/0014402915598774

Schles, R. A. (2015). Individualized meaning-centered approach to braille literacy education (I-M-ABLE) case study: Ajay's story. *Journal of Visual Impairment & Blindness, 109,* 60–65.

Texas School for the Blind and Visually Impaired. (2007). *EVALS: Evaluating visually impaired students using alternate learning standards emphasizing the expanded core curriculum.* Austin, TX: Texas School for the Blind and Visually Impaired.

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Oral Braille Reading Decoding Strategies of Middle School Students Who Are Blind or Have Low Vision

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The value of literacy is widely recognized. Libraries host story time for young children to encourage interest in reading. Preschools begin literacy instruction with identification and writing of letters. Groups of friends meet for monthly book clubs. Information is more often shared in text messages, e-mail messages, Facebook posts, and Twitter posts called tweets than by telephone calls or face-to-face conversations.

However, students who are visually impaired (that is, those who are blind or have low vision) may face unique literacy challenges as they learn to read and write braille. One such challenge relates to slower reading speeds for students who read braille as compared to those who read print. Wall Emerson, Holbrook, and D'Andrea (2009) found that for students in grades one through four, on average, the reading rates for print readers were approximately 1.5 to 2 times faster than the rates for braille readers, with the differences increasing as the grades advanced. One reason that braille often results in slower reading rates than print is related to perceptual span (Savaiano, Compton, & Hatton, 2014), the number of symbols that can be perceived at one time that provide useful information while reading (Raynor, 1986). For skilled print readers, the width of perceptual span is 14 to 16 characters (Raynor, 1986); however, braille readers perceive significantly fewer cells at a time (Savaiano et al., 2014). One solution to the smaller perceptual span encountered by braille readers is the use of contractions, which allows for combinations of letters to be presented in fewer cells, but this arrangement brings its own challenges. In addition to learning letters, sounds, grammar, and spelling, braille readers must learn almost 200 contractions and composition signs and the rules for using such symbols (Wall Emerson et al., 2009). This extra hurdle influences the decoding skills of braille students. For example, when the contraction for *one* is used in the word *money*, decoding can be challenging because of the syllable break in the middle of the *one* unit and because the letters *o, n,* and *e* sound differently in the word *money* than they do in the word *one*, which is most commonly associated with the contraction.

Challl (1983) described two approaches to decoding that can be seen across five stages of reading development. In stages one and two, children apply bottom-up or text-based strategies. They utilize letter-sound relationships, word lengths, and sight words to build familiarity and fluency. Focus is on the text itself more than on the meaning conveyed by the text. Stages three, four, and five are marked by children employing top-down or reader-based decoding strategies as they shift from learning to read to reading to learn. Readers attend more to the meaning of the text, and they rely on the context of the message and their own knowledge for decoding.

Although a model specific to braille reading development does not exist, Steinman, LeJeune, and Kimbrough (2006) postulated that the development of braille readers is similar to Chall's (1983) stages for print readers. In this parallel, Chall's decoding strategies (text-based or reader-based) offer a theoretical perspective for the present study, which sought to answer the following questions: What decoding strategies do braille-reading students utilize? And what instruction is provided by teachers in response to reading errors or decoding strategies? Soon after the onset of data collection and analysis, it was determined that another question should be investigated: What types of reading errors do these students make?

Methods

This study was conducted as collaborative action research, which involved two teachers of students with visual impairments and one university professor. According to Bruce and Pine (2010), *action research* is recursive and problem solving, often involving multiple cycles of action and reflection. All components of the study were approved by Boston College's Institutional Review Board.

Over an eight-week period, students participated in lessons focused on oral reading of braille with their teachers of students who are visually impaired, Melody and Beth, two to three times per week. During these lessons, the teachers documented decoding errors, supported students in the use of decoding strategies, and provided further literacy instruction as needed. Over the course of the study, Melody and Beth utilized the data that they collected on their students to reflect upon and adjust their instructional practices.

Participants

The teachers of students who are visually impaired involved in this study, Melody and Beth, currently teach at a residential school for students with visual impairments. Both hold masters of education degrees specific to teaching students with visual impairments, and both have over 35 years of experience in special education. In addition, Melody is certified in Wilson Reading Language, level one, and Beth has a masters of education degree in technology in education.

