Teachers' Experiences with Literacy Instruction for Dual-Media Students Who Use Print and Braille

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Structured abstract: *Introduction:* This study analyzed survey responses from 84 teachers of students with visual impairments who had provided literacy instruction to dual-media students who used both print and braille. *Methods:* These teachers in the United States and Canada completed an online survey during spring 2015. *Results:* The teachers reported that they introduced braille to their students at the mean age of 7.8 years. The three most common reasons reported for introducing a student to braille were the student's diagnosis, print reading speed, and print reading stamina. The amount of instructional time in braille literacy varied widely, and slightly more than 60% of the students were initially introduced to uncontracted braille. The teachers reported that approximately half of their students were at or above grade level with their print literacy skills, but only about 25% were at or above grade level with their braille literacy skills. *Discussion:* Both contracted and uncontracted braille were used when beginning braille instruction for students reading both print and braille. The roles of student motivation and confidence appeared to be important considerations when designing and providing braille literacy instruction. *Implications for practitioners:* There are many factors that should be considered when determining if a student should transition from print to braille as a primary literacy medium. Motivating students to want to learn and use braille is critical. A comprehensive curriculum is needed for use with established print readers at various reading levels who are making the transition to braille.

Vision loss can affect a student's proficiency with learning to read and write. Teachers of students with visual impairments are responsible for conducting comprehensive assessments to determine the optimum primary literacy medium for their students and to identify if there is a need for dual-media instruction in both print and braille (Koenig & Holbrook, 2010). Visual efficiency, reading efficiency, and prognosis are important considerations in the assessment process (Bell, Ewell, & Mino, 2013; Koenig & Holbrook, 2010). If a student is likely to experience progressive vision loss, it is essential to address both immediate and long-term literacy needs, which may require providing reading and writing instruction in both print and braille. Some students begin literacy instruction as dual-media learners, some students begin as print readers and later learn to read braille, and, in rare cases, some students initially read braille and later learn to read print (Koenig & Holbrook, 2010).

Research investigating the reading and academic performance of students who are dual-media learners is limited. Lusk and Corn (2006) gathered information about 103 students in the United States and Canada who were receiving simultaneous literacy instruction in both print and braille. Teachers reported that although 35% of their students were reading below grade level in print, 57% were reading below grade level in braille (Lusk & Corn, 2006). These findings were of concern, since both reading proficiencies were so low. Identification of the factors, assessment strategies, and materials necessary to support increased print and braille reading efficiency were identified as areas for further study. In addition, Lusk and Corn (2006) suggested that future research explore at what level of visual acuity and visual field should dual media be implemented.

A variety of approaches exist for providing braille literacy instruction, including beginning with uncontracted or contracted braille; using a basal reading approach; implementing a whole-language approach; using an individualized, student-centered approach; or utilizing a combination of two or more of these. Prior to the ABC Braille Study, a clear consensus could not be reached on the most effective strategies for teaching braille reading skills (D'Andrea, 2009). The ABC Braille Study found that introduction to more contractions earlier in instruction correlated to better performance on reading measures such as vocabulary, decoding, spelling, and comprehension (Wall Emerson, Holbrook, & D'Andrea, 2009). The authors concluded that regardless of the approach used to introduce the braille code, basic reading skills and processes should be the primary focus of braille literacy instruction (Wall Emerson et al., 2009).

Students with effective literacy skills can derive meaning from what they read, which significantly affects motivation for reading and leads to higher levels of reading achievement (Melekoğlu & Wilkerson, 2013). Students who are less engaged in reading are at risk of failing to learn to read proficiently (Morgan, Fuchs, Compton, Cordray, & Fuchs, 2008). If students lack the literacy skills to obtain meaning from what they read, their motivation for reading decreases or fails to develop altogether. Melekoğlu and Wilkerson (2013) reported that a lack of reading motivation limited students' willingness to improve critical reading skills and strategies necessary for academic success. In contrast, students with higher levels of motivation for recreational reading were characterized by increased academic performance and positive reading behaviors such as engagement and comprehension (Naeghel, Keer, Vansteenkiste, & Rosseel, 2012).

Reading motivation trends among students who read braille mirror those of their print-reading peers. Data from the longitudinal ABC Braille Study demonstrated that prekindergarten through fourth grade students in the high-achieving reading group were more likely than students in the low-achieving reading group to read by themselves and to report that they liked reading (Sacks, Hannan, & Erin, 2011). Students in the low-achieving reading group were more likely to report that they did not like anything about braille, and students in the high-achieving group more often reported there was nothing they disliked about braille. The researchers concluded that motivation is a critical factor in reading achievement and that teachers of students with visual impairments need to work in collaboration with other team members to identify and implement strategies for motivating students who are struggling to learn braille.

The current study reports the results of a survey administered to teachers of students with visual impairments in the United States and Canada that gathered information about their experiences with providing instruction to dual-media learners. Teachers were asked

to provide information about their students' print and braille literacy skills, as well as their motivation for and confidence in reading.

Methods

Instrument

A survey was developed using Survey Monkey, an online survey tool. Teachers of students with visual impairments were asked about their training, background, and experiences specifically related to teaching students who use both print and braille literacy media. For the remainder of the survey, each teacher selected one student who used both print and braille and responded to questions with this student in mind. Questions were answered about the student's demographic background, assessment tools used in determining media literacy, curricula used in instruction, student confidence, and student motivation for using print and braille.

Criteria for participation and recruitment

Approval to conduct the research was obtained from the Institutional Review Board at the University of South Carolina Upstate. An e-mail invitation with the survey link was sent to teachers of students with visual impairments across Canada and the United States. The survey remained open for two months in the spring of 2015. Certified teachers who had provided braille literacy instruction to at least one student who used both print and braille in the last three school years were invited to participate. They were required to be able to report on at least one student who was in an academic literacy program, read within two years of grade level, and had an established method for reading and writing. In addition, their student had to meet at least one of the following criteria: (1) he or she had already learned to read and write in print, but was learning braille because print was no longer a viable literacy medium; (2) he or she was a current print reader learning braille as a secondary reading medium, with the expectation that both media might be used in the future; or (3) he or she was a younger student simultaneously learning to read in both print and braille.

Table 1
Demographic data of the teachers of students with visual impairments ($N = 84$).

Variable	Number (%)
Gender ($n = 84$)	
Female	79 (94.0)
Male	5 (6.0)
Years of experience ($n = 84$)	
1–3	9 (10.7)
4–6	11 (13.1)
7–10	15 (17.9)
11–15	13 (15.5)
16+	36 (42.9)
Reading endorsement ($n = 83$)	
Yes	13 (15.6)
No	70 (84.4)
Setting in which employed ($n = 83$)	
Itinerant	70 (84.4)
Residential or specialized school	7 (8.4)
Resource classroom in a public school	6 (7.2)

Eighty-four certified teachers of students with visual impairments participated in the study. Seventy-eight (92.8%) worked in the United States and six (7.2%) worked in Canada. Demographic data for the participants is provided in Table 1. Sixty-three of the teachers (75.0%) had between one and 15 students on their caseloads who received direct visual impairment services. The remainder had a caseload of 16 or more students.

Results

All data were via teacher report through the online survey. No verifying data were collected or reviewed by the researchers. Not all questions were answered by all participants. Throughout the Results section, the *n* is indicative of the number of teachers of students with visual impairments who answered that question for their students. Statistical data

analyses related to motivation and confidence were performed using SPSS version 23.0.

The current age of 81 academic students ranged from 6 to 18 years ($M = 11.5$, $SD = 3.2$). Thirty-three (39.3%) of the 84 students had at least one documented additional disability. Ten students were deaf or hard of hearing, nine had a learning disability, six had autism spectrum disorder, three had a traumatic brain injury, two had a physical disability, two had other health impairments, and one had an intellectual disability. The current educational level ($n = 83$) was 49 (59.0%) in elementary school, 16 (19.3%) in middle school, and 18 (21.7%) in high school. Of the 84 students, 62 (73.8%) had a clinical low vision evaluation and were provided instruction in the use of optical aids before a decision was made to introduce braille.