Three middle school students participated in the study, all of whom attended the residential school where Melody and Beth teach and each of whom reads braille at varying levels. All students were given pseudonyms in order to protect their identities. Justine was 13 years old when the study began, with a braille reading level of eighth to ninth grade. Her visual impairment is attributed to septo-optic dysplasia, bilateral optic nerve hypoplasia, intermittent esotropia, nystagmus, and lack of color vision. John, also age 13 years at the onset of the study, had a braille reading level of fourth to fifth grade. His eye condition is stage five retinopathy of prematurity. The third participant, Bill, was 14 years old when the study started, and his braille reading ability aligned with Patterns Primer and level one with only two years of braille instruction. Bill's visual impairment is due to Alstrom syndrome, rod-cone disorder, hyperopic astigmatism, and nystagmus. In addition, Bill has attention deficit–hyperactivity disorder and a bilateral mild-moderate hearing loss for which he wears hearing aids. Informed

consent was obtained from the participating teachers and the students' parents prior to data collection. The students also assented to involvement in the study.

Data sources

Over an eight-week period, students engaged in oral reading two or three times per week with their respective teacher. Three reading sessions were videotaped, one each in the first, middle, and last month of the study. For each reading session, the teacher recorded the following information on a data collection form: each misread word, the decoding strategy applied to each misread word, the level of teacher prompts or instruction, and teacher notes such as the nature of the braille reading error. The data collection form identified a priori decoding strategies (for example, uses context clues, sounds it out, uses experiential learning, looks it up in a dictionary) and prompting levels (independent, verbal, or gestural prompt; verbal explanation or scaffolding; teacher modeling; or instruction in braille contractions), but the teachers were able to record strategies or prompts used that did not appear on the established list.

Data analysis

Data were analyzed using the constant comparative method (Glaser, 1965). The teachers reviewed data sheets throughout the study and adjusted their teaching practices accordingly. In the end, they utilized the data forms to determine the misread words, the types and counts of reading errors, the types and counts of strategies used, and the levels of prompting for each student. A thematic analysis was also conducted of the comments made by the teachers regarding the types of errors demonstrated by the students.

Results

Justine

Justine evidenced decoding errors as a result of braille errors (41), unknown meaning of words (11), word substitutions (8), proper nouns (3), word omissions (4), and mispronunciations (3). For 14 misread words, the type of error was not identified. Examples of braille errors included *enough*, *the*, *quite*, *through*, *ever*, *ound*, *ness*, *many*, *ea*, *immediately*, and contractions occurring in the middle of words. Justine did not know the meanings of *strove*, *intermittent*, *bayonets*, and *bottleneck*. She substituted *harass* for *harness*, *nicks* for *necks*, *bank* for *back*, and *incident* for *accident*. Most often, Justine reread the text (26) or utilized a dictionary (11) to decode words that she had previously misread (which were text-based and reader-based strategies, respectively). She also had one instance of employing a decoding strategy that was not present in the a priori list, which was discussing possible meanings of a word with her teacher before consulting a dictionary.

John

John's decoding errors were attributed to braille errors (50), unknown meanings of words (13), word substitutions (7), proper nouns (1), omitted words (2), and mispronunciations (2). In addition, John misread 61 words for unidentified reasons. His errors in braille included *just*, *name*, *ought*, *ment*, *ing*, confusion between *e/i* and *st/ea*, and contractions within words, among others. The meanings of *cavalry*, *coonskin*, *barracks*, *plasma*, and *antigen* were unknown to John, and he substituted similar words such as *tub* for *tubes* and *showed* for *shows*. His most common decoding strategies, both text-based, were breaking words into syllables (44) and sounding out words (35). He also used two decoding strategies that were not in the a priori list: teacher assistance in determining the applicable dictionary definition (reader-based) and phonetic spelling provided by the text (text-based). Each of these strategies was used once. John's teacher also provided instruction on braille contractions (36). John and his teacher sometimes employed multiple

decoding and instructional strategies for a single misread word, resulting in a higher strategy count than word-error count.

Bill

Bill's reading errors were the result of braille errors (115), unknown word meaning (1), word substitutions (1), mispronunciations (3), letter reversal (1), and unidentified errors (22). Braille errors were documented for, but not limited to, *of*, *every*, *this*, *some*, *name*, *will*, *had*, *ea*, *ch*, *st*; composition signs; punctuation; and confusion between *e/i*, *wh/th*, and *sh/m*. Bill most frequently received instruction on braille contractions (99), and his most common decoding strategy was spelling out words (81), which constituted a text-based strategy. A number of instructional strategies were utilized with Bill that were not part of the a priori list. They were review of vowel and digraph sounds with braille symbols on a magnetic board, review of Tack-Tiles to help with letter recognition, review of problematic braille symbols (contracted and uncontracted), review of vowel sound rules, teacher explanation of word meaning, and flip cards of problematic words. Each of these strategies was noted once, and some were used as pre- or postreading strategies. Bill sometimes used more than one strategy per misread word, which resulted in a strategy total greater than his word error total.