Students ($n = 79$) were introduced to braille from age 2 to 17 years, with a mean of 7.8 ($SD = 3.2$) years. Teachers were provided with a list of informal and formal assessment tools used in the decision-making process, with more than one response allowed and space provided to list additional tools. The most frequently reported tool reported by the 81 teachers who answered the question was observation of student performance in reading and writing activities ($n = 37$); followed by informal or locally developed learning media assessment ($n = 33$); learning media assessment developed by Koenig and Holbrook (1995) ($n = 26$); *Functional Vision and Learning Media Assessments for Students who are Pre-Academic or Academic and Visually Impaired in Grades K–12* (Sanford & Burnett, 2008) ($n = 18$); and *Evals* (Texas School for the Blind and Visually Impaired, 2007) ($n = 6$).

Eighty teachers of students with visual impairments reported on the amount of time elapsed between the initial decision to teach the student braille and the start of formal instruction. Forty (50%) reported less than one month, 24 (30.0%) reported one to three months, seven (8.7%) reported four to six months, five (6.3%) reported seven to nine months, and four (5.0%) reported more than one year. The majority of 82 students (68, 82.9%) had been receiving braille instruction for more than one year.

The teachers of students with visual impairments were provided with a list of student characteristics that may have influenced the decision to introduce the student to braille, and they could select multiple options. The most frequently selected characteristics were the student's diagnosis ($n = 69$), print reading speed ($n = 37$), print reading stamina ($n = 33$), future plans for higher education ($n = 28$), future plans for employment ($n = 17$), print reading decoding skills ($n = 14$), motivation level ($n = 14$), and print reading comprehension ($n = 13$). The teachers were also provided with an opportunity to list other factors that they considered when making the decision to transition the student from print to braille. The most frequently mentioned item was assessment data about the student's print reading ability ($n = 46$), followed by the need to establish a foundation of braille literacy skills for the student because of the belief that the student might not have access to braille instruction at a later time ($n = 31$), availability of resources to assist the student in making the transition from print to braille ($n = 13$), time in the teacher's schedule ($n = 12$), the teacher's personal belief about when a student should transition from print to braille ($n = 10$), and availability of other team members to support the student's transition to braille ($n = 8$).

The teachers were asked if they began initial instruction with contracted or uncontracted braille. Of the 74 who responded, 29 (39%) began with contracted braille and 45 (61%) began with uncontracted braille. When asked about at what age students were introduced to braille, they reported that 25 students aged 4–10 years and four students aged 11–14 years were introduced to contracted

braille initially. The mean age of these students was 7.62 years (SD = 2.72). Similarly, it was reported that 36 students aged 2–10 years, 5 students aged 11–14 years, and 2 students aged 15 and 17 years, respectively, were introduced to uncontracted braille initially. The mean age was 7.57 years (SD = 3.43).

An open-ended question asked teachers of students with visual impairments what influenced their decision to begin instruction in either contracted or uncontracted braille. Seventy-three reported a variety of considerations. The three most frequently mentioned were the student's personal characteristics or abilities (n = 19), the teachers's personal beliefs (n = 19), and the braille curriculum used (n = 10). The teachers' personal beliefs were almost equally divided between beginning with uncontracted braille (n = 10) and beginning with contracted braille (n = 9). A teacher who cited personal beliefs as a consideration said, "I believe uncontracted braille helps students to become better spellers." Another who cited personal beliefs for beginning with uncontracted braille said that there is a "faster satisfaction or usability to introduce the full alphabet first." Yet another had a contrasting personal belief: "I feel teaching uncontracted braille makes double the work. First learn uncontracted and then learn contracted." Other common considerations were the age of the student and the blending of braille literacy instruction and the general education curriculum. One teacher said, "I use uncontracted braille to keep the student more connected with the curriculum used in her classroom."

The amount of braille instruction students received in a typical week was reported by 81 of the teachers of students with visual impairments. Seven (8.6%) students received one half-hour or less of instruction per week, 10 (12.4%) students received more than one half-hour but less than one hour per week, 19 (23.5%) students received one to one-and-one-half hours per week, 11 (13.5%) students received more than one-and-one-half to two hours per week, 14 (17.4%) received more than two hours but less than three hours per week, four (4.9%) received three to four hours per week, 10 (12.3%) received more than four hours to five hours of instruction per week, and six (7.4%) received more than five hours of instruction per week.

The teachers were provided with five statements related to a student's access to braille during instruction. Forty-three said that they allow the student to see their hands while reading braille, 19 said they showed the student braille configurations visually as the student read braille tactually, 18 obstructed the student's view of his or her hands during braille reading, nine blindfolded the student when he or she was reading braille, and nine simultaneously showed the student the word or sentence in print as the student read the braille tactually. In some instances, it was reported that visual access was not possible for the student because of the significance of the vision loss. Other teachers reported that the student naturally closed or diverted his or her eyes from the braille page.

Table 2 includes teachers' reports of how many words their student read in print and braille per minute. They were not asked to report sources of data used in answering the questions about reading rates. Some teachers provided reasons for why they did not report their student's print or braille reading speeds, or both. Twelve teachers reported that they did not know the student's print reading speed or that the data were unavailable. Three other teachers reported that their students could no longer see print. Similarly, 11 teachers reported that they did not know the student's braille reading speed or that the data were unavailable. Eleven additional teachers reported that their students were still in the initial stages of learning braille letters.

Seventy-seven teachers reported on the print literacy skills of their students. Eleven

Table 2
Reading rates of the students in words per minute (wpm).

Medium	Education level	1–10 wpm	11–30 wpm	31–50 wpm	51–75 wpm	7–100 wpm	101–125 wpm	126–150 wpm
Print	Elem.	9	5	8	5	3	1	1
	Middle	1	2	2	2	0	2	0
	High	0	2	1	4	2	0	0
Braille	Elem.	8	15	3	5	0	0	0
	Middle	5	2	3	0	1	0	0
	High	1	6	4	1	1	0	0

(13.1%) students were performing above grade level, 30 (39.0%) were performing at grade level, and 36 (46.9%) were functioning below grade level. For braille literacy skills, three (4.2%) out of 72 teachers reported above-grade-level-performance for their students and grade-level performance for 16 (22.2%). Fifty-three (73.6%) students were reportedly functioning below grade level.

Teachers were provided with a list of common tools used to write braille, and could select multiple responses. The most frequently used tool was the Perkins Brailler ($n = 76$), followed by refreshable braille displays ($n = 17$), braille notetakers ($n = 16$), embossers ($n = 7$), Perkins SMART Braillers ($n = 5$), Mountbatten Braillers ($n = 4$), slate and styli ($n = 4$), and the electric Perkins Brailler ($n = 3$).

Teachers were provided with a list of common school subjects and asked to report the primary medium students used for each subject. Table 3 summarizes these data.

The teachers were provided with a list of materials and curricula often used for braille literacy instruction. They could select multiple responses to indicate what they used with their students. The most commonly reported materials were teacher-developed materials ($n = 54$); followed by *Building on Patterns* (Boley et al., 2009–2012; Pester, 2006; $n = 32$); *Mangold Developmental Program of Tactile Perception and Braille Letter Recognition* (Mangold, 1994; $n = 29$); *Braille Fundamentals* (Cleveland, Levack, Sewell, & Toy, 2002; $n = 15$); *Patterns* (Caton, Pester, & Bradley, 1983; $n = 14$); *I-M-ABLE* (Wormsley, 2011; $n = 3$); *Braille Connections* (Caton, Gordon, Pester, Roderick, & Modaressi, 1997; $n = 3$); and *Braille Too* (Hepker & Coquillette, 1995; $n = 3$).

Table 3
Primary learning medium used by academic students, by subject.

Medium	Education level	English or language arts	Mathematics	Science	Social studies	Music	Computers and technology
Print	Elementary	31	42	32	31	29	30
	Middle	10	16	12	13	9	11
	High	9	12	11	11	5	8
Braille	Elementary	12	4	7	8	1	2
	Middle	1	1	1	0	0	1
	High	3	2	1	1	0	1
Auditory	Elementary	5	2	7	8	10	8
	Middle	5	0	3	3	1	2
	High	5	3	4	5	2	3
Total		81	82	78	80	57	66

Table 4
Student level of motivation and confidence for reading materials in print and braille.