Discussion

Across students, the nature of word errors varied greatly. Meaning- or experience-based errors accounted for 14% of Justine's total errors and 10% of John's, but only accounted for 0.6% of Bill's misread words. Unidentified errors (those not required on the data form such as guessing or rushing) comprised 17% and 15% of Justine's and Bill's errors, respectively, but John's unidentified errors made up 45% of his total word error count. Errors related to the braille code were a substantial portion of all of the errors for all three students. This was the most common error evidenced by Justine and Bill, with 49% and 80%, respectively. Although not the most frequent type of error for John, it still accounted for 37% of his misread words. It is also interesting to note that the students demonstrated many of the errors multiple times in a single week.

The decoding strategies that Justine, John, and Bill utilized primarily correlated to Chall's (1983) text-based strategies. For example, Justine frequently reread the text to correct her errors, John often sounded words out or used syllabication, and Bill regularly spelled words out. While most of the decoding strategies were text-based, there was some evidence of reader-based strategies. Justine demonstrated most of the reader-based strategies by consulting a dictionary to determine the meaning of words and by discussing possible definitions with her teacher prior to using a dictionary. John had only one instance of a reader-based strategy (consulting a dictionary), and Bill had none. Based on the large number of braille errors, instruction in the braille code was often employed in response to reading errors or ineffective application of a decoding strategy. Such instruction, used with John and Bill, primarily focused on contractions.

A valuable component of action research is the insight generated by teachers to inform their practice but also to guide the practice of others. Through the course of this study, Beth learned that even proficient braille readers may demonstrate braille errors in decoding. More specifically, errors that masquerade as syllabication, phonetics, or word knowledge may, in fact, be braille related. With these realizations in mind, Beth plans to increase her students' exposure to braille contractions within words and intentionally review braille contractions even with proficient readers.

Similarly, Melody realized that a considerable amount of braille exposure, practice, and memorization is necessary for students to

recognize words and read them fluently; simply teaching contractions is not enough. For example, one of her students could identify contractions within familiar words but not within new words such as recognizing *ound* in the word *found* but not in *around*.

The findings of this study yield a number of implications for practice and further research. Analysis of decoding errors and strategies should be utilized in designing individualized reading instruction. Future research should focus more specifically on the types of errors that students make while reading. This could help teachers more accurately anticipate and identify their students' errors. In addition, research should consider whether decoding and instructional strategies have a positive impact on reading.

Limitations

One important limitation of the present study is that it included only three braille readers who were quite heterogeneous in their reading levels and in the ages at which they began receiving instruction in braille. Another limitation relates to the short duration of the study. Eight weeks did not provide a sufficient amount of time to consider whether the decoding or instructional strategies had a positive effect on reading. Furthermore, this study was not initially designed to focus on the nature of student errors. Rather, the research question emerged as important soon after the study began and became one of the most interesting and influential findings. The data collection form, developed during the design stage, did allow some room to record such information but not sufficient room, resulting in a high percentage of unidentified errors.

Conclusion

Justine, John, and Bill demonstrated several decoding errors and utilized a variety of decoding strategies while reading. A substantial number of misread words were attributed to braille errors even for proficient braille readers, which led to the use of teacher-initiated instruction in addition to or in lieu of student use of decoding strategies. Recognition of the frequency of braille errors is important in planning instruction and considering future research endeavors.

References

Bruce, S., & Pine, G. J. (2010). *Action research in special education: An inquiry approach for effective teaching and learning.* New York, NY: Teachers College Press.

Chall, J. S. (1983). *Stages of reading development.* New York, NY: McGraw-Hill.

Glaser, B. G. (1965). The constant comparative method of qualitative analysis. *Social Problems, 12*(4), 436–445.

Raynor, K. (1986). Eye movements and the perceptual span in beginning and skilled readers. *Journal of Experimental Child Psychology, 41*, 211–236.

Savaiano, M. E., Compton, D. L., & Hatton, D. D. (2014). Reading comprehension for braille readers: An empirical framework for research. *International Review of Research in Developmental Disabilities, 46,* 177–205. doi:10.1016/B897-0-12-420039-5.00004-6

Steinman, B. A., LeJeune, B. J., & Kimbrough, B. G. (2006). Developmental stages of reading processes in children who are blind and sighted. *Journal of Visual Impairment & Blindness, 100*(1), 36–46.

Wall Emerson, R., Holbrook, M. C., & D'Andrea, F. M. (2009). Acquisition of literacy skills by young children who are blind: Results from the ABC Braille Study. *Journal of Visual Impairment & Blindness, 103*(10), 610–624.

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