	Print		Braille	
Rating	Motivation (n = 77)	Confidence (n = 70)	Motivation (n = 77)	Confidence (n = 46)
Very motivated or confident	32	8	14	18
Somewhat motivated or confident	18	14	32	18
Neutral	12	6	8	0
Somewhat unmotivated or unconfident	4	20	13	6
Very unmotivated or unconfident	8	22	7	4
Unmotivated or unconfident	0	—	0	—
Depends on the task	3	—	3	—

Participants were asked to rate their students' level of motivation and confidence with reading print and braille for completing academic tasks. Table 4 provides their ratings. Correlations were computed to determine if there was a relationship between the student's motivation and level of confidence with reading in each of these media. The Kendall's τ test identified a positive correlation ($\tau = .391$, $p < .05$) between motivation and confidence for students reading print. No significant differences were found between motivation and confidence for students reading braille.

Teachers were asked about the type of material students read for pleasure. The most frequently reported type of material was fiction books (n = 51); followed by nonfiction books (n = 33); web pages (n = 17); picture books (n = 16); graphic novels, including comic books (n = 10); e-mail (n = 7); and magazines (n = 6). Large print (n = 33) was the most frequently reported method for how students accessed pleasure reading materials, followed by auditory (n = 26), e-readers (n = 25), standard print (n = 22), computer (n = 16), live reader (n = 14), hard copy braille (n = 12), and refreshable braille display (n = 2). Teachers were provided with a list of audio devices and asked which options their students used to access pleasure reading. More than one response was allowed. E-readers (n = 25) were most frequently reported, followed by the National Library Services player (n = 13), Victor Stream (n = 9), and BookPort (n = 8). Table 5 reports the frequency for the number of times per week students used braille, print, or auditory to access the pleasure reading materials.

Discussion

Eighty-four teachers of students with visual impairments shared information about their work with students who used both print and braille literacy media. They reported that their

Table 5
Frequency of students' reading for pleasure using various media.

Frequency	Print (n = 76)	Braille (n = 76)	Auditory (n = 73)
Daily	18 (23.7%)	3 (3.9%)	12 (16.4%)
3–5 days per week	11 (14.5%)	2 (2.6%)	12 (16.4%)
1–2 days per week	18 (23.7%)	11 (14.5%)	14 (19.2%)
Less than 1 day per week	13 (17.1%)	19 (25%)	13 (17.8%)
My student does not read [in this medium] for pleasure	16 (21.1%)	41 (53.9%)	22 (31.5%)

students were introduced to braille at a variety of ages, and a wide range of informal and formal assessment tools were used in the decision-making process. There is a need for more formalized ways to determine the need for dual media instruction. In addition, it is not clear from these data which students would benefit from beginning braille instruction with contracted versus uncontracted braille. Future studies that use longitudinal approaches, similar to that used by the ABC Braille Study, and focus specifically on dual-media learners of various ages, have the potential to provide the field of visual impairment with this type of valuable information.

As illustrated in Table 3, braille was less likely than print to be used as the primary literacy medium across all grade levels and for all academic subjects. This may indicate that the students in the study were more proficient in reading print than in braille. A higher proportion of elementary-age students reportedly use braille in their academic classes as compared with students in middle and high school. With the exception of English language arts for elementary-age students, braille was equally or less likely than auditory modes to be used as the primary literacy medium. Although students were more likely to use braille for that subject than for any other, only 19.8% of students across grade levels used braille as their primary literacy medium for it. Fewer students primarily utilized braille for science (11.5%), social studies (11.3%), mathematics (8.5%), computers and technology (6.0%), and music (1.8%). This finding may be the result of students having higher proficiency with literary braille than with the Nemeth Code for Mathematics and Science Notation. It is unclear from the data whether students utilize a single medium or dual media for their academic subjects. Although the primary literacy medium was reported for each subject, some students may use multiple media for a subject, depending upon the task. If a student is prone to visual fatigue, an advantage of dual-media instruction may be that the student could use braille for subjects or content that are not visual in nature, such as reading text. If this method effectively reduces visual fatigue, the student may then be able to use vision for tasks that are more difficult to access tactually or through auditory means, such as map reading and interpreting graphs and figures.

Other characteristics that may be predictive of how successful a student will be in learning braille could not be definitively identified from this study. However, the data suggest that incorporating braille in both academic and nonacademic settings, including for recreational activities, may enhance motivation for developing braille literacy skills. With the exception of one teacher of students with visual impairments, all respondents identified motivation as being important for a student learning braille. The majority of students were reportedly very or somewhat motivated for reading print (64.9%) and braille (59.7%). Although only 15.6% of dual-media students were reportedly somewhat or very unmotivated for reading print, 26.0% of dual-media students were somewhat or very unmotivated for reading braille. Despite the acknowledged importance of motivation, many teachers reported that their student only used braille for academic purposes. The number of students who read for pleasure daily was remarkably low for all literacy media, particularly considering that more than half of students were reportedly very or somewhat motivated for reading in print and in braille. Students were six times more likely to read daily for pleasure using print (23.7%) as compared with braille (3.9%). Similarly, although 38.2% of dual-media students reportedly read for pleasure three or more days per week in print, only 6.5% of these students read in braille at this frequency. In part, this may reflect that braille instruction is often delivered in a one-on-one setting with a teacher in a format that is focused on acquisition of braille

contractions and rules rather than approached by how to incorporate braille in the student's lifelong literacy skill set. It is essential that students' reading preferences be considered and that they have access to a wide range of motivating braille reading materials. It is also important that teachers assist students of all ages in identifying meaningful ways for incorporating braille into their daily lives for activities such as labeling household items; writing notes or cards to a pen-pal; reading, writing, and following recipes; making lists; managing money; reading menus; reading environmental signs; and other similar tasks that promote independence, self-confidence, and motivation for using braille.

There was a statistical significance between teachers of students with visual impairments' perceptions of student motivation and their perceptions of student confidence in using print to complete academic tasks. It is noteworthy that not all teachers who provided a ranking of their student's motivation to read print and braille provided a ranking of student confidence. Further study is needed to evaluate the relationship between student motivation and confidence in developing skills in a new literacy medium. In addition, future study that collects data directly from students is warranted.

Limitations

This study has several limitations. First, data were self-reported from the teachers of students with visual impairments and were not verified by the authors through record review or observation. No work samples to document student reading or writing were collected. In addition, these teachers were not asked to report measurements used in answering the questions about reading rates and grade level. Since the majority of them reported that they worked with students in itinerant settings, knowing the students' motivation for reading for pleasure, the types of literacy tools they used in core academic subjects, and the students' perceptions of their literacy abilities may have been limited. In addition, no data were collected from students about their motivation or confidence to use print and braille to achieve academic tasks.

Implications for professionals

Since learning braille contractions and rules does not ensure that braille will become a meaningful literacy tool, it is crucial for educators to formulate strategies for tailoring instruction to address the individualized learning needs and preferences of students. Braille knowledge and skills should be reinforced through incorporating braille into motivating, practical, everyday life activities beyond the academic learning environment. To promote and encourage more students to develop strong braille literacy skills, teachers of students with visual impairments need to ensure that students have access to motivating, age-appropriate, pleasure-reading materials in braille. To become proficient braille readers, students need to read braille in multiple and varied settings, not exclusively during instructional time with teachers or for academic purposes. In the initial stages of braille literacy instruction, pairing braille pleasure reading with print or auditory versions may be beneficial for the student so that he or she does not become frustrated due to difficulties with tactile discrimination, limited braille knowledge, or inefficient decoding skills that could interfere with braille reading fluency and comprehension. These are important considerations for increasing student motivation and building proficiency with braille reading.

Although *Building on Patterns* was reportedly the most frequently used curriculum for teaching braille to established print readers, this program was not designed for dual-media students and, therefore, it may not be as effective for this population as it is for the target audience. The field of visual impairment would benefit from the development of a curriculum that is specifically designed for academic dual-media learners at varying

educational levels. Many teachers of students with visual impairments reported having developed their own materials. A database for locating and sharing materials and a framework for evaluating their quality and efficacy would be beneficial to the field of visual impairment.

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